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CULTURAL SPACE PRODUCTION IN THE EMERGING CITIES: A CASE STUDY OF SHANGHAI

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Abstract

Following the rapid pace of urbanisation, Chinese cities have launched a new wave of large-scale infrastructure, including cultural building construction. From 1998 to 2015, more than 250 grand theatres were built together with libraries, museums and children's palaces. Through case studies of four theatres built in Shanghai, this paper penetrates the phenomenon of the 'heat of cultural buildings' and discovers the history, intentions and effects of these theatres on Chinese cities.

Keywords

Cultural space, Chinese cities, grand theatres, city branding.

1 Introduction

One remarkable development in China since 1980 is the rapid pace of urbanisation. The urbanisation level was 18% in 1978, jumped to 57% in 2016. With the deepening market economy, wealth, talent and value-added industries are being drained to and concentrated in the provincial and coastal cities. Chinese cities, whether in the first, second or third tier, are making every effort to enhance their financial, economic and cultural status.

In efforts to enhance their status, Chinese cities are increasingly reliant on cultural megaprojects to project their identities and define their dynamic visual landscapes. New cultural buildings are usually constructed in 'new towns' or cultural districts and integrate a grand theatre, library, museum and gallery or a children's palace. Since 1998, more than 200 new cultural buildings incorporating grand theatres have been constructed across China, funded by trillions of dollars. The newly built grand theatres in China may outnumber the sum of similar buildings constructed in Western Europe since World War II. No other country has constructed so many grand theatres and other cultural buildings in such a short period, which raises a number of issues of general concern.

Why and how have so many grand theatres been built so quickly? How were those designs selected in the process of decision making? How do these theatres influence the ambience of a city, and how do they provide public space and amenities for a vibrant civic life? What are the design strategies which help the clients' goals?

This article attempts to answer these questions using Shanghai as an example. The authors hope to examine how a grand theatre is built with a particular mission in urban development. The article uses four theatres in Shanghai to align with the salient phenomenon in China's urban construction in the late 20th and early 21st century and reveal the development trajectory of Chinese cities.

2 Landscape of Power and Cultural Space

When the People's Republic of China was established in 1949, the mission of capital construction was to express state power and national identity. A national identity is not a natural attribute that precedes statehood but a process that must be cultivated for a long time after a regime has gained political power. Before the tenth anniversary of the People's Republic, the Communist government launched the construction of ten grand buildings in Beijing. These magnificent edifices demonstrated socialist strength and the government's confidence at home and abroad at a time that the country was weak economically and isolated amid Cold War antagonism. In the 1980s, the French president François Mitterrand constructed public buildings on a large scale in Paris. These buildings consolidated political rule and enhanced the state's image. Beijing of the 1950s and Paris of the 1980s are typical examples of the use of public/government buildings to project a political image.

When China converted to a market economy in the 1980s, the ideological persistence was dropped and gradually replaced by economic competition between countries and cities. This is parallel to the worldwide trend of globalisation when the Cold War ended. In the years after the open-door policy was adopted and the global economic wave reached China, the mission was modernisation and 'catching up' with the world's advanced economies. Chinese leaders at the central and provincial levels had an urgent imperative to attract foreign investment and 'be connected with the international track'; that is, building like an international city and behaving according to international norms.

During Mao's era before 1980, the dominant idea was 'production first, living second'. Most cities did not have sufficient housing, let alone decent performance space. In 1996, the central government issued an instruction that the country should build 50 or more cultural facilities, such as libraries, museums and theatres "which are compatible to economic level and represent the image of state and relevant cities". Political legitimacy was shifted and translated to modernisation and globalisation in China in the 1990s. Building the city for the global economy is the ultimate source of urbanisation. Advanced cultural spaces, such as libraries, museums and opera houses, are indispensable for a modern city and 'connecting with the international level'. The government believes that when a city's hardware (infrastructure, cultural buildings, housing etc.) is well prepared, investment from home and abroad will naturally flow in and activate the economy.

The keen competition between Chinese cities is reflected in the burgeoning GDP and the physical planning of magnificent towns or 'civic' centres. At the same time, the extensive construction of cultural facilities satisfied the rising middle class, who have more leisure time

and money to allocate. The cultural facilities allow families to grow accustomed to reading books, visiting museums and attending performances of high culture (such as operas and concerts). The building of cultural facilities partially balances the ubiquitous commercial activities of profit making. However, in China the capital for cultural facilities comes mainly from government expenditures and state-owned corporations.

Therefore, the rapid emergence of cultural facilities, including grand theatres, is the result of many entangled influences over the past 20 years, where urbanisation is the cause, globalisation the catalyst and consumerism the result of society. The process of building performance spaces in Shanghai fits well into the above framework.

3 Restoring the Old Glamour

As an early 'global' city in the eastern China, Shanghai was exposed to Western civilization in the late 19th and early 20th centuries. With the opening of the port, parts of the city were leased to the United Kingdom, the United States, France and Japan as concession areas. Western management and materialistic advancement transformed the city into a modern society, which attracted millions of people from nearby provinces and foreign countries. Between the two World Wars, Shanghai was under the spotlight in the Far East and was nicknamed the 'Oriental Paris': its ports, factories, garden houses, department stores, hotels and apartment buildings were a physical manifesto. Before the burst of the Pacific War, Japanese troops had occupied many provinces and Greater Shanghai, but the foreign concessions remained untouched. This extended and enhanced prosperity in this 'isolated island' from 1938 to 1941. Intellectuals, writers and artists gathered in Shanghai, particularly in the concession areas because of their effective management and clean environment. The city became an early centre of film production, symphonies, plays and Chinese opera in the 1920s.

In its heyday, performance halls and cinemas were constructed in the concession areas. These cultural facilities, together with dancing halls, luxurious hotels and apartment stores, splendidly gilded the city centre. During the Pacific War, Japanese troops entered the concession areas and dragged the city into war. After the Communist Party took power in 1949, Shanghai was planned as an industrial base. Sporadic cultural pavilions and cinemas were built together with workers' residential areas at the city's periphery. In 1959, the central government built ten 'grand buildings' in Beijing to celebrate the ten year anniversary of the People's Republic of China, at the expense of great famine in other provinces. In the wave of building grand projects to symbolise the strong socialist dictatorship, Shanghai once prepared blueprints for an opera house that could seat an audience of 3,000, but the project had to be shelved because of economic difficulties in the early 1960s.

In 1978, China embarked on its open-door policy and began to eagerly learn Western technology and management. At the time, Shanghai was embarrassingly dilapidated, and its only remaining glamour came from its old 1930s foreign concession legacies, a source of pride for Shanghainese. However, in the early years of the open-door policy, Shanghai was busy housing its residents and building hotels and offices for the burgeoning market business after decades of delay. The city took off again when Pudong, the east bank of the Huangpu River, was developed in 1990. In 1993, the GDP of Shanghai was US$1,500 per capita. Although the city was still in the lower-middle income stage, the construction of

cultural buildings was tabled in the government's agenda because the city was keen to be an international model of cultural exchange and communication.

4 Shanghai Grand Theatre, 1998

When southern China was rising, Shanghai, once the 'Oriental Paris', dimmed. In early 1994, violinist Itzhak Perlman and the Israel Philharmonic Orchestra toured Shanghai, but the city lacked a qualified professional concert hall, which left Perlman disappointed. The highest-class performing facility was the conference hall of the municipal government, a temporary pavilion remodelled from an old building in the 1950s. The event shocked the government. Huang Ju, the mayor, pointed out that cultural construction must be achieved in tandem with economic construction. The government planned to build a grand theatre, 'lifting the face for Shanghai people, and being responsible for the future generations'.

Vice-mayors Gong Xueping and Chen Zhili selected a site next to the municipal government, facing the People's Square. People's Square in Shanghai exactly parallels the function of Tiananmen Square in Beijing. The municipal government was set at the central axis, north of the People's Square. On the opposite side is Shanghai Museum. Both buildings were designed by the Shanghai Civil Architectural Design Institute and completed in the early 1990s. The grand theatre stands to the west of the government building, and the Shanghai Planning Exhibition Pavilion is on the east. The siting strategies of the grand theatre and museum show the government's determination to govern the city with soft and cultural power.

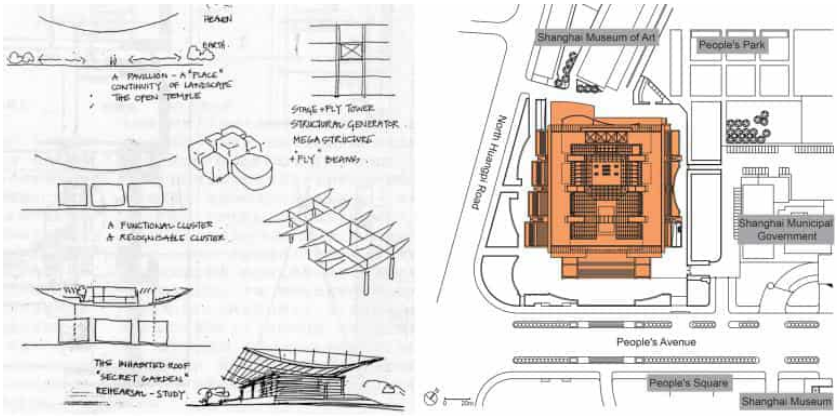

Figure 1. Sketch and master plan of Shanghai Grand Theatre

An international design competition was held in early 1994, and the French firm Arte Charpentier Architectes won. Charpentier's design featured a reverse flying roof supported by a truss, with a crystalised white glass box inserted under the roof. The rear of the site is against the old Jockey Club (which was the city library at the time), so the length is limited. The grand theatre consists of a lyric theatre of 1,631 seats, a drama theatre of 575 seats, and a studio theatre of 220 seats. The front lobby links only to the lyric theatre. The other two small theatres take the back and leftover space. Their entrances are on the side, without a spacious lobby. Therefore, only the lyric theatre can cater to all major performances. Under its thick roof are restaurants and cafés. The reverse flying roof resembles a sacred palm gesture toward the sky. After three years of intensive construction, the grand theatre officially opened in August 1998.

The Shanghai Grand Theatre was selected from an international design competition, and the design stood out from the Chinese architecture at the time. This was the first international design competition of cultural building in China and set an example for other cities. The glass curtain was imported from Germany and the white stone-clad columns were brought from Greece. The crystallised glass and white lobby create a noble temperament. The completion of Shanghai's grand theatre began decades of construction of similar grand theatres in other cities, particularly the fiercely debated national theatre in Beijing. A year later, the international design competition for the national theatre in Beijing was run in three rounds.

The grand theatre is a notable achievement. The Shanghai Grand Theatre opened in August 1998 and has accommodated many impressive performances from around the world, including the musicals Les Miserables, Cats, The Lion King and The Phantom of the Opera. The once-angry violinist Itzhak Perlman and the Israel Philharmonic Orchestra returned to perform, as did the Berlin Philharmonic Orchestra and many other artists and musical troupes. The theatre stages an average of two performances every three days. The vacant day is used for installing and breaking down setting and for rehearsal. In terms of income, the theatre receives a yearly government subsidy that accounts for around 8% of its funding. Approximately 70% of its income comes from box office receipts and the rest from site rental and sponsors, such as Buick. Its annual income of nearly RMB70 million (around US$11.5 million) is spent on operation, including performances, staff salaries and maintenance fees.

5 Oriental Art Centre, 2005

The thrust of Shanghai is from Pudong, the east bank of Huangpu River. The Pudong area is even larger than the city proper on the west bank. High-class apartments, Class A office buildings, and technological parks were constructed in the area. When the Shanghai Grand Theatre was planned in 1994, it was assigned the performance types of opera and ballet. An Oriental concert hall designed by Japanese architects was planned in Lujiazui of Pudong. The site was found to be too small, and the oriental concert hall was moved to the administrative district of Pudong. By taking this opportunity, the Pudong government hoped to make it more than merely a concert hall. (Fig. 2)

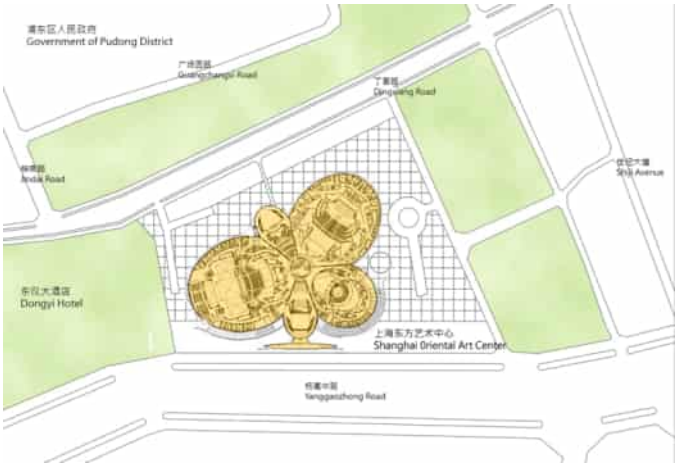

Figure 2. Master plan of Oriental Art Centre

The original concert hall was expanded to three performing spaces under one roof and named the Oriental Art Centre. Its ground-breaking ceremony was held in March 2002 and was completed in early 2005. It was designed by French architect Paul Andreu, who had already designed the Shanghai Pudong Airport terminal in 1997 and the National Grand Theatre in Beijing in 1999. Andreu is fond of symbolic shapes, which the decision makers in China also enjoy. In the Oriental Art Centre, Andreu designed a five-petal magnolia, the city flower of Shanghai. The three large hemispheric petals are the concert hall (2,000 seats), opera house (1,100 seats) and recital hall (300 seats), and the two small ones are the entrance and exhibition hall. The three performance halls are relatively enclosed, and the leftover space is for public use. The performance space is enclosed by a thick concrete wall, from which steel rods support the external curvilinear curtain wall. The external wall is made of bulging glass curtain, and all internal walls are decorated with warm-coloured porcelain panels.

Almost every important music troupe in the world has performed at the Oriental Art Centre. According to a statistical investigation commissioned by the art centre, many audience members come from the western side of the Huangpu River, crossing the Yangpu and Nanpu Bridges. The high-class performance centre, plus the library, sport hall and other facilities, make the area appealing to high-end global residents. The completion of the Oriental Art Centre greatly boosted the confidence of the Pudong government. It is a cultural landmark of the city, particularly the Pudong of Shanghai.

As part of the Pudong district government facilities, the Oriental Art Centre was planned on vacant land and surrounded by parks and wide roads. The government office building and Science Museum are also in the area. They were beautifully drawn, like independent sculptures, in the master plan, but were not designed for the convenience of pedestrians. The main public transportation is the metro line, whose exit is around 500 m away, and pedestrians are exposed the elements. There are no restaurants or food courts within walking distance, so audience members must eat in other places and then travel to the centre. As it is away from the city centre and the west bank of Huangpu River, where most residents are concentrated, audiences must rush to catch the last train back home, and thus they must usually leave the theatre before the curtain call.

The Oriental Art Centre is managed by Poly Theatre Management Co Ltd, which manages 56 theatres in China. The income and expenditures of the Oriental Art Centre are similar to those of Shanghai Grand Theatre. The difference is that the Oriental Art Centre does not receive a government subsidy. All of its money comes from box office receipts, sponsorships and occasional government grants for special project applications.

6 Oriental Concert Hall, Shanghai Symphony Orchestra, 2013

Shanghai established the earliest philharmonic orchestra in China, by the International Settlement in 1922. Before the orchestra had its own concert hall, the musicians packed into a small house to practice, where noise from street and next door was inevitable. When music was recorded, even in the summer, the air-conditioning had to be shut down. In 2009, Shanghai government gave the old Shanghai diving pool to the orchestra to build its concert hall. The site is in the city centre, where Metro Line 10 passes underground. The client first

found the acoustic consultant Yasuhisa Toyota from Japan, who had designed concert halls for Suntory in Tokyo and Disney in Los Angeles. An architectural design by Japanese architect Isozaki Arata was selected from four competitors, and Tongji University design institute assisted as the local architect.

A 2,000-seat concert hall and a 300-person recital hall (also a recording studio) are arranged longitudinally in a box along the road. The long lobby serves the two halls and links them to a sunken garden. The auditorium in the concert hall is designed in a vineyard pattern, with the terraces warmly cascading to the stage. To prevent noise, double concrete walls, each 250 mm thick and 400 mm apart, were poured. As mentioned above, Metro Line 10 passes under the site. To isolate the concert hall from the train noise, 168 short concrete posts were built from the foundation, upon which were installed dampers produced in Germany. The floor and the building are actually suspended atop a raft of springs and thus will not shake when a train speeds through beneath.

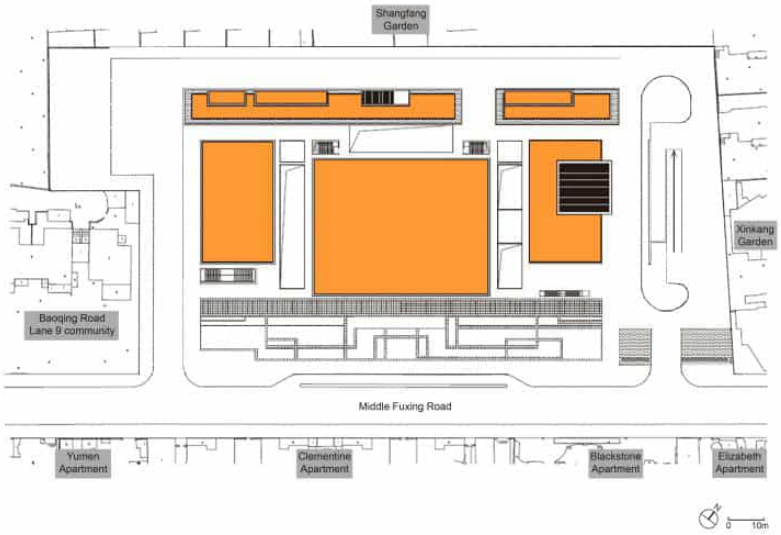

Figure 3. Master plan of Symphony Orchestra Concert Hall

The Shanghai Symphony Orchestra moved into its new home in 2013. The venue is near the Conservatory of Music, so the art teaching/learning and performing can include more interactive communication. Not only does the orchestra rehearse and perform in the concert hall, but it also hosts touring international music troupes. The building enhances the status of Shanghai's symphony orchestra, which is able to attract better musicians and more sponsorships.

7 Poly Theatre, Jiading, 2014

While the city proper was busily building subways, skyscrapers and cultural buildings, the suburban towns were making their own way towards modernisation. Dr. Sun Jiwei, graduated from Tongji University, was responsible for the town planning and construction in Qingpu and Jiading, both old rural towns in Shanghai, in the 21st century. He believes that excellent architecture can light up the old city. The rural towns have more land than the crowded city and thus more freedom for designers' creativity. When he moved to Jiading, he planned a new CBD, parks and landscapes for the district and invited famous architects from home and abroad to design public buildings. With this thinking, he and the client invited

Japanese architect Tadao Ando, who was said ‘to understand China's construction conditions and be flexible enough’.

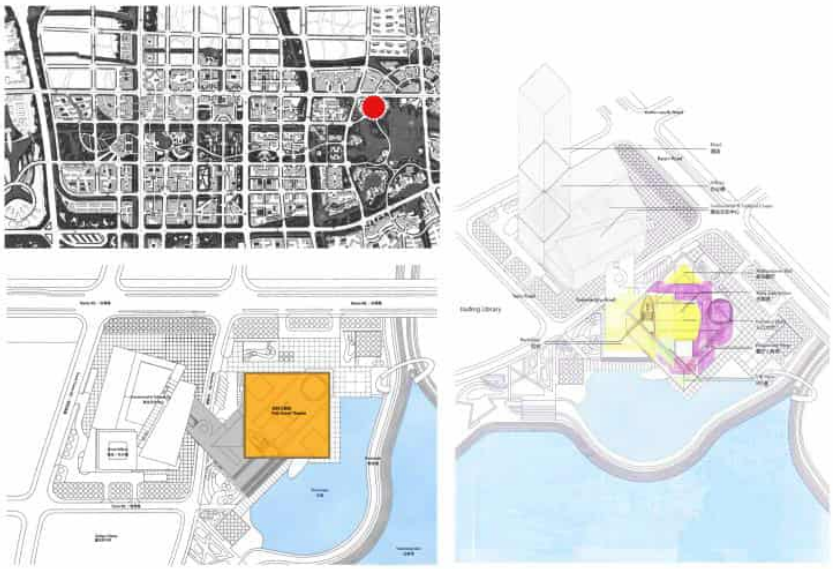

Figure 4. Master plan of Poly Theatre

Tadao Ando began his China venture in 2004 and has designed nearly 20 projects in various cities. He is highly esteemed and eagerly sought after, and his designs have won enthusiastic applause from municipal leaders and clients. The Poly Theatre is located at the end of a road axis facing a large park and lake. The basic building form is a square 100 m on each side. A 1,575-seat theatre lies diagonally in a 34-m-high square box. The central axis of the auditorium extends to the main entrance in the corner. Four groups of cylinders, 18 m in diameter, are inserted into the box. They interconnect and form a complicated interior space and are reflected on the external wall. Through the dramatic holes on the external wall, people from the park can peep into the internal space, like a ‘cultural kaleidoscope’. The lake is extended to the theatre, and an open stage projects into the water. The huge double-curved surface is cladded with aluminium strips, which have a timber-like texture after heat treatment. According to Ando, wind and light in these complicated spaces are making another play.

Many world cities will welcome designs from such a Pritzker Architectural Award laureate. An old rural town between Shanghai and Jiangsu Province, Jiading has hosted a Volkswagen production line, ‘German Town’, a Formula One racecourse and some ancient heritage. The Jiading New Town is one of the three new towns planned to upgrade suburban Shanghai, and it will house up to one million residents. During its rapid development, it has had Tadao Ando’s name to lift its face. Tadao Ando had not previously designed a grand theatre and grasped the opportunity to make this statement and add to his already brilliant portfolio. Although far (28 km) from the city center, Poly Theatre has served residents with its own performing niche in the nearby areas since its opening in 2014.

8 Conclusive remarks

In less than 20 years, Shanghai has restored the old concert hall and built nearly ten grand theatres, a dance theatre, a play house, a concert hall and a circus city. Three of the four

theatres mentioned above were the result of direct investment by government, either municipal or district. Poly was built by the Poly Group, a private corporation with a government and military background, and the land was provided by the government. In return, Poly gained a concession price of land in nearby sites to construct office and housing blocks. The four theatres, like most grand theatres built in China, were directly or indirectly funded by government. It is true that taxpayers' money should benefit more people. However, most of these theatres shut their doors during the daytime and are only open to ticket holders in the evening.

The Shanghai Grand Theatre faces the People's Square. An iron fence surrounds the outdoor grassland. Passers-by can only appreciate the crystalline sculpture-like theatre at a distance. Many residents in the surrounding areas never have a chance to enter the theatre. The management has explained that there are too many people in the square. If the theatre removes the fence, tourist buses will park in front and damage the pavement. Opening the lobby to the public is unthinkable. In the Oriental Art Centre, people can enter the box office only after passing through security guards and an X-ray bag check. After buying tickets, people are allowed to enter the lobby, which connects to the three performing spaces. As it is far from the city and the Metro line, and because of the strict entrance security check, very few people will be in the mood to stroll through the lobby during the day. The situation is similar with the Poly Theatre. The lobby opens to the public on the second Sunday every month, but only for four hours. The concert hall of the symphony orchestra is aligned with other buildings in the street of the old French concession area. Because it partly sinks into the underground, pedestrians can hardly find its full face in the tree-lined road. It is modest and intimate and not as glamorous as the other grand theatres. It is among the very few theatres that open to the public their lobby and exhibition gallery, where musical instruments and interactive sound devices are displayed.

In these theatres, a ticket is usually priced RMB80 (US$13) to RMB1,800 (US$300), according to the location and the class of performance. The average admission ticket at Shanghai Grand Theatre is RMB207 (US$34.50) in 2015. Although the theatres make every effort to obtain sponsorship funding to reduce prices, a ticket is still expensive for most working class residents, whose monthly salary is around RMB5,000 to RMB10,000 (US$833 to US$1,666). Compared to the state-run museums and libraries, which are freely open to the public, the theatres can serve only a handful of middle- and upper-class people. If the indoor and outdoor public space can be open to the public free of charge, the theatres will display better social functions and enliven civic life.

This article briefly reviews the production of four theatres in Shanghai in the past twenty years. By discussing the various theatres' situations, we can answer the questions raised in the beginning. Many grand theatres were initiated and built, mainly for the city's imperatives of enhancing their domestic and international status, producing an ideal environment for (foreign) investment and providing a venue for high art. After the major theatres, other cultural buildings and the subway network (580 km long) are completed, Shanghai plans to jump from an 'international metropolis' by 2020 to a 'global city' by 2040 that possesses a configuration of international resources, influence and high competitiveness. Such cultural venues are indispensable for a city with this global ambition. In terms of per-capita GDP, China is still a developing country. However, first-tier cities like

Shanghai, Beijing, Guangzhou and Shenzhen are catching up with Hong Kong, Singapore and Tokyo. They have sufficient resources to build cultural facilities, which are regarded as the city's calling cards in the official and mass media.

Rapid urbanisation promotes economic growth and gathers more people into the city. More and more of these people become affluent each year, and they demand cultural vitality. The conceptual cultural buildings are constructed to substantiate the city's claims to global significance. The increasingly strong wave of post-industrial consumerism supports the operation of cultural spots and allows them to thrive.

In Unitarian China, there is one more characteristic in addition to the cultural building production in capitalist cities. The central government hopes to maintain the strong momentum of economic development and the local governments compete for resources. 'Global cities' and 'perfect urban and cultural facilities' are important indexes to win in the competition among cities. With the leadership of the Communist Party, decisions are made from the top down with little opposition at the civic level, which makes site selection, excavation, preparation, design and construction relatively smoother than in the 'democratic' societies, whose public expenditures are scrutinised by a voter-elected council or congress. Even in difficult financial circumstances (as in the case of Shanghai Grand Theatre), the Chinese government can motivate social forces (mainly state-owned corporations) to solve the problem. Social watchdogs, public opinion and financial procedures are bypassed. The grand theatres are new spectacles in Chinese cities, wrought by absolute ambition, power and money.

This Chinese characteristic is making miracles. The Sydney Opera House took 17 years to complete. The West Kowloon Cultural District of Hong Kong has been discussed for 20 years and has gone through several rounds of planning and Legislative Council debate. The first building, Xiqu Theatre, is still under construction 5 years after ground was first broken. In contrast, the grand theatres in Shanghai and other Chinese cities were usually completed in 3 to 4 years. The implementation ability of the Chinese government and developers are unchallengeable. Some may be rough in construction, but most theatres reach international standards and are praised by the international artists and musical troupes.

Although the design schemes considered public use and accessibility, most theatres' social function extends only a couple of hours before the show, as the lobby opens at 6.30 PM for the audiences. The theatres run open days and other outreach activities once or twice per month. More people can attend the seminars and view exhibitions on those days. Compared to the huge investment they require, the magnificent space and prominent status they present in the city, and the citizens' high expectations, theatres' social functions need to be better and more fully displayed.

The design and building quality of the four theatres is completely different from the trajectory of Chinese architecture. They set trends and examples for Chinese architects in the design of cultural buildings. Each, both, or all can be aligned with phenomena in Chinese architecture; for example, a symbolic form with a story, the use of a cultural building to vitalise an area, form determined by technology and the use of star architects to promote a remote area. The aspiration of being 'global' is partly realised through the concerted efforts

of government, developers, designers, theatre managers and audiences in a consumerist society.

Acknowledgements

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EMPATHETIC SUSTAINABILITY - A HUMANITARIAN PRECEDENT IN HONG KONG

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Abstract

More and more cities around the globe are challenged to create an empathic community towards undesirables within their urban fabric. It is not only a struggle to understand the real life situation of individuals forced to sleep in unimaginable places, it is an even greater challenge to help someone in that situation transition back into society. Empathic sustainability is creating innovative and sustainable design solutions to better the lives of the less fortunate. This paper introduces a humanitarian movement in Hong Kong by the charity ImpactHK. Hong Kong is a highly dense city with one of the largest wealth gaps in the world. ImpactHK is an authentic humanitarian movement in Hong Kong that strives to create empathic solutions for the homeless by recognising a great need for sustainable solutions and rehabilitating programs for helping individuals in great distress. They have just completed the renovation of their first facility. This paper looks specifically at the unique way ImpactHK is setting a precedent for empathic sustainability through their efforts with the homeless in Hong Kong and their innovative forward thinking. This facility is fully designed and built with sustainable materials allowing adaptable uses for a wide range of initiatives. The aim of this paper is to highlight specific emphatic methods used by ImpactHK wed together with their sustainable design solutions in a case study to introduce a new type of precedent for urban humanitarian renewal. This paper concludes by demonstrating how the visionary ideas of ImpactHK are setting the precedent for empathic sustainability.

Keywords

Empathetic Sustainability, homeless, urban community, ImpactHK, adaptive reuse

1. Introduction to Empathetic Sustainability

In defining a new term *empathetic sustainability*, it is important to first appreciate the parts of the term that are forming it. Jeff Rotmeyer, Founder and CEO of ImpactHK, defines empathy as, "knowing that it isn't possible for us to fully understand what another is experiencing." Borrowing this definition and extending it into the design realm, an empathetic design thus enables interpretation according to different individuals needs and abilities. Empathetic spaces must therefore be human-centric, able to adapt with an inviting presence that encourages user participation. Based on this principal, spaces need to be designed and used

in order to become sustainable, otherwise they are abandoned and forgotten. Designing spaces with functional limitations according to one specific function is in opposition to an empathetic design solution. Empathetic designs must acknowledge and encourage freedom of flexible use providing spaces that can transform according to the users needs. As users themselves establish memories and meaning within a space, it then becomes a place. Establishing a space as a place is the necessary step that transforms any space into a sustainable place through the users connectivity to that place. Sustainability has a vast array of interpretation and understanding depending specifically on the topic being described as sustainable. For the purposes of this paper, sustainability is understood in terms of social principles of flexible usable human centric space. It also extends to include adaptable reuse of materials as sustainable design solutions. These are the fundamental principles behind empathetic sustainability.

Having the opportunity to design/ build the first centre for ImpactHK (The Guest Room), the term *empathetic sustainability* evolved. This is the recognition of the less fortunate, with intentions to create innovative design solutions as a humanitarian movement to better their lives. In other words, to consciously design flexible human centric spaces that fully benefit the specific needs of less fortunate people. This is the underlying principle of empathetic sustainability and the intention of the design program established specifically for The Guest Room.

2. Urban density specific to Hong Kong

With a population of just under 7.5 million people, some areas in Hong Kong like Mong Kok have 120,000 persons/km². These statistics rank Hong Kong as one of the most densely populated urban cities in the world. With only 20% buildable land area, Hong kong's landscape is constricted to island shore lines and mountainous slopes. The lack of space results in an urban challenge causing growth to develop vertically creating a compact urban concrete jungle. The cost of living within such means results in a vast wealth gap with pockets of homeless people trying to carve private spaces for themselves within what little public space remains available.

Publicness in Hong Kong is defined by private establishments offering privatised public spaces in exchange for additional building height square footage. Such spaces appear to be public spaces for public use, however actually function more as restricted private space. As a result, streets, alleys and pedestrian bridges are the true public spaces in Hong Kong available for public use without restriction. This is where we find most of the homeless communities trying to survive night to night while owning just a few things for basic daily survival.

3. ImpactHK

I've had the pleasure of observing this rather impressive humanitarian movement in Hong Kong over the past several years, starting from a small blog called 'The Guest Room' growing into a registered charity supporting roughly 400 homeless individuals each week throughout Hong Kong. The ImpactHK community, led by Founder and CEO Jeff Rotmeyer, started with the goal of doing just one single kind act per month for the homeless. These monthly events quickly became popular amongst the public, allowing ImpactHK to increase the number of

events and support for the homeless. They are now on the streets of Hong Kong supporting the homeless every night of the week.

Initially criticised for doing more of the same 'bandaid' methods for the homeless, their approach is vastly different. The underlining principle is to build trust and friendships with the less fortunate people they encounter. ImpactHK does not interview or force conversations. They simply show kindness again and again. Once the trust is built, ImpactHK prefers that individuals make the first step towards them. Once a friendship is established, further steps are then discussed to help the individual potentially make a transformation back into society by giving them a real opportunity for a second chance at life.

ImpactHk is not the only charity trying to make a difference for the less fortunate communities of Hong Kong, but they are one of the only charities to really make a priority of transitioning people off of the streets with a holistic approach. Jeff of ImpactHK claims, one of the biggest challenges is overcoming stereotypes of the homeless by people who have never been in contact or spoken with them. ImpactHK bridges this gap through their Kindness Walks and Kindness Rides. The walks are organised by ImpactHK everyday inviting the public to walk through identified areas carrying food, hygiene supplies and clothing to then distribute to those in need. Many volunteers attend each week and share their experiences with friends. The amount of weekly walks and the volunteers has quickly grown organically involving nearly 2000+ volunteers this year.

The goal of ImpactHK is to start with an established trusting friendship. This then leads to the opportunity for ImpactHK to offer a private rental space for a current homeless person to transition off the street. Jeff firmly believes that giving someone a second chance starts with holistic rehabilitation. He tries to empathise with the homeless and understand that there was considerable trauma and difficult circumstances that lead the individual to homelessness and additional layers of pain and damage caused while being homeless. With their holistic approach, ImpactHK provides an opportunity to rehabilitate emotionally, mentally and physically.

After moving off the street and agreeing to work with The Guest Room, a formerly homeless person (soon to be a Community Helper) would hopefully go through a full holistic transformation. Once the friendship is established and trust forms, the emotional transformation occurs through regular required visits with The Guest Room counsellor, nutritionists and established mentor. A wide variety of sports and educational opportunities are also offered and encouraged to help gain strength, endurance and drive. Working in The Guest Room is an essential part of the transformation. All Community Helper jobs are on a part-time basis and relate directly to giving back to the community. It is hoped to be a successful framework similar to a rehab process. Currently their are several job options available through ImpactHK which are selected according to the interest and talents specific for the Community Helpers.

By establishing a strong community of volunteers, now known as ImpactHK, and strong connections with several homeless, it was clear that creating a centre to further help the homeless transition was the next crucial step for ImpactHK. Jeff observed a need for further support in specific areas like Sham Shui Po, an adjacent neighbourhood of Mong Kok. He

wanted to directly make an impact helping with essential necessities for the vast majority of homeless in Hong Kong and extend further help to the less fortunate surrounding community with more immediate solutions such as food, drinking water, clothing and laundry. This was the start of The Guest Room, initially the name of Jeff's blog, now a unique place that sets a precedent for empathetic sustainability.

4. The Guest Room Design

One of the many strengths of The Guest Room is the incredible community of followers that come together through ImpactHK each day to help contribute towards such a life transforming cause. ImpactHk thrives on a backbone of thousands of volunteers in Hong Kong that give back direct to the community. The momentum with ImpactHk is palpable and sets aside the vast wealth gap among Hong Kong residents, bringing together all walks of life to interact and help together.

A typical day in The Guest Room unfolds as this wealth gap is blurred with paid employees, friends, volunteers and formerly homeless friends, titled Community Helpers all working together with the same goal, to help people in need. The layers of activity and the various people interacting throughout the day are all part of the root of success of this place. People of all backgrounds are invited to come together here to help, work, volunteer and give back. Bjarke Ingels once said, People need to understand a building (space) looks different often because it performs differently. In The Guest Room, we wanted the space to look different from the first impression to the last impression. Every detail was considered and is a direct reflection on the intended purpose within that space. The mixed use of familiar objects and furnishings reused in unexpected ways throughout the spaces offer a solution that is inviting and comfortable with a unique eclectic aesthetic. It is hoped to intentionally mirror the transformations that will occur at all levels among both the volunteers as they encounter the space and the homeless who come for help. From the Guest Room as a previous metal shop, to the painful path of it's Community Helpers, to the volunteers who experience this place, the design of The Guest Room manifest transformation.

4.1. Location and the renovation layers

In search of the location for The Guest Room, it was critical to select a space that was within walking distance of the larger homeless communities making it easily accessible for them to visit. Once the location was selected, the goal was to then formulate the design strictly around the needs of the users and consider adaptive sustainable use within each space. When the site was handed over, the existing conditions were extremely dilapidated with deteriorated walls, rusted metal, exposed electric connectivity, water damage, decrepit floors, a hole in the ground for a toilet and no water supply. There was little worth salvaging. The space was previously used as a metal shop with installed mechanisms to lift and move heavy pieces of metal using a centralised linear metal beam running the length of the space. With the goal of adaptive reuse in mind and a limited budget, we immediately decided to work with the existing layout as much as possible not erecting any additional new walls and keeping all exposed electrical and metal beams. Just as the homeless transformation occurs in layers and over time, the former metal shop had a layered transformation of its own. The project went straight into demolition mode scraping walls, removing old tiles, rust and the metal floor panels. The first new layer was the poured concrete floor, plastered walls and new tiles

necessary for waterproofing the kitchen and bathroom areas. Once the initial surface makeover was complete, the secondary layer of water and electric was added using exposed copper piping for all water input and output and checking the existing exposed electrical points.

In keeping in line with the original elements of the metal shop, all exposed electric, metal stairs and upper loft remained and the ceiling was kept as an exposed high ceiling to maximise the natural light entering from the front facade. The full interior was then painted in a VOC Free non-toxic paint. This set up a blank canvas to then be further developed in layers with the large community of ImpactHK volunteers and the Community Helpers adding color to both the walls and interior fittings.

It was the next step that became the first pivotal moment for The Guest Room. The vast community of volunteers and several Community Helpers together were a large part in the success of the final transformation of the interior. Together they all worked alongside each other, completing various painting and building tasks, undefined by any labels other than friends. We felt it was extremely important to invite the volunteers and the Community Helpers into The Guest Room together as early as possible in this process of redevelopment to help them each establish a feeling of attachment and connection to the space. It was also important that from the beginning, there was not a divide between the volunteers and Community Helpers. Everyone came together working as one. The final layer for the renovation was the front facade. This is a glass facade set back from the adjacent sidewalk providing a unique front porch experience. The facade uses frosted glazing up to 6 feet visual height and clear story glazing at upper heights. This is to offer some privacy without compromising the natural day lighting.

4.2. Program

The essential needs of both Community Helpers, current homeless and the many volunteers were all taken into careful consideration when designing the interior spatial program. As the needs were calculated and defined, specific solutions were developed for the homeless to have a way to transition back into society using the spaces. The Guest Room aims to function as a distribution centre for donations to be given directly to the homeless, thus storage was essential in spatial planning. The design went much further than a drop off/ distribution facility, in hopes of setting a precedent for empathetic sustainable urban design.

The Guest Room employs a simplified open plan design for flexible usage, low-cost sustainable (reused) materials when possible, with the main focus on the cause, helping the homeless. In keeping in line with its name, The Guest Room hopes the frontal porch space will feel like an inviting public social place, yet the overall usage is left to the needs of those using it. There is not a singular defined use for this space. Instead it could have overlapping functions from relaxation, gathering and eating to a cafe integrating the public with the Community Helpers.

Just as the first impression on the Kindness Walks is establishing trust, it is hoped to establish a trusted first impression with The Guest Room starting on the front porch. By placing a double sided open glass front Community Refrigerator to one side of the front porch anyone is invited to take what they need no questions asked. This innovative solution is hoped to implement the initial first layer of trust. The Community Refrigerator will house daily food donations from local organic farmers, bakeries and various selected restaurants for the surrounding

communities. We are hoping that as we establish a regular trust and connection on the front porch, individuals will feel encouraged to step further into the space.

Figure1. (top left) initial space, (top right) transformed blank canvas, (bottom) formerly homeless friends and volunteers working together

Just inside the front facade is the Living Room, a social welcoming space with comfortable sofas, table and chairs. This space is meant to reflect recognisable furnishings found in a residential living room to help establish a relaxing public private usage by both volunteers, staff and Community Helpers. The fittings and colors in the Living Room were designed to extend an eclectic welcoming mood that would be inviting to anyone entering this space. Just like the front porch, this space has unlimited usage flexibility. It is the main area for the centre, transforming between a gathering place for volunteers, workshop space for various events like Kindness Matts, gallery space housing art work for sale on the walls to an event space for events like Improve Night.

An oversized 513 Peacock color painted arrow (see Figure 1, bottom) is used as a literal way finder to encourage entering further into the space. 513 Roulotte paint on the opposite wall,

(see Figure 3) adds a playful element blurring the lines of ceiling, edge, surface decoration and wall. This is intentionally meant to be a playful juxtaposition that directly reflects the function of The Guest Room. With paint extending beyond expected edges, over top of the art work, exposing only 2/3 of the time on the clock and partially covering the adjacent tables and benches, it is hoped that the old is not forgotten and the new shiny paint is not just a makeover. This wall implies a real transformation has occurred without forgetting the surface that once was.

Once you pass through the frontal Living Room, you are then greeted by a reception desk. This is a transformed former table with 2 broken legs and a bookshelf now permanently fixed together as one supports the other. The chair behind has been partially painted 2/3 new coat of paint, leaving hints of the beauty it once was. A full length chalkboard extends floor to ceiling on the nearby column that is the most central element in this space identifying the name of the place.

As you step further into the space past the slogan #kindnessmatters and the reception desk, there is a shift from public to private and a literal physical spatial squeeze from the adjacent sites stair. This area has several over lapping functions, yet again can be transformed according to need and use. It is often used as a live music corner designed for some Community Helpers who are musicians to play at various events and offer music lessons. There are also community dining room tables with an electric mix of mismatched chairs around and a second hand clothing shop. This area utilises an open plan to maximise flexible use with all movable furnishings. The tables are all on wheels, clothes hang on bars that swing and attach to the adjacent wall and movable construction ladders act as additional hanging display areas.

Stepping further back into the space is the open kitchen equip with induction cookers, oven and a large industrial washer and dryer. These W/D set is specifically available for anyone to do their laundry and to clean the donated clothing that has not been properly washed and dried before distribution. This area is used largely for food prep, washing and sorting food donations and laundry. It can also be transformed to accommodate cooking classes and events.

One of the largest transformations that occurred was in the toilet area adjacent to the kitchen. In doing so, the design was intentionally very playful and meant to be an unexpected combination of elements at different levels with unexpected purposes. All new exposed copper pipes were installed extending into the tap and the walls display high contrast patterned tile adjacent to bright colors. This is a small space that makes a big impact!

As you transition up the stairs adjacent to the kitchen into the Cock Loft, there is a large storage area adjacent to a single room. This space is the most private space

Figure 2. (left) previous conditions, (right) renovated transformation

within The Guest Room and is designed for comfort with recognisable furnishing that endue relaxation, a sofa, table and beanbags. Keeping in line with the flexible
sustainable use establish throughout, this space will be used as a private counselling room, for meeting with the mentor, taking a quiet rest, reading and catching up with emails. Just as the furnishing here were carefully considered, the Cock Loft has taken on its own playful character as well. Three fourths of the room including the floor and ceiling are painted in 513 Lagoon paint to create an illusion of bended edges. The aim of continuing the paint on all surfaces was to further blur the lines of here and there implying the elements of past and future. The opposite wall, adjacent to the entrance, is covered in pages of an old book left at The Guest Room. The story is scattered all about mixed up with some parts covered and the backs of the pages concealed towards the wall. Together the pages no longer tell the story in full, revealing only half of the whole, leaving behind the rest. You must walk fully into the space to experience this unexpected detail. As the Community Helpers will be the primary users of this place, they will enter somewhat scattered in life like the pages of the book on the wall. With each continued session (counselling , mentoring, relaxing) it is hoped to be a safe place to help them through their holistic transformation. This space will also house a small library of donated books as well as computers for personal use to reconnect virtually.

4.3. Adaptive reuse

The design aesthetic for each space was considered specifically in relation to the desired users and informed directly from the user needs. It was important to understand their specific needs to fully help establish a connection with the space. Just as establishing trust is the first important element in the Kindness Walks, trust was also the intended first experience at The Guest Room. The frontal porch space is very special in that it offers a unique threshold experience. The idea is that need and supply with repetitive use is hoped to establish the first steps of trust.

The overall spatial plan is kept as an open plan to house the various different functions and activities of the centre. The list of necessary program factored into the functional purposes. An additional essential part of the planning was how each space could transform in use during the day and evening hours for optimal sustainable usage. The goal was to ensure each space had maximum flexibility in use and potential transformation for the various functions needed.

All furnishing for The Guest Room were carefully selected from Crossroads, a charity structured to provide resources that directly meet the needs of others by donating quality second hand goods. The selection was a lucky draw of unexpected finds. In line with the framework established for The Guest Room, these furnishings were also considered as part of the story having a second life. We invited the ImpactHK volunteers, the Community Helpers as well as the public to come and help us paint The Guest Room adding character through color on the walls, floors, ceilings as well as the donated Crossroads furnishings. The idea was to invite everyone to come together to have a hand in creating this new place while transforming the furniture with a fresh coat of paint. In doing so, all items painted were to have at least 1/3 remain unpainted to show what the item once looked like compared to the new and improved painted version. This played into the adaptive reuse of sustainability, thus making everything new, while keeping an element of the original condition.

Figure 3. 513 Roulotte wall - Living Room

A long side table was cut by thirds and designed with new unexpected functions beyond a desk. It is now reused as a desk on one side of the wall and adapted into the bathroom basin counter extended out on the other side. A cooking pot was reused as the new basins in the updated bathroom with the handle holding the toilet paper rolls. A standard solid door was flipped on the side to be the kitchen countertop. Several broken parts of different furnishings were fixed together to provide a new compositions with new unexpected uses. Exposed copper pipes extended to become the actual taps in both the bathroom and kitchen. All tables were positioned on wheels. Wooden chairs were painted each with maximum 2/3 the area covered with paint as an electric mix of various shapes, colors and sizes were positioned together around the dining table indicative of the users that would soon fill the space.

The spaces themselves transition between various functions and the furnishings are easily moved and shifted according to the needs of the space. As mentioned, the frontal living room transitions throughout the week between a welcoming space, gathering space, working area for events and food distribution. The extended dining room provides space for larger cooking events and smaller daily meals. These are just some of the observed flexible uses and transformations that are occurring daily thus far. These transitions are easily achievable with

simple design solutions of movable furnishings in addition to adaptable lighting that offers a mixed setting of ambient, task and accent lighting options.

5. Conclusions

As a prototype for empathetic sustainability, the identity of individuals passing through the front porch is blurred as everyone comes together to merge as a social juxtaposition in The Guest Room. It is a type of community gathering place specifically designed around the needs of the homeless and less fortunate. Homeless people do not have any true private space of their own. They try to claim a temporary private space within the high density public urban fabric of Hong Kong. The Guest Room is a unique place able to offer a temporary private solution for them to get everyday essentials and take a rest. It is hoped that The Guest Room will be an extension of the surrounding areas to directly help the less fortunate people in need.

ImpactHk is largely about extending knowledge to the public to erase the negative connotation of the label homeless, and the fears that come with being around people who live on the street. The Kindness Walks help bridge the gap between the well off and the less fortunate. This may be a temporary moment of connectivity, however as volunteers establish trust, this gap lessens. Real trust leads to real transformation. This is a community effort and is possible with the unique framework established by Jeff through ImpactHK to ensure that the transformations are not a temporary solution, they can be a lasting life changing holistic solution.

Jeff has stepped into this community trying to make a lastly impact providing direct solutions that are drastically transforming lives by offering a real second chance to transform back into society. It is impossible for the public to know the struggle and experience of what it feels like to live on the streets with no real private space to call your own. It is also impossible to understand how it feels to constantly be checking your area to ensure no-one is taking the few things you own or violating you as you try to rest. Kindness Walks are the first step by ImpactHK in contact with the homeless and are used to help distribute supplies, build trust and to help the public learn how to empathise with the real life conditions of what it truly means to be homeless. The Guest Room is the bigger picture which sets the precedent for how a place can be a solution to rebuild less fortunate communities with an emphatic sustainable solution.

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ARCHITECTS AS (SOCIAL) ENTREPRENEURS: RECENT EXPERIENCES FROM COLOMBIA

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Abstract

This paper observes how architects in Colombia have responded to changing circumstances, as the traditional role of the architect as the responsible of design and oversight of construction is being challenged by difficulties in territorial control, on the one hand, and dominance of profitability concerns over quality of architectural design and urban environments, on the other. Three types of alternative practices are described: one based on social activism, one based on the architect becoming a real estate developer, and a third one that combines these two models. Some of the most relevant projects are brought up for discussion and questions are raised regarding the training architecture students require to assume these new roles.

Keywords

Colombian architecture; Contemporary architectural practice; Architectural activism; Architects as entrepreneurs.

1 Introduction

The Latin American built environment is the result of complex socio-economic and political circumstances in which high inequality and informal economies are the underlying reasons for the notably contrasting, dynamic and volatile building activity. Colombia, one of the most inequitable countries in the world [1], boasts an informal employment ratio of 62% [2] and has a long history of struggles between the authorities and illegal groups for territorial control. Similarly, the quality of the Colombian built environment heavily suffers from lack of control –resulting in informal settlements- and lack of legal or political incentives for meeting criteria of quality in architecture and urbanism, which produces massive developments of at best mediocre specifications.
Thus, in Colombia the role of architects in its traditional sense –as actors responsible of designing and overseeing construction of individual buildings, within an institutional framework that guarantees a livable urban environment– is challenged on the one hand by the state and on the other hand by real estate developers. The scope of action for those

wishing to develop projects that achieve to improve their surroundings is narrow, and for many it is limited to public competitions or up-market projects. This paper describes some of the organizational models that Colombian architects have creatively developed over the last decades in order to broaden the above-mentioned scope.

2 The deficiencies of the public realm and private practice

Over the last 25 years, Colombia has set a worldwide example in the use of architecture as part of public policies. The fact that since the 1990s, governmental organizations on a national level are required to hold public competitions [3], in combination with the relevance given to high quality architecture and public space by some of the most influential actors on a local level (notably the mayor's offices of Bogotá under Enrique Peñalosa and Antanas Mockus, and Medellín, under Sergio Fajardo, Alonso Salazar and Aníbal Gaviria), has stimulated public and semi-public institutions nationwide to invest in high quality architecture. Since 2008, public and semi-public projects account for 63% of the architecture awards given at the main local event, the Colombian Biennale of Architecture [4]. Adding non-profit institutions, this figure even rises to 79%. Paradoxically, many of the state-sponsored award-winning projects are in fact responses to urban environments that lack basic infrastructure and facilities, which should have been provided by the state in the first place. Thus, these projects, seeking to "integrally improve", "regenerate" or "de-marginalize" sites, communities or neighbourhoods, in other words look to bring the logic of the state to otherwise peripheral or marginalized territories.
The margins of the state control, however, are not only to be interpreted in the sense of peripheries, but also in the sense of space left between bodies, law and discipline [5] or the flexibility and interpretability of regulations. The noteworthy practice of public institutions as actors capable of improving urban environments with architecture and public space harshly contrasts with their role as regulators and guarantors of the architectural and urban quality of private developments. Building regulations are in many cases limited to maximum heights, placement, safety and use classes. In smaller municipalities, zoning laws are often excessively flexible and allow for large-scale developments by private parties. As a result, architectural quality beyond the aforementioned basic topics is a marginal, mostly ignored issue in political debate on territorial control or advancement of building codes.
A significant part of Colombia's urban landscape is being given form by real estate developers, who follow a business model in which underused plots are redeveloped into high-density residential or commercial buildings, pre-selling the units to individuals in order to finance construction itself. As a result, architectural design in these projects is focused on efficiency – maximization of saleable area and minimization of construction costs– and heavily influenced by marketability parameters. This leads to standardized units and the reduction of not-easily-marketed architectural qualities such as optimal natural lighting and ventilation, insulation, soundproofing, etc. Additionally, social housing policy is based on individual subsidies given to families that acquire new, private-built units under a certain cost limit. In order to keep costs down, developers prefer large-scale developments on cheap land, leaving large populations of low-income workers to settle in high density communities in peripheral locations, many times without proper urban facilities or transport to their jobs.
Another part of the landscape is shaped by the informal economy, which comes with its own housing market, largely explicated by the concept of "progressive housing": a house is constructed level-by-level, often over the course of several decades, and subdivided into as many smaller units as possible to generate income for the owner. As the informal

neighbourhoods develop, densities rise but open space is usually very limited. Also, since building codes tend to change over time, and fragmented, individual plot-based redevelopments take place, "formal" landscapes tend to "informalize". At the same time, formerly peripheral, "informal" neighbourhoods become strategically located, so that in these areas the "formal" logic of real estate developers begin to replace the informal constructions. After all, both environments form "an integrated system of the land and housing market" [6]. The "informal" approach only sporadically requires the presence of architects, while in the "formal" approach architecture is ruled, as explained before, by profitability.
The circumstances and practices described above have led to a situation in which architectural quality is only important in institutional projects and a small part of corporate and upscale residential projects. Among them, these projects add up to a very, very small portion of the built environment. Needless to say, this situation affects not only citizens and their built environment, but also the opportunities of architects wishing to contribute to their cities and landscapes with the creative solutions and research-based processes they are taught in architecture school.

3 Architectural activism

One of the more radical responses to the described situation has been the appearance of collectives and NGO's addressing the situation of marginalized populations and urban areas before the public opinion and working actively with communities. In itself, this is not a new phenomenon. The Techo ("Roof") foundation, for example, has been active for decades, with subsidiaries in all Latin American countries and over 3.300 dwellings and 400 community centres built. Recently, however, some actors have added different, creative approaches to the traditional model of assistance to poor communities.
Pioneered by Simón Hosie, the youngest architect ever to be awarded the Colombian National Prize of Architecture (in 2004), these actors have focused on community-based planning and designing, iconic architecture and public discussion of findings. Hosie, as a recently graduated architect, went to live in the remote community of Guanacas in the Southern Colombia region of Cauca, and, over time, convinced his neighbors to build a Casa del Pueblo ("Home of the people" or "Home of the village"). His anthropology-based approach to architecture has led him since to design a platform for geo-referenced, qualitative information on rural communities called Living Plans, and to take the Casa del Pueblo concept to other communities, one of them the site of the El Salado paramilitary massacre, for which the design process and the built project proved to be a profoundly important part of repair and reconciliation.
Fundación Pies Descalzos (the "Bare Feet Foundation"), an initiative of Colombian pop singer Shakira, hired architect Giancarlo Mazzanti for two of its projects. Mazzanti was known for his design of a public library in the shape of three large rocks on a Medellín hilltop -visible from the better part of the city-, explicitly emphasizing on the symbolic function of the project for the poor peripheral neighbourhood it was located in. A similar approach can be seen in both of the Pies Descalzos projects: an extravagantly shaped roof over a sports pitch in the extremely poor neighbourhood of Altos de Cazucá on the outskirts of Bogotá (2011) and a school in a poor area of Cartagena, Loma del Peye, in which, rather than the classrooms themselves, the building evolves around a large atrium covered by a mountain-shaped roof whose function is as much bioclimatic as symbolic (2014). Mazzanti's projects undoubtedly

have contributed to take architecture for marginal communities beyond the mere solving of problems.
The idea of collective thinking has been taken beyond participatory design by Arquitectura Expandida, a Bogotá-based collective that focuses on constant exchange of ideas with their counterparts in other countries (Santiago Cirugeda's "Recetas urbanas" –urban recipes– was among the pioneering projects of "collective thinking"), but also organizes encounters for similar-minded organizations in Colombia that go far beyond the scope of architecture and urbanism. Defining themselves as activists rather than architects [7], Arquitectura Expandida has amounted a solid base of community-based projects that includes a community centre (2013), a library (2014), both in the Bogotá area of San Cristóbal, and a community-built movie theatre called Potocine (2016), in a play on the name of the site, Potosí. But they also helped develop a music truck with which they host street party hip-hop events in local communities. Beyond Arquitectura Expandida, a similar 2012 project (although less community-based) named Collective Intelligences in the coastal town of Palomino, with the participation of undergraduate students taking on small-scale design and construction challenges, has been widely publicized.
The radical repositioning of the role of the architect by Simon Hosie, the mediagenic architecture of Mazzanti and especially the cooperative discussion-based work of Arquitectura Expandida has put marginal architecture in the spotlight of contemporary practice in Colombia. Arquitectura Expandida's work is both research and action, exploring the margins of architectural practice and occupying the space that outside of Colombia or Latin America would be unavailable due to the state and territorial control.

4 Real estate as a design-based business

The rapid population growth of the second half of the 20th century has led to cities expanding quickly. Ever since the 1980s, the former suburbs of the 1950s and 1960s have increasingly become central areas, therefore experiencing a process of diversification of activities and exponential densification. Small and mid-sized developers seize the financial opportunities of replacing single family houses with apartment or office buildings. Among these developers, there are several led by architects who adopted this business model. Some of them did so very successfully, from the financial point of view. Arias Serna Saravia, for example, started out in the late 1970s as a design firm, but over the last two decades have grown to be a mid-sized real estate development company, focusing on the luxury market and participating in large leisure projects in the Caribbean.
Others, rather than aiming for financial success, decided to become developers seeking creative freedom as they work for themselves rather than for a client. Obranegra, a Medellín firm, has completed several apartment buildings in Medellín on their own initiative. Álvaro Giraldo has managed to include the early phases of architectural projects (site finding, program proposals, investor pitching, financing schemes) in his regular practice, resulting in some of Bogotá's most interesting commercial and mixed-use buildings. These firms and others that have adopted the develop-and-design business model produce, albeit for a high-standard, high-budget clientele, far above average architecture and manage to explore their own interests in the process.
Arguably one of the most interesting examples of this model is the work of the Oberlaender family. Jon Oberlaender, with his wife Mitu and their son Lucas, have been acquiring vacant lots and singe family houses for more than 20 years. The apartment buildings they design,

build and market themselves, stand out as “atypical” among what is offered by developers, often preferring concrete over plaster in the inside finishes, and limiting the size of their carefully placed windows rather than using the floor-to-ceiling glass facades other buildings seem to have set as a standard for upmarket apartments. Two of their recent buildings illustrate this “oddness”: the Vinotinto building features asymmetrical spaces and irregular slabs that allow windows to be higher than the floor-to-ceiling height, and the Uno y medio building, currently under construction, uses a rare split-level distribution in which the social areas have higher ceilings than the bedrooms. No commercial developer would have been interested in this kind of experiments.

5 "Inventing our own kind of studio": El Taller de S.

A one-of-a-kind architecture studio in the panorama described up to this point is Bogotá-based El Taller de S, which has been active since 2008 and combines social activism with real estate development. According to their own testimony [8], El Taller de S’s first project followed the idea of one of the two founding architects to acquire, rather than just an apartment for himself and his family, a building fit for a rehabilitation job, with the goal to live in one of the units. They found a distressed building with legal issues, managed to acquire the building at a low price, solved the legal trouble and completed the rehabilitation with financing from friends and family in 2010. Their sensitive approach to the existing building, a 1940s example of modernist architecture, and to recycled materials won them several awards and the attention of the community of architects. The scheme was successfully repeated twice over the following years [4].

Notwithstanding the merits of these projects as they contribute to the safeguarding of architectural heritage, the buildings in question are conveniently located and inhabited by higher-income groups. El Taller de S, however, became interested in taking on the challenge of designing for deteriorated areas and poorer populations, both lacking high-quality architecture and urban interventions. The new approach took them to the historical Las Cruces area, located on the “wrong side” of Bogotá’s colonial district and known for drugs-related problems and safety issues. They acquired three vacant plots within a hundred meters’ distance and designed three projects.

Proyecto Pasajes, as the three projects were named jointly, takes on the local historical tradition of the *pasaje* or passage, a closed street with extremely small dwellings, most of them consisting of a single space. The 82 micro apartments designed by El Taller de S range in size from 18 to 45 m2 and share courtyards of different shapes and types. Where the buildings face the street, commercial spaces contribute to the pedestrian activity and street safety. Concrete masonry units are used as the main material and floor-to-ceiling windows allow the new architecture to be both contextual and easily recognizable, as red brick and bright colours are the most common elements of the surroundings. The transparency, black window frames and monochromatic surfaces remind the modernist sophistication implicit in earlier projects of El Taller de S. And as this minimalistic approach is taken beyond aesthetics to the scope of building economics, it seems highly appropriate for a project that takes the value of design to a poor neighbourhood.

With a project that is entirely self-managed, has a social basis, is site-specific and historically underpinned, and contributes to its surroundings, El Taller de S managed to introduce a radically distinct type of project in Bogotá’s architectural landscape. Undoubtedly, it will and should become an example to be followed for the current generation of young architects.

6 Toward a different kind of architect?

Few freshly graduated architects, however, are prepared to undertake risky endeavours like the ones conducted by Arquitectura Expandida or El Taller de S. Colombian architecture schools put important emphasis on topics such as cultural heritage, public space, low-income housing or urban landscapes. But very little of their alumni manage to put into practice their awareness and sensibility, assumedly because of the harsh market and employment conditions described in the first part of this article. The architects and firms mentioned in this paper, however inspiring their work may be, are a small minority within the architectural community.

Should architecture schools in Colombia, rather than postgraduate programs in Management or Urbanism like those offered by the world's leading institutions [10], explore the training of architects in social sciences and entrepreneurship? Could interdisciplinary training fill some of the conceptual lacuna and provide the lacking skills for a more social role of the architect in contemporary society? Should exploring the boundaries of their profession be part of all architects' training? These are questions, even if they call for further inquiry and comparison both within Colombia and Latin America and abroad, that should be addressed as part of current reflections on the role of architecture and architects in society.

For a start, a wider understanding of the concept of "project" is needed. Architects, especially in Colombia and other Latin American countries, should not only respond to problems defined by others, but also conceive them. They should set the agenda, influence the public opinion, create opportunities and be able to find partners, in order to address urgent topics with research and creativity. Their social awareness should be central to their acting, and their capacity of transforming space should benefit all parts of society.

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GENIUS LOCI, INNOVATION AND TRADITION IN LINA BARDI'S WORK IN BRAZIL

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Abstract

Genius Loci is a fundamental concept to the cultural and aesthetical differentiation in the overcoming of the modernist way of thinking to the contemporary one. This notion, an indisputable Italian cultural heritage, was determinant and contributed to innovation overseas. It is the case with the architect Lina Bo Bardi, who started her work in Italy at *Studio Ponti* and directed publications such as *Domus*. She and her husband Pietro Maria Bardi moved to Brazil in 1948. Pietro was a distinguished Italian art critic in the period before World War II who defended the modernist way of thinking. He directed remarkable Italian galleries, and was later responsible for the foundation of the main art museum in São Paulo - *MASP*. After the Niemeyer-and-Lúcio-Costa era, and the modernist city of *Brasilia*, Lina Bo Bardi stood out as one of the most important designers and architects in Brazil. This paper intends to analyze her work "*Fábrica Pompéia*", with its successful accomplishment to reuse the pre-space occurred through the understanding of the Genius Loci and where creation and innovation have dialogued with tradition. The lesson from Italian culture converged into a piece of work with strong identity inserted in its social and cultural environment. She was requested to design a new building, only for cultural use, by demolishing the existing factory. Lina opposed her client by proposing a building beyond its cultural use that would eventually convey preservation and innovation. As a result, she created a space of high social reach, and with a program so complete like very few in the world. Lina's unique intellectual action occurred through a dialectical exchange between Italian cultural heritage - most specifically the *Genius Loci* - and the comprehension of the new environment where her intervention took place: her understanding, foreign at first for her Italian origin, was one that best captured the Brazilian soul.

Keywords

Genius loci; Innovation; Preservation; Lina's Bardi work; "*Fábrica Pompéia*".

1 Introduction

This paper's main approach is the notion of *genius loci,* emerging from the classical and Latin cultural tradition, referring to the "spirit of place": *Genius Loci* used to be worshiped in Roman

religion. Romans believed that every place had a particular genius - *"nullus locus sine Genio".* This genius used to define the characteristics of the place, and determine its singularity and identity. The association of a genius with every place might have occurred by analogy to household geniuses – spirits of ancestors who inhabited their former homes and protected those who lived there, to continue their tradition.

Photos **1** – Main Entrance of SESC 2 – Main area with a water pond representing the Brazilian rivers. - Photography by Haroldo Gallo, 2014.

2 Household Gods and Genius Loci

The Greek and Roman houses used to shelter altars on which there was always a fire or embers that could not be extinguished. Household gods expressed themselves in the flame of fire continuously fed by the family. The origin of the sense of home and property goes back to this idea. Coulanges points out there has always been a belief in the continuity of life (while addressing the old beliefs on the soul and death, going back to the Indo-European races, origin of the Greek and Latin people). They regarded death as a simple life change and believed that the soul of the dead remained in this world, near men. For them, each dead individual was a God who kept the good and the bad trends they had acquired while on Earth. In this sense, Coulanges refers to Cícero and says:

> *"Those that the Greeks called demons we call Lares."28 This religion of the dead appears to be the oldest that has existed among this race of men. Before men had any notion of Indra or of Zeus, they adored the dead; they feared them, and addressed them prayers. In the house of every Greek and Roman was an altar; on this altar there had always to be a small quantity of ashes, and a few lighted coals.29 It was a sacred obligation for the master of every house to keep the fire up night and day. Woe to the house where it was extinguished. […] We may suppose, therefore, that the domestic fire was in the beginning only the symbol of the worship of the dead; that under the stone of the hearth an ancestor reposed; that the fire was lighted there to honor him, and that this fire seemed to preserve life in him, or represented his soul as always vigilant."* [1]

The idea of household gods is the genesis of the idea of Genius Loci. However, household gods are concrete entities, inspiring and tutelary individualities, spirits that cohabitate the dwelling of a family. Differently, the *Genius Loci* refers to an entire community, and although it might impregnate a place, it is not characterized as a "concrete" entity. It is characterized as a link of unity, a factor of identity. Something that exists abstractly, and can be identified sensitively and conceptually, inherited from previous traditions not always conscious in the present. This concept has been fundamental to the conceptual overcoming of the modernist worldview that is more linked to the spirit of the time than the spirit of place. Time and place are both

fundamental to the understanding of the question researched here, and set its limits and extensions.

Photos **3** – Main circulation space connecting different warehouses used as cultural activities and sports areas - **4** – Façade on a side street showing the *"foyer"* of the theater. - Photography by Haroldo Gallo, 2014.

3 Zeitgeist x Genius Loci

The spirit of the time is defined by the word of German origin *"Zeitgeist"*, meaning "the spirit of the age" or "sign of the times". The term refers to all intellectual and cultural ambience of the world at a particular period in time. This thinking is a foundational reference to the modern movement and the "International Style". To be modern is an experience of time and space shared by humans all around the world in an ambience of frequent self-transformation, and at the same time, able to transform the things around it because of the so-called machine age. This environmental experience nullified the geographic and racial borders, also class and nationality, religion and ideology, with the intention to unify and equalize all the humans. Willing to highlight the contradictions of the modern thinking, Marshall Berman teaches us:

> *"To be modern is to find ourselves in an environment that promises us adventure, power, joy, growth, transformation of ourselves and the world-and, at the same time, that threatens to destroy everything we have, everything we know, everything we are. Modern environments and experiences cut across all boundaries of geography and ethnicity, of class and nationality, of religion and ideology: in this sense, modernity can be said to unite all mankind. But it is a paradoxical unity, a unity of disunity: It pours us all into a maelstrom of perpetual disintegration and renewal, of struggle and contradiction, of ambiguity and anguish. To be modern IS to be part of a universe in which, as Marx said, "all that is solid melts into air."* [2]

However, time and place condition a particular territory. In the moment that, in the 1960s, the parameters of modernism began to be questioned, the concept of Genius Loci resurfaced as a less mechanistic approach to the world that revalued place in its relation with time. The concept of genius loci, far from being an esoteric approach, is characterized as an abstract entity, the result of collective tradition that impregnates materiality and can thus, be felt, identified, incorporated and appropriated. Talking about time and constructed space Norberg-Schulz tells us:

> *"Time is not a phenomenon, but the order of fenomenal succession and change. Buildings and settlements, however, are static, apart from certain mobile elements of secondary importance. Nonetheless man has succeeded in "building" time, by translating basic temporal structures into spatial properties."* [3]

Two books published in the 1920s written by “Le Corbusier” are paradigmatic to the modern thinking and carry the notion of “*Zeitgeist*”: “*Vers une Architecture”, about buildings and* “*L’urbanisme*”, about cities. Likewise, two other paradigmatic books in the 1960s, marked the rupture of the modernist thinking, one of them titled "Complexity and Contradiction in Architecture" written by the American architect Robert Venturi, like Le Corbusier’s building’s book, and another "*L'Architettura della Città*" written by Aldo Rossi, emerged from Italy, extended the approach from the buildings to the urban space and cities. In our opinion, these geographical origins of the authors have great consequences on the thinking. One of this new paradigm, the Italian one, emerged from a cultural ambiance conveyer of a rich heritage, whose experience allowed the perception of the misconception of the historic denial.

In the book "The Architecture of the City”, the artistic values are extended from an isolated constructed artifact to urban contexture. Rossi understood that the value of the *locus* is both singular and universal. He commented that the classical world considered that the local deity, the Genius Loci, guarded the site. He believed that in our historical culture, in every situation we also refer to another, that distinguishes the space and transforms it into place, being thus, determined by space and time. It is possible to observe this explicit approach in the following text, when Rossi explains the value of the ‘*locus*’, at the same time singular and universal, related to the place itself plus the constructions that make it up:

> *“I have already used the term locus several times in this book. The locus is a relationship between a certain specific location and the buildings that are in it. It is at once singular and universal. The selection of the location for any building, as also for any city, was of primary importance in the classical world. The “situation”—the site—was governed by the genius loci, the local divinity, an intermediary who presided over all that was to unfold in it. The concept of locus was also present at all times for the theoretician of the Renaissance, even if by the time of Palladio and later Milizia its treatment took on an increasingly topographical and functional aspect. In the writings of Palladio, one can still sense the living presence of the classical world, the vital secret of a relationship between old and new. More than just a function of a specific architectural culture, this relationship is manifest in works like the Villa Malcontenta and the Villa Rotonda, in which it is precisely their “situation” which conditions our understanding […] It is possible to identify such a singular point by a particular event that occurred there at some time or an infinite variety of other causes, both rational and irrational. Even within the universal space of the Church, there is still an intermediate value that is recognized and sanctioned, the possibility of a real—if extraordinary—idea of space. To bring this idea into the domain of urban artifacts, we must return to the value of images, to the physical analysis of artifacts and their surroundings; and perhaps this will lead us to a pure and simple understanding of the value of the locus. Foil such an idea of place and time is seemingly capable of being expressed rationally, even if it embraces a series of values that are outside and beyond what we experience.* [4]

The *Genius Loci* is a totality composed of meaning and structure. The meaning is in the relation that a place has with others and with objects, in what it "concentrates", while the structure is constituted by the formal property of a system of relations. We intend to demonstrate that the architect Lina Bardi had, in her Brazilian work, this vision and sensibility, and this occurred, or it was possible, because of her particular and specific background and origin.


Photos **5** – Inside the common areas, highliting the furniture designed by Lina; **6** – Inside the *"foyer"* of the theater defined by the roof connecting two warehouses. - Photography by Haroldo Gallo, 2014.

4 Lina Bo Bardi

The protagonist of this study, Acchillina di Enrico Bo, known nowadays as Lina Bo Bardi, was born in Rome in 1914 and passed away in Brazil in 1992. Her life, background, specific education, experiences and influences from Italy to Brazil provided her singular sensibility, allowing her the identification and appropriation of the 'genius of place'. Adopting it like a conceptual and operative reference in all her creative work. The intellectual environment the couple Lina and Pietro lived in, one around art, modern architecture and popular culture, integrate this sensitivity and vision.

She was the daughter of Enrico and Giovanna Bo. Her father was an engineer and constructor in Rome, and a dilettante painter. Achillina di Enrico Bo studied Architecture in Rome, in the 1930s, during the full fascist war period, acquiring a solid knowledge about philological restoration at the *Scuola Superiore di Architettura di Roma*. To this background education, other experiences were added, such as readings, militancy in writing, illustration and drawing in Italian magazines. Due to the shortage of demand in the war years, Lina devoted herself to journalistic and editorial activities, managing *Domus* Magazine. Her renovating and unquiet spirit, and the nostalgic intellectual Roman ambience, made her exchange the hometown for Milan. In Milan, she worked in the studio of Gio Ponti, prominent Italian architect and designer who worked in a wide professional spectrum, being consistent with the modern ideology of the global project. However, his intense experimentalism, without breaking commitments with the modern – he cared more for the pure lines than its ideology – and despite the provincial fascist environment, experimented where the modern orthodoxy could not have reached, by even resorting to the classical tradition.

Still in Rome, Lina met Pietro Maria Bardi, important figure in the Italian world of art. While working both as a critic of art and gallery owner, he was present in the important polemics of the directions and renovations of the aesthetics expression in Italy, in spite of his engagement with the fascist government. It is worth mentioning the relationship established by Pietro and Le Corbusier, especially during the trip with the architects of CIAM from Marseille to Athens in 1933, and his participation in the controversial questions regarding the competition for the Florentine Railway Station *Santa Maria Novella*. His defense of the modernist language against the classic one stood out. His relationship with the architect Giovanni Michelucci and the Tuscany Group is also relevant. Last but not least, and proof of his engagement with the modernist thinking and the ideas of renovation in the aesthetic expressions, it is his

relationship with Giuseppe Terragni, the author of the '*Casa del Fascio*' in *Como*. Bardi's importance in Italy is clearly expressed in the words of Francesco Tentori:

> *"What? Are you interested in Bardi? He was a fascist, a fool…" We notice many times how some expressions meant to be definite are nothing but adequate to camouflage a status of ignorance regarding the subject being discussed. It works like this for Pietro Maria Bardi. Conversely, [...] we rest assured that this fascist, this fool, must be known as: a protagonist of the Italian culture between both World Wars; the creator of one of the most interesting museums in the whole world, after the War. We want to say that, especially in the field of architecture, Bardi was the number one agent, and irreplaceable, of a process of cultural renovation, of physical modernization which – without him, without his passionate and remarkable journalistic intervention – surely, wouldn't have happened in Italy, as it actually happened. Today, it is impossible to grasp how important the opinion, always clear and firm, of this straightforward writer was for the public authorities and the architects in Italy in that time."* [5]

Unhappy with the direction of Italy's post-war, the couple moved to Brazil with a significant collection of art works and craft items, and there met the Brazilian entrepreneur Assis Chateaubriand, who invited them to assemble the museum that he had idealized: hence was the birth of MASP, which Pietro directed for 30 years, alongside extensive other operations.

Arriving in late 1946 on the boat '*Almirante Jaceguay*' in Rio de Janeiro, the couple there encountered an ongoing environment of renovation in the Arts, in affinity with the modernist ideas. Representing that, there was *MESP - Ministério da Educação e Saúde*, the most emblematic urban building from the Brazilian modernity in that time and only possible there. Oscar Niemeyer and Lúcio Costa, among others, designed *MESP* under previous conception of Le Corbusier in 1935. The iconic building was visible from the sea and seemed to welcome them. About this, the historian Silvana Rubino claims:

> *"When Lina Bo e Pietro Maria Bardi arrived here, Brazil seemed to wave at them, through the brise-soleil and the columns of this building (referring to MES), with the possibility of a new world, certainly not the same promises that once attracted waves of European immigrants, but those of another intellectual and institutional realm, in which modern architecture seemed possible, inevitable and even a final sentence, as Mário Pedrosa wished for."* [6]

Photos **7** –Banner of Lina's Architecture Exhibit in 2014; **8** – Pedestrian passages connecting different sports facilities; **9** – Open plan inside the main warehouse and private places defined by Lina's furniture. - Photography by Haroldo Gallo, 2014.

5 The SESC Pompéia

The analyzed work, was an undertaking commissioned to Lina by SESC - Social Service of Commerce, a private nonprofit institution, open to the community. Intending to deploy a new unit in the west of the city, SESC asked the architect to design a project based on the premise that the former drum factory would be demolished to construct a new edifice for cultural activities.

The pre-existing factory was built in 1938 by a German company. In 1945, it was transformed into a drum factory and after, into a refrigerator industry. Between the 19th and 20th centuries, with the industrialization of the city, the region of *Pompéia* developed and received a strong immigrant contingent, particularly Italians. The region's urban profile was extended along the railway, marked by smokestacks, industrial sheds and workers' housing. With the wide dynamic transformation of the city during the 20th century, industries were transferred and their sheds abandoned, thus the real estate market substituted the existing buildings for highly verticalized new ones for the upper classes. In this changing context, Lina intervened.

When starting her work, Lina realized that the factory sheds had concrete structure with beams of the *"Viereendel"* typology, pioneer in Brazil, sealed with brick masonry and with pavilioned characteristic; moreover, the site was appropriated for leisure, in a particular way, by the population on weekends. The following words of the author denote that the *Genius Loci* had been identified from the beginning:

> *"When entering, for the first time, the then abandoned 'Pompéia Drum Factory', in 1976, what awakened certain curiosity in view of an eventual recovery to transform the place into a social center, were those pavilions distributed rationally according to the English projects of the early European industrialization in the mid-nineteenth century. However, what fascinated me, was the elegant and anticipatory cement structure. Cordially recollecting the pioneer Hennebique, I immediately thought about the duty to preserve the work. [...] The second time I was there, on a Saturday, the mood was different: no more the elegant and lonely Hennebiquean structure, but a cheerful audience of children, moms, dads and elderly passed from one pavilion to another. Some children ran, the boys played football in the rain falling from damaged roofs, laughing through kicks that threw the ball into the water. The moms prepared meat skewers and sandwiches at the entrance of Clelia Street; a puppet show, full of children, was going on nearby. I thought: all this must remain so, with all this joy."* [7]

Lina's approach, due to her cultural baggage, allowed the immediate identification of the spirit of place with its patrimonial values and ambiance. Hence her conservation premise instead of the intended demolition. The work of architecture allows an existential appropriation that transcends its practical aspect and reaches the psychological dimension of perception and symbolization. The artistic dimension of architecture lies precisely in this appropriation and symbolization. Besides shelter, we inhabit all of our living space, which makes it imperative to transform mere spaces into meaningful places, constituted by its material substance and environmental character, possessing a distinctive identity, which since antiquity, has been understood as *Genius Loci*.


Photos **10** – Block of Warehouses of the old factory and the new building of sports – highlighting the water towers in the place of the old chimney; **11**- Private places defined by Lina's furniture. - Photography by Haroldo Gallo, 2014.

When the conquest of the existential dimension characterizes the artwork, then a site is transformed into a place, that is, the "a priori" meanings potentially present in the environment are discovered. Although places change, and sometimes rapidly, the *Genius loci* is not lost or modified if the identity is maintained: the so-called *"Stabilitas Loci"* has been a necessary condition for human life. Lina's recognition of the vocation of the place, a basilar moment of architecture, is a form of poetry. Making practical edifices is not enough: only when a whole ambiance becomes visible, architecture concretizes the *Genius Loci*. [8]

Her proposal involved, in addition to maintaining the existence, a broad program of culture, sport, education and socializing. However, the distribution and hierarchization of activities determined new edifications, especially for sports. Naturally, because it is less impacting, the cultural part was located in the pre-existing sheds, and the interference was so subtle that it is unnoticed. In the internal space, the scale is adapted according to a gradient from intimate to collective, providing socializing and fostering encounters, besides the re-signification of space.

In another block, new sports edification was located, with several connecting spaces between them. These connectors act as catalysts or centralizers, giving specificity and scale to the places. The new block has dense plasticity. It is consisted of bare concrete with pure volumes of diverse dimensions, connected by walkways, whose journey intentionally exposes humans to time. Part of it, is the water tank, executed in cylindrical rings of bare concrete, whose form, verticality, expression, position and proportion allude to the no longer existing factory smokestack. The unusual language of these blocks contrasts with the preexistence and maintains the notion of cluster. A strong attribute of this project is the special dialogue between old and new.

According to Lina, the transformation is something inherent to life itself. Then, I highlight here that even in the restrict context of the architectural artifact, in order to preserve it is necessary to intervene and many times to transform, because the monument is never something that occurs only in itself: it is something that is transformed over time, in the processes of relationships. There is not an architectural work of the past, as simple or as complex as it is, that does not contain traces of a continuous transformation and adaptation. There is not a monument that has not followed a trail of ancient times in its primal absolute integrity, be it in drawing, be it in shape, be it in substance from which it had originally been conceived. [9] In this sense, Lina doesn't have a romantic vision about the past. She does not live in the past but, in the present time, the past lives in her! That is visible in her architectural interventions.

Lina's working process did not occur from a distance: her studio was the building site itself. She used to arrive early and stay until the end of the work, along with her assistants and workers: the details emerged with unveiling of difficulties and unexpected potentialities, without haste, but with much precision. Called by the author "citadel of freedom", the entire space is both egalitarian and libertarian, and despite following the legacy of modernist ideals, it breaks orthodoxies and characterizes a creative and differentiated proposal in the scope of contemporary Brazilian architecture.

Architects André Vainer and Marcelo Ferraz, her early assistants, enhanced the attributes of her projects for cultural facilities, with humane socializing as a generative force:

> *"They are true oasis of comfort and civility in our suffering metropolises. Spaces that praise the city as place of celebration, respect, and the possibility of being free" and "strangely, spaces to experience solitude amid collectivity, something difficult to achieve in Western societies, with noises and terrible events".* […] [It was] *an association of pragmatism with dream and utopia that has always believed in the possibility of building spaces for socializing with resource-saving and wide-ranging, combining simplicity with sophistication, rigor and poetry."* [10]


Photos **12** – Private places defined by Lina's furniture; **13** – The new blocks, as seen from the street. - Photography by Haroldo Gallo, 2014.

6 Conclusion

It is likely that the interpretations expressed herein, were not conscious premises of the architect, but they are consistent with her training and repertoire, which added to her ideology and special operating way, resulted in a unique work of high architectural and social qualities and dense cultural and symbolic identity. This demonstrates that Lina's unique intellectual action occurred through a dialectical exchange between Italian cultural heritage – most specifically the identification of the *Genius Loci* – and comprehension of the new environment where her intervention took place: her understanding, foreign at first, for her Italian origin, was one that best captured the Brazilian soul.

If Lina hadn't been aware of *Genius Loci* propositions, it is clear that she had a strong awareness of the importance of history and heritage in her approach to transform the reality through the architecture and as an architect, whose final responsibility is to transform the present constructed space in a better new one for the future, maintain a strong dialogue with the new and the old, without losing the memory and the identity. Finally I highlight some of her words:

> *"Shackle's must be cast off, but the past and all its history must not be just throw out too, the past should be seen as historical present that is still alive, posing the task of forging a different*

'real' present time, what is needed is not the specialist's in deep knowledge, but an ability to understand the past historically and distinguish whatever will be useful for new situations today". [11]

Photos **14** – Open plan inside the main warehouse and private places defined by Lina's furniture; **15** – Dialogue between the pre-existent and new buildings. - Photography by Haroldo Gallo, 2014.

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The 5th International Conference on Architecture and Built Environment with AWARDs
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THE DESIGN AND TRANSFORMATION OF COMERCIAL AIRLINERS INTO RESILIENT AND ADAPTABLE ARCHITECTURE

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Keywords

Adaptability, Recycle, Reuse, Resilient, Transformation, Second Life

1 Introduction

Hidden and forgotten in the southwest deserts of the United States, away from public view and discourse, are the anonymous airplane graveyards, with their expanding area and ever-growing numbers of obsolete airplanes dating back to the Second World War. The once majestic and most advanced technological inventions of mankind are discarded to decades of slow erosion by the sun and the wind. Last year, an interesting article titled "The Boneyard - - Old jets are retired to the New Mexico desert" appeared in the 05/13/16 issue of USA Today by journalist Ben Mutzabaugh in which he eloquently describes the boneyard adjacent to the Roswell local airport. The article presents an exhibit of retired airplanes from the Boeing 777 to the 727 and other planes, like "the red 1962 Lockheed Jet Star JT 12-5 that once flew Elvis". Ben continues to describe the site as a popular tourist destination for observing the decaying and exposed airplanes as an airplane cemetery museum that brings back "lot of memories" of our aviation history. For architects, this junkyard is an untapped resource ready to be reshaped, reused, and brought back to life. A potential refuge, a new line of furniture, a new housing typology, and many other visions are possible second lives to be created from these obsolete airliners.

It has also been 15 years since Architect William McDonough's visionary book "Cradle to Cradle" introduced a new model and approach to existing manufacturing and design. He produced the Hanover Principles, "a set of statements about **designing** buildings and objects with forethought about their environmental impact, their effect on the **sustainability** of growth, and their overall impact on society". Professor Paul Laseau's books, "Visual Notes" and "Architectural Drawing", on visual thinking, studies the subject of visual acuity, the ability to see more in what we experience or observe, and the methodology to integrate that process clearly and accurately for others to understand. So, the process and value of reusing and recycling become important components in architecture as we design new environments, in combination with our ability to visualize and communicate these concepts. Also, embedded in this sustainable second life concept is another challenge: resiliency.

Excessively violent storms are becoming a more frequent occurrence in our weather patterns,

and our architecture is not up to the task of combating their damaging forces. Buildings are swept away in floods and hurricanes, blown apart in tornadoes and straight winds, crumbled by earthquakes, and torched in forest fires. Resilient architecture needs to be investigated, created, and built in order to live safely in our climate-change environment.

These are the two challenges that have been the mainstay of the Aero-Architecture studios conducted at Ball State University's College of Architecture and Planning. The studios were able to build a design vocabulary of using airline parts as primary building materials in creating innovative and resilient architectural spaces, and finding a variety of reuses for these forgotten airliners. The resultant student projects were first informally introduced to a group of young aeronautical engineers working at Boeing, as well as the chief engineer of the 747-800. They encouraged us in the continuation of these projects, and invited our students to visit the assembly plant in Everett, Washington, where they were introduced to aero technology, airplane components, assembly logistics, new materials, and integral design methodologies. The plant tour also allowed students to see the process of manufacturing commercial airliners, and gave them close-up opportunities to examine the scale of the components that make up the aircraft.

The paper will present five years of aero-architecture through graphic communications of the graduate studios that utilized the airplane bone yards to reinvent the obsolete into state-of-the-art living environments and create a second life for the Boeing Commercial Airliners. The communication challenges were to illustrate the continuous value of aeronautical engineering, to demonstrate the endless opportunities of the second life of airplanes, and to visually address the resilient challenges of future climate-change environments.

2 The Studio Brief

The architecture graduate studio design challenge was to invent a second life for the Boeing Commercial Airliners. The studio engaged in the challenge to program, develop and design contemporary sustainable habitats by utilizing the components of the decommissioned commercial airliners as primary material for the projects.

3 The Program

The design studio began with a visit, via Google, to airline graveyards in Arizona, during which they investigated particular models and then reinvented the obsolete into state of the art habitats and created a second life for the Boeing Commercial airliners. The challenge was to define and redefine these once majestic ships of the sky and transform them into sustainable living spaces on earth. The projects began in the research stage (team process), with the analysis and the investigation of airplanes, and terminated with individual design solution of architectural form, space, and technology.

The other design research component was the analysis and understanding of extreme weather patterns, environmental forces and the destructive effect they have on architecture.

Figure 01 The bone yards of the Southwest and the present methodology of airplane recycling process

4 The First Project

The first project was to utilize, reinvent, and reform the fuselage into a new urban architectural environment, integrated with layers of sustainable architectural concepts for contemporary urban living patterns of working, living and playing. These projects were then presented and critiqued by Aeronautical engineers at the Boeing Assembly Plant and in the Future of Flight Museum in Everett, Washington.

The studio then received a plant tour in order to gain more understanding of the scale, technology, and assembly of the planes for their second studio project. (Plant photographs by Boeing) The tour allowed students to see the process of manufacturing commercial airliners, and gave them up-close opportunities to examine the components that make up the aircraft.

5 The Second Project

The second project is to respond to the gained knowledge and experience of the tour and engagement from the Boeing Plant visit and the Boeing presentation and discourse. Student then design more integrated systems of the utilization of airplane components.
Below are a few examples of the students' projects and the added value they incorporated into their designs.

Figure 02. Proposed disassembly plant and design studios

6 Aeronautical Disassembly and Research Facility, by Joshua Stowers

Have you ever wondered what happens to a retired aircraft, especially the commercial airliners? Well, many end up in the desert, useless and abandoned. But why? Few facilities exist to disassemble an aircraft, but those that do rip and shred the airplane into useless chunks of scrap material. Why not recycle parts just the way they are?

Commercial airliners are assembled similarly to cars, right on an assembly line, albeit a slightly bigger one. With all their pre-made component technologies integrated into the construction of an aircraft, why not simply reverse-construct the plane? The Aircraft Fleet Recycling Association has already set goals and standards for aircraft disassembly, but why not go further?

In business, money is everything, and an aircraft's scrap value alone does not justify the cost of cutting it apart. So how does one overcome this? By producing an environment that encourages the creative reuse of airplane parts and materials for manufacturing products and incorporating them into architectural design, decommissioned aircraft would have enough value to economically justify their disassembly.

A zero-waste disassembly plant would provide refurbished airworthy parts back to the airlines, provide raw materials for an on-site manufacturing facility, and ensure every scrap is recycled. Attached to the facility, an education, training, and research facility would incubate entrepreneurs, provide a platform of opportunity to researchers, and be the center of the discussion for spearheading efforts of sustainability after the useful life of aircraft.

By establishing added value to the process, this facility makes possible the tools, space, and leadership needed to create and establish new uses for aerospace technologies. The aim of this facility is to be a platform where all the other projects in this paper become possible, by providing the opportunity and means for their construction.

Figure 03 A rescue and medical module

7 Extreme Environmental Medical Response Module, by Lucas Holwerda

Past research has shown that disaster response times and relief housing alleviate fears and concerns about safety and health in post disaster scenarios. While the relationship between housing and physical health has been the focus of considerable research, healthcare design and deployment—which are especially necessary in mitigating long term injury—have received much less attention. This study examines the issues of disaster response and deployment design through research of healthcare response in real disaster scenarios. I believe the findings will show that thoughtful design through empirical evidence, interviews, and working knowledge of healthcare programming can result in shorter response times and better health services immediately following catastrophes. In addition, only a handful of agencies currently have programs that target the health and security needs of disaster victims. This research suggests that there is a significant mismatch between healthcare knowledge and healthcare design response in disaster settings, which perhaps require exceptional response, the most.

Utilizing case studies of organizations providing medical response in Haiti such as the United Nations Educational, Scientific and Cultural Organizations (UNESCO), The Red Cross, AmeriCares, and the United States Military, we can begin to gain insight into how response times for adequate medical care may affect social justice in post-disaster communities. In addition, a site visit to Haiti in March of 2013, three years following the earthquake disaster, provided opportunities of conducting observational research, as well as the implementation

of interviews with local citizens and organizations such as the aforementioned case studies.

Through the use of Post Disaster Response Evaluations (PDREs) and literature reviews, policies and resulting designs appear, which inform how a responsive design may provide adequate medical response, and supports facilitating and alleviating concerns of inadequate social justice while generating a means of mitigating medical response that place citizens into categories (amputees) that root social stigma.

This design initiates the real-life concern that simply a quick response in catastrophic scenarios is not enough. An empirical approach towards medical response design coupled with an understanding of local social belief systems, provides a framework for drastically improving the lives of the vulnerable stakeholders in disasters.

8 Global disaster search and rescue module by Daniel Potash

The Global Disaster Search and Rescue Module is a new alternative to traditional search and rescue operations. Utilizing existing aviation technology and products, these modules provide search and rescue teams with everything they need to operate in post-disaster situations. Due to the existing engineering capabilities, these modules are designed to withstand extreme conditions including the potential after-effects of a disaster. With the frequency of natural disasters increasing, these modules would be stationed around the world to be ready at a moment notice. The Global Disaster Search and Rescue Modules will make the jobs of rescuers easier, therefore saving more lives faster.

Figure 04 Coastal resilient housing

9 Aero BLOC, Resilient coastal housing, by David Smith

The Aero Bloc is a modular community, designed for a new breed of urban dweller. Recycled 737 fuselages provide the container for the modules, which can provide shelter for living, growing, retail, and many other uses including outdoor green space. Each module is designed to be entirely self-sufficient. Through the incorporation of efficient and smart systems the modules gather their own energy, collect water, and provide a dynamic pod for occupation. The entire complex grows organically based on need and input from the client and environment. Basic cellular rules for growth, architectural guidelines, and client needs determine the placement of the module in the Bloc.
The modules are prefabricated in a facility off-site, and delivered via barge or truck to the site. Before delivery the modules are completely finished according to client and engineering specifications, and upon arrival the integral crane automatically lifts the pod into place before a small team easily installs them into the superstructure. What is created is a complex network - a hive - of urban communal space. The superstructure provides a “quick connection,” or a port where the modules can be plugged in and unplugged easily. This design allows for the easy mobility, high quality and efficient production, and flexibility of the structure. The pods are made to be able to be relocated if needed with simple means, and the 737-fuselage size allows it to be transported with most means.

The modular system and self-sufficiency also allow the Bloc to perform well in times of disaster. The Bloc is meant to resist the damages caused by flooding. The modules can be lifted to a higher placement as waters rise, and their on-board energy harvesting and water systems allow them to sustain themselves when infrastructure fails. The module itself is strong and resilient, and can resist the damages caused by high winds and water damage, and if the modules are damaged, they can easily be replicated and replaced.

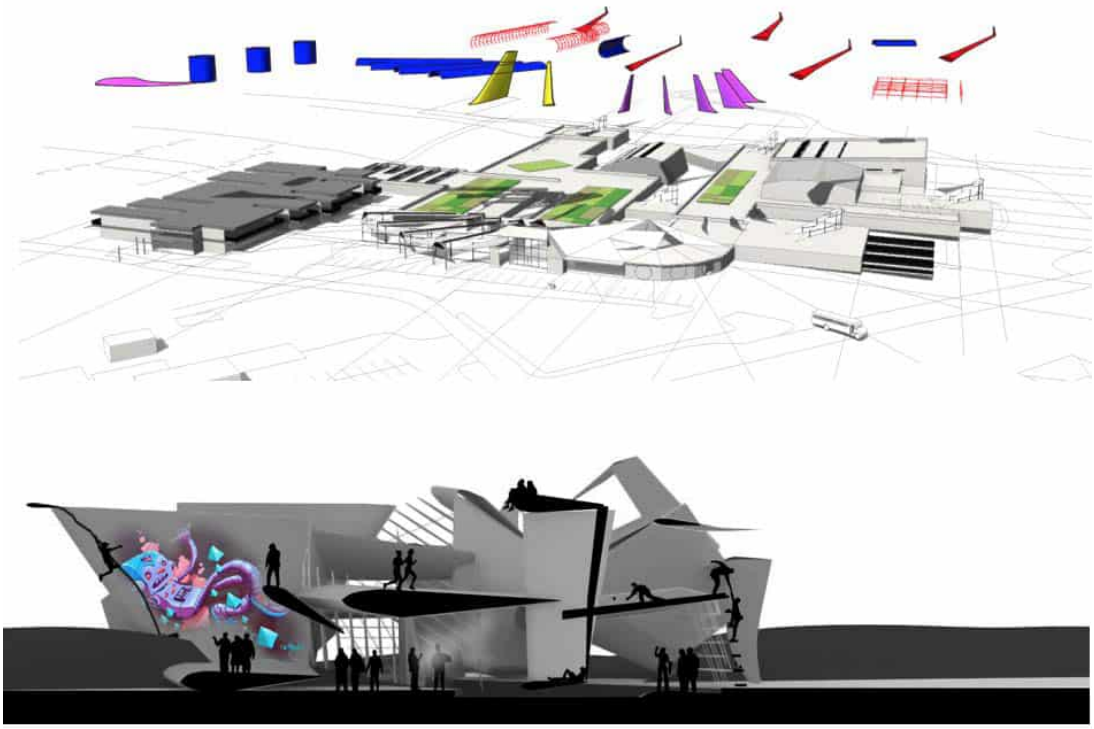

Figure 05 Tornado response architecture

10 Tornado Refuge by Glen Cramer

Every year, many people are killed or injured by tornados. Building collapse and flying debris are to blame. Suburban communities located in tornado alley are at a high risk of such destruction. After being devastated multiple times in the past decade, Moore, Oklahoma is in desperate need of a stronger and more robust school to resist the next storm. This school and community center sits next to a large suburban neighborhood with little or no protection. In the event of a likely storm this building will serve as a tornado shelter for those residents as well as a safe haven for the students and staff.

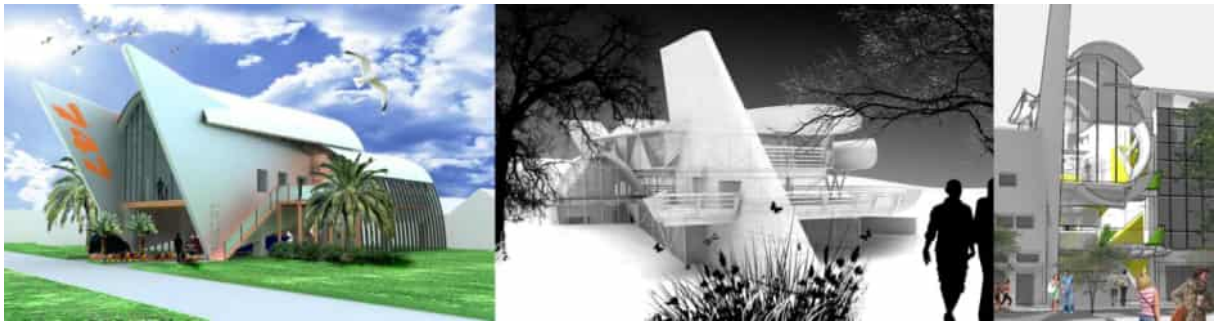

Figure 06 Inserting and folding plane components

11 Inserting and folding of airplane components by Tara Murphy and Alexis Flowers

On March 2, 2012, an F3 tornado ripped through an Indiana small-town of Henryville and destroyed their K-12 school. The storm caused considerable damage and left the educational facility in disrepair. The project inserts resilient airplane components into the redesign of the school that would create a more protective environment against future storms and create a unique educational environment.

By folding airplane parts, an exterior multi-functional community facility is developed in an inner-city neighborhood. The folded spatial composition allows for seasonal festivities, public markets, evening venues, and a variety public play.

Figure 07 Aero architecture housing

12 Aero-Architecture Housing by Eric Bearman and Miguel Ramirez

New suburban and urban housing topology are designed by utilizing airplane parts in a variety of methods that result in more integrated systems and have the capacity to weather more violent storms. The parts of the fuselage will function as a safe room and the wings as a roof and water collection/storage system. The wings can also become aerodynamic structural walls to divert winds and collect energy. The concept is to convert a typical static house into a dynamic energy-producing facility for contemporary suburban and urban living environments.

Figure 08 Fire resistance

13 Fire Resistant Habitats by Morganne Walker

Wildfires, whether caused by nature or man, have destroyed millions of acres of forest, wildlife, and human dwellings and will continue on that path for years to come. This project looks into the possibility of being able to design a habitat that can survive a wildfire. By using the three-layered structure of the airplane engine as a main refuge against the heat of a forest fire and wrapping and extending the living unit with a sacrificial outer core of a recycled fuselage, one would be able to survive the fire and rebuild the dwelling after a major fire.

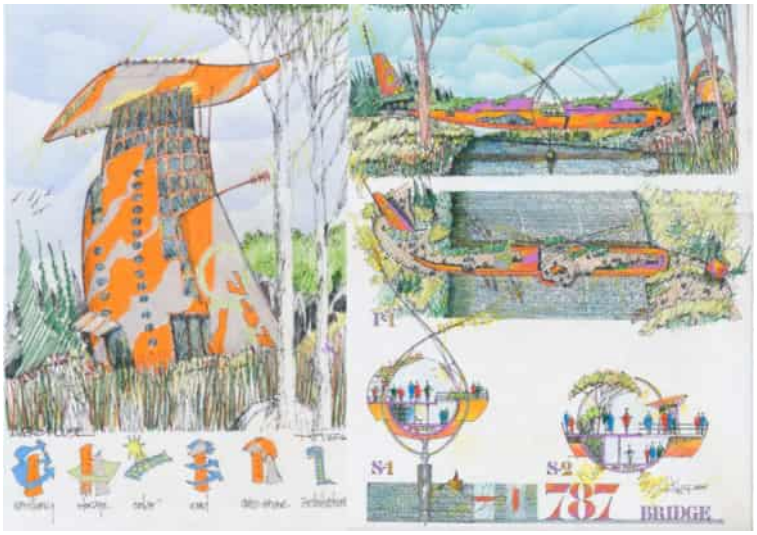

Figure 09 Aero bridge and Aero house

14 Looking forward

The proposals presented in this paper and in my past design studios are by no means an exhausted range of possibilities. The opportunities for new design and architectural innovations are endless, particularly with airplanes and the constant demand for sustainable efforts looking ahead. Whether it be bridges or homes, shelters or landscapes, the inspiration to push forward and challenge standard conventions will continue to grow. All we have to do is open our imaginations and visualize the possibilities right in front of us.
In the article “The 747 Had a Great Run. But Farewell Doesn’t Mean the End”, Zach Wichter writes about the last flight of a 747 heading to the Southwest to retire. “I’m going to cry before today is over”, said Rebecca Johnson, one of the flight attendants on board. “It’s just part of aviation history. To be a part of it is kind of awe inspiring”.
Some parts will be reused, but the major components, the shell, and its history will occupy an empty and desolate space in the southwestern desert, waiting for a second life.

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ADAPTIVE REUSE IN SIGNIFICANT RESTORATION PROJECTS IN QATAR

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Abstract

In the recent years, many Gulf States have typically experienced accelerated and complicated problems of urbanisation, and despite their rather short history, they have resulted in significant urban growth and infrastructure provision to contemporary architecture. Affecting the direction of the rapid urbanization, there is a perpetual dispute, between the construction of a new, modern identity and the promotion of traditional architecture as a possible way to establish new relations with the local history and culture. In the struggle for the definition of a new architectural identity in the Arab emerging cities, this paper focuses on the action needed to preserve architectural heritage, with the aim of showing some significant examples of adaptive reuse projects, recently completed in Qatar. The growing number of conservation projects show that there exists a need to strengthen appreciation of the local architectural and building traditions, as a way of bringing to light and regenerate the historical memory of these local places. This paper provides a comparison between some recent conservation projects completed in Qatar, analysing a number of various proposals for reusing the restored urban fabric and architectural buildings. The data analysis made it possible to classify these proposals in ways that could be applied to other adaptive reuse projects in future. The aim is to define an approach that is consistent and will be able to give expression to the Arab culture in matters of conservation and re-use, whilst respecting shared international rules.

Keywords

Change of use; Flexibility; Architectural Heritage; Historic Buildings; Conservation

1 Introduction

In the Gulf Region, due to the recent discovery and exportation of oil (1960-1970), the urban development and growth of many cities, has generated enormous flows of wealth and investment.

Among the Arab Countries, Qatar is one the most influent protagonist of the scene that has been subjected to an unprecedented economic boom, and its capital, Doha, is becoming a

new *global city*. As a consequence, the rapid urbanisation has produced a negative impact both on the natural process of growth of the urban centre, and on the local architecture preservation [1] [2].

In fact, in Doha the urgent need to provide homes and services for immigrants, definitively altered the city centre, damaging the remains of the urban fabric and some traditional buildings. Thus a permanent conflict afflicts the growth direction of Doha: on one side the construction of a postmodern global city, represented by advanced infrastructures, innovative materials and spectacular architectures; on the other side, the safeguarding of Qatari heritage reusing the neglected urban fabric, and the abandoned buildings, with the aim of establishing new relationship with the past and the local culture.

2 Overview of the current status of restoration

This research presents an analysis and description of some significant restoration projects recently completed in Qatar, comparing their deterioration, the conservative approaches used when carrying out works, and the various proposals for reuse [3]. All the data was compared, giving a complete overview of the current situation of architectural, archaeological and urban adaptive re-use interventions in Qatar. In the current debate between innovation and tradition, the paper describes how, under the pressure of the media impact that enhances the new image Doha as a *global city*, the value of the Qatari traditions and the historical roots, has gradually increased in the past decades [4] [5].

How can we avoid the total loss of cultural heritage and historical identity of Doha while nurturing the value of its new condition of a global city, strongly projected into the international growth?

3 Doha and the value of innovation: a new global city

Due to the huge capital flows generated by the oil, in recent years Doha has emerged as a new *global city* [6] with a central position in the international finance. As a result of the globalization, some cities, such as New York, London, and Tokyo, have played the role of world financial leaders, but contemporarily new growing centers, like Doha or Dubai in the Gulf, have imposed their role on the global economy, influencing the international movements of finance.

Affected by the globalization mechanisms, the local and international finances have placed huge capital on world-wide investments in Doha, involving transportation companies, entertainment and media societies, as well as large urban and real estate projects, managed by international investors. The urban growth of Doha was mainly concentrated in the northern areas of the city, where new urban strategic projects have pursued a certain priority of implementation as foreseen by the Qatar National Vision 2030 (QNV), promoted by the Qatar General Secretariat of Development Planning (QSPD) [7].

3.1 West Bay the innovative business center

To attract international capitals and investments, the image of Doha was therefore enhanced and promoted inside the ongoing competition between the capitals of the Gulf Regions. This process has generated evident socio-economic and political consequences into

the Qatari territory. In Doha, the search for a strong media impact into the local and global competition has been pursued by constructing new prestigious projects, which included luxurious functions and technologies to attract global capital and new investors.

In particular, the contemporary core business of Doha, the West Bay area, has been recently developed into a modern specialized economic district, promoting the construction of "five starts" architects' project as elements of characterization and commercial interest (Figure 1).

Figure 1. The West Bay business district in Doha.

4 Doha and the value of tradition: safeguarding the Qatari heritage

The rapid growth of Doha has consequently generated a massive construction of new spectacular architectures, ultra-modern and contemporary projects that, in most of the cases do not have any connections with the local tradition and the characteristics of the site. New conflicts of identity have arisen by the construction of the contemporary architectures, that have generated a deep sense of extraneousness to the place. The new construction process has also negatively affected the development of Doha city center, damaging the existing historical buildings and seriously threatening their survival, as the only remaining evidence of the local traditions [8].

Over recent decades the local administrations of many cities in the Gulf, have given very little relevance to their cultural heritage, due to the absence of any laws or regulations for their safeguard until as late as 1980. Since then the rapid demolition of many historic buildings has aroused interest in the conservation of national architectural and urban heritage.

In Qatar, the legislation to safeguard the heritage is defined by "Antiquities Law no. 2 of 1980, Law no. 23 of 2010, and two Emiri Decrees of 2009" declaring that "an antiquity is considered to be anything left by civilizations or left by previous generations, […] which dates back more than forty years" (article 1 of Law no. 2, 1980). Thus every resource that brings evidence of past civilizations and is over 40 years old, comes under this prescription.

In 2005 the Qatari government set up the Qatar Museum Authority (QMA) with the mandate of promoting artistic, and protection activities that enhance appreciation of the national heritage. The QMA is divided into three departments (Archaeology, Architectural Conservation, and Cultural Tourism) each of them is responsible for a specific area of intervention in safeguarding the existing heritage. Since 2004, the State of Qatar government agency, Private Engineering Office (PEO), has been working alongside the QMA

to develop and manage projects and properties of direct interest to the Qatar Emir. Both QMA and PEO are responsible for a wide projects' range including the architectural restoration and urban rehabilitation of historical sites, with the aim of integrating the preservation of heritage into new construction projects [9]. Although specific institutions and laws do exist for the restoration and conservation of historic buildings, there is still a need to improve the current processes and raise standards, by promoting examples that show a good application of management strategies in compliance with international rules. [10].

4.1 Adaptive Reuse for urban interventions: new entertainment places

Thanks to the restrictions imposed by the institutes and regulations, some urban rehabilitative interventions have recently been launched to control the rampant demolition phenomenon and revitalize the abandoned urban fabric by reusing the areas as new entertainment places.

This began with the launch of many restoration projects such as the refurbishment of the Souq Waqif (2004-2008) in the historic center of Doha and the adaptive reuse of the Al Wakrah fishermen village that was restored and is currently reused as the new "souq". The historic Souq Waqif was built about 100 years ago, in the city centre of Doha, not far from the port. In 2004 the government launched its conservative and typological restoration project which was carried out under the direction of the Private Engineering Office (PEO).

The restoration work was completed in 2008, with the intention of bringing to a halt the worsening deterioration of most of the existing buildings, conserving all of the oldest structures dating from before 1950, and recovering the traditional ones in the more recently built parts, following their architectural typology [11]. The Souq Waqif adaptive reuse intervention constitutes an urban upgrading project that affected a large part of the historic city (Figure 2). Many traditional uses were brought back, such as commercial areas for the sale of mixed goods (clothing, textiles, gold and jewels), foods (fish, spices, fruit, vegetables,) as well as hotels, restaurants, art galleries, artists' studios, temporary or permanent art exhibitions, calligraphy and photographic studios, and carpet exhibitions. Some innovative uses have recently been introduced in the "souq", for example, new areas for celebrations of historic and contemporary events, music concerts, circus and theatre performances, and sporting events, open-air gardens with sports facilities and water features in the public square.

Figure 2. Souq Waqif. Restaurants and shops.

The adaptive reuse project of Al Wakrah was completed in 2015, under the direction of the Private Engineering Office (PEO) and was financed by the Emir. The intervention was about the urban regeneration of the historical fabric of Al Wakrah fisherman village, located close to the ancient port, which was abandoned for many years. The area was then transformed into the new Souq of Wakrah, through an urban reuse project that involved the reconstruction of many collapsed buildings, the removal of disfiguring elements and materials, the adaptation of the premises, and the management of new commercial units (Figure 3). In Al Wakrah the strong identity of the place was maintained with the birth of a new citadel where currently are located new activities and functions, and still the true cultural, and social values are tangible and well preserved.

Figure 3. Al Wakrah Souq. Public spaces for the new entertainment activities.

4.2 Adaptive reuse for architectural interventions: new cultural places

The increasing interest in safeguarding the architectural heritage of Qatar has also led to numerous restoration projects at the architectural scale in the historic center. The aim was to preserve the existing historic buildings, which were in an extremely deteriorated condition, close to the collapse as a result of the neglect and abandonment during the last decades.

The residential project of Msheireb Downtown Doha (2008-2017) currently nearing completion, is located in t Doha city center and includes the re-use project of the Heritage Houses (2006-2015) [12] completed in 2014. The intervention was carried out under the supervision of the Private Engineering Office PEO and the direction of Msheireb Properties real estate company, a subsidiary of the Qatar Foundation. The Heritage Houses are four historic residential buildings that date from the early 20th century: Bin Jelmood House (1924), Company House, Radwani House and Mohammed Bin Jassim House (1913) (Figure 4).

Figure 4. Mohammed bin Jassim House.

Today Mohammed bin Jassim House is a museum of the old Msheireb Quarter history and includes an exhibition about the residential project, currently nearing completion. Bin Jelmood House is a museum dedicated to the history of slavery in the region, and Company House hosts an audiovisual exhibition of the workers employed in the petroleum extraction industry in Qatar. The national institution of Msheireb Museums has been established with the aim to protect, preserve and promote knowledge and appreciation of the architectural value of the restored buildings.

The adaptive reuse project of the Barzan Towers was completed in 2015 under the direction of Qatar Museum Authority. The towers are located in the northern area of Umm Salal Mohammed and were built at the turn of the 20th century as a protection for the “rawdat”, the natural valley where the precious rainwater was collected in its natural downward flow. The completed restoration works included a structural consolidation of the towers, which had subsided and cracked because of the weight. The mosque and the "Majlis" located within the walled enclosure, were also restored including an external re-ordering with the creation of a pedestrian path (Figure 5). The traditional defensive function of the towers was changed, and they are currently used as a museum to exhibit the defensive systems of the towers.

Figure 5. The Barzan Towers in Doha.

With the aim of reusing the abandoned and neglected Al Dakhira Mosque, the conservative restoration and structural works were completed in 2015 under the direction of the Private Engineering Office and provided the ruse of the mosque as a new cultural and religious centre. Before the restoration works the ancient Al Dhakhira Mosque, which is well-known because of its position overlooking the seafront in the north-east coast of Al Khor, was showing the types of deterioration that typically occur in very damp saline environments,

and which had led to serious problems of capillary rising damp in all of the perimeter walls. The external plasters were restored, particularly the parts at the base of the walls that had been affected by very serious exfoliation and detachment caused by the penetration of rising damp from the subsoil. To improve the usability of the spaces and to protect the interiors, new aluminium doors and windows with large openable glazed areas were fitted, along with new electrical and air conditioning systems. (Figure 6).

Figure 6. Al Dhakhira Mosque, the new cultural and religious center.

4.3 Archaeological interventions in Al Zubarah

Al Zubarah archaeological site is located on the north coast of Qatar, about 100 km from the city of Doha in the locality of Madinat ash Shamal.

The restoration project and the campaign of archaeological excavations, were completed in 2014 under the direction of the Qatar Museum Authority (QMA) and Qatar Islamic Archaeology and Heritage Project (QIAH) (Figure 7) [13] with the aim of promoting collaboration between the local community and the various investors, ministries, and universities of Qatar. Al Zubarah was an ancient fortified commercial city, which grown in the 11th century AD during the Islamic medieval period, but was destroyed in 1811, and was finally abandoned at the beginning of the 20th century. The Archaeological excavations brought to light the remains of the ancient Al Zubarah city including the streets, the palace, mosques, houses, fishermen's huts, the harbour, and the defensive walls. During the campaign of archaeological excavations, the bases of the buildings were excavated, cleaned, and consolidated, bringing to light the materials used for construction. Because of the proximity of Al Zubarah to the sea, there is a high concentration of salts in the subsoil as well as in the construction materials (the binders, the blocks of stone, and the plaster) which had caused the deterioration of the structures. Al Zubarah is now used as an outdoor urban archaeological museum and has partly been provided with facilities and services for tourists and visitors.

Figure 7. Al Zubarah archaeological excavations in the outdoor museum. (Source: Authors)

5 Results: The most significant approaches in the field

Analysis of these restoration works to the architectural and urban heritage made it possible to compare the methods used, providing an exhaustive and representative description of current adaptive reuse practice in Qatar.

The approach to restoration taken for each intervention was related to the government authorities responsible for the works. The adaptive reuse projects have often been in isolation, and that no general plan exists for coordinating all works. Analyses and comparisons were made in relation to the scale of each adaptive reuse project, the type of work carried out, the upgraded systems, the materials used, and how the interventions had been completed to enable the buildings and the urban fabric to be brought back into use.

The completed works clearly fell into two main categories: the urban and the architectural. The urban category includes urban regeneration and conservation works, which are few in number but on a large scale. The architectural category includes a large number of small buildings with different typologies and functions. It was also found that the same construction methods were fairly frequently used, such as the method of sun-dried bricks and mud mortars, traditionally compressed using a specific pestle for grinding mud; the irregular "danchal" wood poles form door and window lintels; and the traditional boxed wooden “marazim” gargoyles.

The types of restoration work were carried out in relation to the taken approach, which was more or less preservationist depended on the existing state of the building and how badly deteriorated it had become. In some case, the adaptive reuse projects preserved the existing structures only, in particular for the buildings that were to be given a new museum use (the Tower Museum, the Heritage Houses Museum, etc.) (Table 1). The intention was to preserve the existing materials as found, without alteration. In other adaptive reuse, particularly where the deterioration was very advanced, decisive structural consolidation was carried out combining traditional and innovative materials of more recent adoption, such as reinforced concrete, cement mortar, and concrete blocks. In the case of commercial and entertainment reuses, the restoration projects allowed for typological reproduction, for which upgraded services were provided as required by the new uses.

Table 1. Schematic comparison of adaptive reuse projects recently completed in Qatar.

Name	Date	Agency	Project	Old use	Adaptive Re use
Souq Waqif	2008	PEO	Urban regeneration	Souq	Commercial - Entertainment
Al Wakrah	2015	PEO	Urban regeneration	Fishermen Village	Commercial - Entertainment
Heritage Houses	2014	PEO	Architectural restoration	Residential Houses	Cultural Museum
Barzan Towers	2015	QMA	Architectural restoration	Defensive structure	Towers Museum
Al Dhakhira Mosque	2015	PEO	Architectural restoration	Mosque	Religious and Cultural Center
Al Zubarah	2014	QMA	Archaeological conservation	Residential	Outdoor Museum

6 Conclusion

In Doha, new emergent *global city*, despite its fast urbanization and modernization, there is a growing need to safeguard the historical heritage.

In fact, the recent phenomenon of globalization, strongly characterized by the standardization of processes, brought to light some important issues related to the values of Qatari local tradition and the respect for architectural identity, which risk disappearing because of the latest massive demolitions.

The research presented some significant restoration projects, recently completed in Qatar showing how these adaptive reuse interventions can provide one valid alternative for the growth of the city, respecting and preserving the existing architectural culture and traditions. Describing and comparing the intervention made it possible to verify that in Qatar today there exist many different methods for the conservation of architectural, urban and archaeological heritage and that these are dictated by the different approaches taken by the governmental bodies responsible for the projects.

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ADAPTIVE REUSE AND DESIGN FLEXIBILITY THE CASE OF PALESTINIAN VERNACULAR ARCHITECTURE

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Abstract

This paper studies adaptive reuse of vernacular buildings in Palestine. It focuses on flexibility of these buildings and their adaptability to accommodate change. It investigates some examples which were adapted for new uses. It examines the effect of change and the extent to which these buildings are considered suitable for their new uses.

The paper discusses the concept of adaptive reuse through the study of some examples of Palestinian vernacular houses adapted for new uses. The examples which will be studied were originally used as private residences during the 18th and 19th century and were constructed in an indigenous way to satisfy their users' needs. These buildings accommodated the extended families of their owners before they were abandoned and left to deteriorate and fall into destruction. Political, social and economic changes during the beginning of the 20th century affected the development of the vernacular architecture and left these buildings, to a certain extent, unsuitable, useless and unable to cope with the change in user lifestyle.

The paper introduces the vernacular residential architecture of Palestine and its main characteristics. It studies the adaptive reuse of some examples and evaluates the attempts undertaken to solve problems related to change of use. The paper will gives answers to some questions related to the flexibility of the vernacular houses and the extent of their suitability to new uses, why these buildings failed to cope with the change in their users requirements, whether they are still usable today, how they were adapted for contemporary uses, what where the compromises, do the vernacular still preserve its inherent qualities, and what do current users think of these buildings.

Keywords

Adaptive Reuse, Change, Flexibility, Vernacular Housing, User.

1 Introduction

This paper investigates flexibility in design and adaptive reuse of vernacular Palestinian houses. Two examples of traditional houses were investigated; both were conserved and reused by An-Najah National University for two scientific centers. In both examples

adaptation were carried out taking into consideration prolonging the life of the historic buildings and preserving their heritage quality.

The vernacular Palestinian house which used to accommodate a large extended family could no longer satisfy the contemporary requirements of the modern nuclear family. Many of the vernacular courtyard houses are of great significance to Palestinian cultural heritage. Adapting these buildings for new uses offers them a new life and contributes to preserving their cultural significance.

In the process of conservation and adaptation of historic houses for current uses, architects are faced with different challenges. They are faced with the fact that the buildings have to satisfy their users' needs and requirements and are to be upgraded to meet modern standards, and at the same time their cultural and heritage qualities retained.

2 Adaptive Reuse And Conservation of Historic Buildings

Adaptive reuse is one of the main strategies for preservation of architectural heritage in contemporary conservation theory and practice [1]. It involves conservation of buildings to undertake a modified change of use required by new or existing users. It is a process that retains as much as possible of the original building while upgrading its performance to suit modern standards and satisfies user requirements [2]. Adaptive reuse enables buildings to be given a second life, enabling them to live and function when they may have been previously underutilized [3].

Changes of buildings to meet the requirements of new uses can involve major internal space reorganization and service upgrades or replacement. Alternatively, adaptive reuse may simply require minor restoration works where nothing changes except the building's functional use [4]. In some cases, the change of use may require refurbishment and/or complete renovation of existing buildings or structures.

A successful adaptive reuse respects and retains the building's heritage significance. It conserves the architectural, social, cultural and historical values of the adapted building. While it serves to address the pressing needs of the local community, conserving a building and change its use contributes to the improvement of the economic, environmental, and social conditions of the surrounding area. When buildings can no longer function in their original use, a new use through adaptation may be the only way to preserve their heritage significance [5].

The significance of adaptation and rehabilitation of existing structures is that extending the useful life of buildings supports the key concepts of sustainability by lowering material, transport and energy consumption and pollution [6]. Reuse of existing buildings has been identified as having an important impact on sustainability of the built environment [7]. The conservation of heritage buildings for reuse provides inherent heritage value to an historic urban area [8], and sometimes, it is the only way that the building's fabric will be properly cared for while making better use of the building itself. Adaptive reuse of heritage buildings maintained the historical value of a city, and preserves irreplaceable heritage [3].

3 The Vernacular Palestinian House

The courtyard house was the only acceptable model of domestic architecture in Palestine until the early twentieth century. It is based on an inward looking design scheme with a central, open to sky courtyard. The courtyard is the major design element of the house and it provides it with natural light, sun and ventilation. It also forms the centre or focal point of the house, and symbolizes its main reference space. All adjacent spaces are linked by the courtyard space, it provides privacy for occupants, and serves as an open air family living space, particularly in summer [9].

The vernacular house layout is structured consistent with the progression from public to semi-public then to private and protected areas; its planning was based on the separation of functions according to degrees of privacy. Accordingly, the reception room and other facilities used by male visitors were totally separated from those private rooms used by the family. Scale and complexity of the house layout were determined according to the economical means of the owner [10] and the size of the house may range from small with two to three rooms to large houses, which consist of several apartments and multiple levels [11].

Access to the vernacular house is usually limited to a single entrance, although a second private one sometimes existed [12]. The entrance is generally designed to prevent direct visual access to the courtyard from the street [13]. The street elevation was usually kept blank and very simple with limited size of windows. On the street level, windows were elevated to an extent that prevents passers-by from viewing the inside of the house. Windows of the upper stories were generally larger and sometimes had a considerable projection to admit light and air. Interior spaces in the vernacular house were not allotted to specific functions, thus the same space was used for different activities. The flexible usage of space was reflected in the simple furniture used in the house [12].

The courtyard house was constructed as part of a dense urban fabric that constitutes the traditional cities of Palestine. Although houses were built adjacent and overlapped, the introverted layout scheme ensured privacy for each and every house. The vernacular house used to accommodate the extended family of two or three generations. In the same quarter within the traditional city, houses of the same family and close relatives used to be built clustered and adjacent to each other for protection and power.

Social and cultural changes experienced in Palestine during the past century influenced the Palestinian family in general and the Palestinian user in particular. User's requirements, needs and expectations consequently changed, and this would have more or less influenced house design. Change in family lifestyle, structure and size, and preference among contemporary users for a small nuclear family rather than an extended one, affected to a large extent the house layout. To satisfy the requirements of the contemporary family, the size of the house was reduced, different functions within the house layout were identified according to the family's needs, and spaces were designed for specific functions. Many of the traditional houses which were used by extended families in the past failed to satisfy the contemporary necessities of their current users and were abandoned and left to fall into destruction and decay.

4 Case Studies

Two examples are taken as case studies. Both are large houses that were used in the past by local extended families. The first example is located in a village on the outer skirts of Nablus and the other one is situated inside the historic centre of the same city. The two examples were adapted for new uses.

4.1 Al Qasem Palace/ Urban Planning and Risk Reduction Center

The vernacular building is located in the village of Beit Wazan, Nablus, near the new campus of An-Najah National University. The palace was built in 1820 as a private residence for the Sheikh Ahmad al-Qasem, who was a powerful figure during early nineteenth century. The palace which accommodated the extended family of the owner was constructed on four levels. Different spaces of the building were distributed on several levels and were all organized around a central open to sky courtyard.

On the ground floor large vaulted spaces were used as stables and other rooms and reception spaces. Raised by few stairs and overlooking the central courtyard, a large iwan (which is a rectangular vaulted space walled on three sides, with one end entirely open) was used as a summer reception area for guests. The upper floors consisted of five different apartments, used in the past by the sheikh's extended family. The private room of the sheikh is located on the upper most level of the palace and has a private stair case to connect it to the main courtyard. In figure no. 1 a section through the building is illustrated.

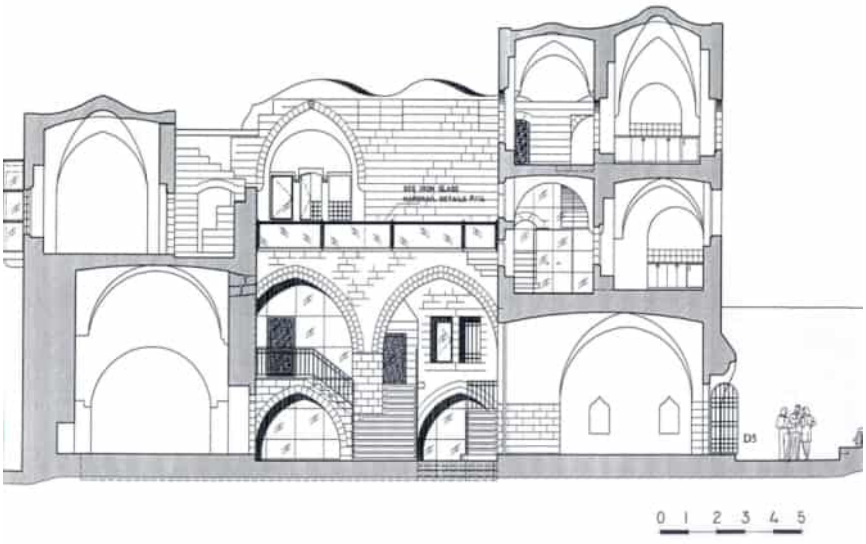

Figure no. 1: Section view across the central courtyard of Al-Qasem palace .

In 2000 the building was conserved and adapted for new uses for An-Najah National University. It hosted two units of the Urban Planning and Risk Reduction Center; the Unit for Regional and Urban Planning, and the Unit of Urban and Architectural Conservation, in addition to spaces for lectures, seminars or meetings.

The building which has several large and small spaces offered good possibilities for the designer in adapting it for new uses. Different sizes of rooms gave flexibility in design, especially in matching different functions for the existing spaces. The division of the palace into different sections used in the past by the extended family of the owner made the building possible to divide into separate administrative sections. However, the palace has a complicated design in the way spaces are linked together to ensure privacy required for the original functions.

Adaptive reuse was carried out taking into consideration that changes will be restricted to the minimum and that the idea is to prolong the life of the building by keeping it in continuous use. All changes were made distinguishable from the original structure and were reversible. Conservation was carefully carried out to bring the building back to its original shape (Figure no.2).

Figure no.2: Central courtyard of Al Qasem Palace/ Urban Planning and Risk Reduction Center

In adapting the building for reuse, the designer was faces with the palace complicated design, compact layout, several levels and several high and narrow stairs. Design for the new use was flexible; the building was carefully studied to examine the hidden potential of the building and the opportunities it offers for accommodating the new use.

4.2 Al- Amad House/ Community Service and Continuing Education Centre.

The house was built in late 19th century for Al-Amad extended family. It was constructed around an open to sky courtyard and consisted of 10 living spaces of an average size of around 30- 35m^2. The house was built on three levels and had and an open terrace overlooking the central courtyard (Figure no.3). The house was in continuous use until the end of the 20th century when it was left to deteriorate and fall apart. In 2013/ 2014 the building was conserved and adapted to be used by An-Najah National University for the Community Service and Continuing Education Centre. Location of the house in the historic core of Nablus, in the center of the city, was convenient for the university to satisfy the center's purpose of reaching and serving the local community.

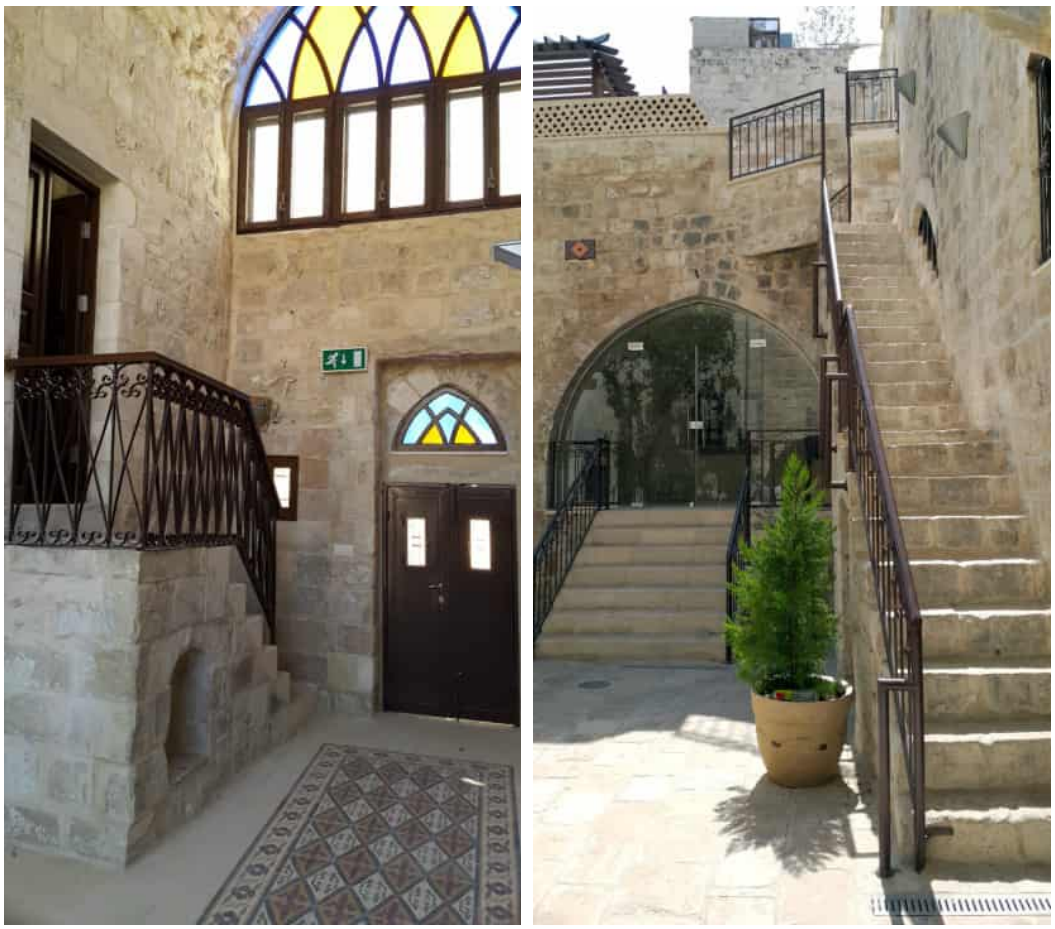

Figure no. 3: Interior and courtyard views of Al- Amad House/ Community Service and Continuing Education Center

In the process of conservation and adaptation of the building for the new use, the main idea was to preserve the building, remove the additions installed by previous users and bring the building back to its original form. Some alterations, which were carried out on the house, were harmful and caused disfigurement of the original structure of the building. Some were carried out to suit the previous users' requirements, such as dividing large spaces and

installing modern kitchens and bathrooms. To conserve the building and retain its heritage significance, structural consolidation was urgently needed and the building was carefully adapted for the new use.

The new proposed use was accommodated in the building taking into consideration the size and layout of each and every existing space and its capacity to satisfy the requirement of the new function it will host. Adaptive reuse was carried out according to a flexible program taking into consideration preserving the inherent qualities of the vernacular buildings.

The centre provides services for different sectors of the community, so the flexibility of its services enabled the designer to accommodate different functions of the center in suitable spaces of the historic building; lecture rooms, computer lab, spaces for workshops and seminars in additions to offices, meeting rooms and other administrative facilities.

5 Design Flexibility of vernacular Buildings

In both of the studied examples it was important that research is conducted in the initial phase of the process of adaptive reuse, and before any design decision is taken. Research provides a number of advantages including understanding the heritage significance of the building and reducing the risk of altering its character. Having knowledge about the heritage significance assists in the design process and enables architects to maintain the integrity of the existing building and structure [3]. In both cases, research gave a better understanding of the building fabric and helped identification of new users' requirements and demands.

Despite difficulties of rehabilitation, architects often find surprising and exciting possibilities which could not be produced when designing new buildings [15]. However, a number of barriers to adaptive reuse have been identified including existing building layout [14]. The layout of each building and its capacity to accommodate new functions were examined and the suitability of the each building for its new use was carefully studied. The layout of the vernacular Palestinian house is based on the courtyard, which forms the centre or focal point of the house, and symbolizes its main reference space. All adjacent spaces are linked by the courtyard space, thus almost all circulation lines running away from, and into surrounding spaces run through the courtyard [16]. In the past, it seems that it was convenient for users of the vernacular house to use the open courtyard as the main circulation space, i.e. they had to move from the inside of the house to the outside while moving from one room to another. In adapting the two buildings for new uses the designer faced difficulty in linking different spaces together and had to deal with this issue by keeping the original divisions of each building layout and separating the functions of the new use according to the original divisions of the house.

The two studied examples are constructed on several levels; the first example is built on four levels and the second on three, in additions, more than one level existed in the same floor. In the vernacular Palestinian house, several rooms in the same storey often differ in height and floor- level, and sometimes one or more steps between rooms were needed. The main objective of the builder was to make certain that every set of rooms are as private and secure as possible [17]. In adapting these buildings for new uses, this issue had to be taken into consideration. In both example spaces on the lower levels were used for functions that

are easily accessible by people as lecture rooms, seminar rooms and meeting spaces. However, due to this limitation it was not easy to adapt the buildings to be used by people with special needs.

The suitability of historic buildings for a large number of uses, i.e. flexibility in planning, depends to a large extent on the mix of room sizes [15]. In the vernacular house, the size of different spaces depends on the structural system used for construction, and it depends mainly on load bearing walls carrying cross vaults or domes. The ranges of room sizes in the studied examples were 20m^2- 80 m^2 in the first example and 20 m^2- 50 m^2 in the second. Above 16 m^2 there is a wide range of possible uses, including subdivision [15]. In both cases functions were selected and adjusted to suit different vernacular spaces, taking into consideration that the room sizes in both examples were adequate for the main use of the building which in both cases required large and small rooms. Large spaces were used as lecture rooms, workshops and seminar rooms, while spaces with adequate sizes for administrative functions were used as offices and very small spaces were used for bath rooms, toilets or kitchenettes and storage. Good fit between the old and new function of the building and the closer the match between these functions; the more straightforward it is to complete the adaption process. In particular a good fit between the existing spaces and required spaces is a key to ensure success of the process of adaptive reuse [3].

In the vernacular house the central courtyard played a major role in providing lighting and ventilation for the surrounded spaces. In the process of adapting the old buildings for new uses, in both cases Iwans which are originally build with one elevation open towards the courtyard were closed by glass walls. This was necessary for the new uses in order to create enclosed spaces or to provide linking spaces between different functions. This was significant because these Iwans are large size spaces that were used for different new purposes required for the new uses. Unfortunately, glazing the Iwans created environmental problems due to the change of the original performance of the building.

Current users of both of the adapted buildings are to a certain extent satisfied. They are proud to be using the historic buildings which in both cases relate users with their past history and cultural heritage. In each of the studied examples, minor problems were spotted, due to the adjustment of the new use to suite the special characteristics of each building. Visitors of both buildings are happy and excited with the exceptional experience of old spaces and unique buildings. After all, each of the adapted buildings presents a successful attempt that saved heritage buildings and proofed the viability of historic structures for current use.

6 Conclusions

In both of the examples taken as case studies the original use of the building was residential; converting the building to a public use was undertaken with special consideration to preserving the inherent architectural qualities of the building. In both cases care was taken to keep changes to the minimum and to ensure that vernacular spaces match the new functions and that the buildings' significance is retained.

Adaptive reuse of a heritage building is a challenging, complex and demanding task. In the process, user's varied needs and demands have to be satisfied, and the limitations of the historic building layout and design have to be taken into consideration. Flexibility in design is needed to match the functions of the new use with the vernacular spaces of the adapted building. A good design and a careful match are essential to ensure that the process of adaptation is satisfactory for users and at the same time that the cultural quality of the heritage building is preserved.

Adapting the two historic buildings for new uses and giving life back to them contributed to enhancing the urban environment and the surrounding urban tissue in both locations. The public use of both cases kept the historic fabrics in use by university staff and students and the general public, especially in the second case in which the center for community services is located inside a historic center.

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AN AFFORDABLE AND ADAPTABLE BUILDING SYSTEM TO TRANSFORM INFORMAL SETTLEMENTS IN CAIRO

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Abstract

Today, approximately 70% of Greater Cairo's 20 million inhabitants are living in urban informal settlements, and the number is expected to continuously increase. These informal settlements suffer from various issues such as overpopulation, high unemployment rate, land shortage, poor living conditions, inadequate infrastructures, and environmental pressures. This paper is a scientific summary of the results from the research project A²L-Mobilius, which is partly funded by the German Federal Ministry of Education and Research (Project: AL²MOBILIUS; Grant Number: GERF-IB-033 Almobilius_01DH14003). The goal of this research is to explore an integrated approach to improve the living condition of local residents as well as to revitalize the local communities. By investigating the context of informal settlements in Cairo, an Affordable and Adaptable Building System (A²BS) based on open building concepts is proposed, which can be easily prefabricated and assembled by unskilled labor. Meanwhile, Decentralized Processing Units (DPUs) tailored to the building system are introduced to enhance three main aspects of life (working, energy, and mobility). Finally, a simulation of a regenerated house based on selected case study building is presented, which integrates A²BS and various DPUs. Additionally, an appropriate business model for the future prosperity of the local communities is discussed in the context of Decentralized Industrial Village (DIV). In conclusion, this research will be a step forward to improve the living conditions of informal settlements in Cairo and worldwide.

Keywords

Cairo, building system, informal settlements, open building, urban regeneration

1 Introduction

The process of urbanization has reached an unprecedented level. According to a recent UN study, 66% of world population will be living in urban areas by 2050 [1]. Currently most of the urban sprawl processes happen in developing world, which trigger a series of social, economic, and environmental challenges as well as opportunities. For instance, Greater Cairo Region is arguably the largest in Egypt, Africa, and the Middle East, and one of the most crowded metropolises in the world. In recent years, nearly 70% of Greater Cairo's 20 million inhabitants are living in urban informal settlements, and the number is expected to continuously increase

[2]. Due to the unorganized administration and many other reasons, these informal settlements suffer from various issues such as overpopulation, high unemployment rate, land shortage, poor living conditions, inadequate infrastructures, and environmental pressures [3]. To tackle these issues, this research presents an integrated approach to improve the living condition of local residents as well as to revitalize the local communities.

2 Methods

The methodology for the project plan is based on the V-Model diagram. The project has been divided into smaller issues that can be addressed with a design module or various modules. As shown in Figure 1, the steps of the model embody one or more work packages of the project. On the left side of the scheme, the preliminary work or project definition starts from a general perspective to details over time. On the right side, the project implementation starts from detailing the modules to reaching a general system in the later stages. As shown in the diagram, the system is set to go through several repetitive loops for optimization. Two cycles particularly concern the communication with stakeholders, of which one is to verify the premise of the project, thus the requirement analysis, and the other to verify the design. Final validation will be conducted at the end of the project, with the comparison of the final system and the revised requirement and stakeholder analysis [4].

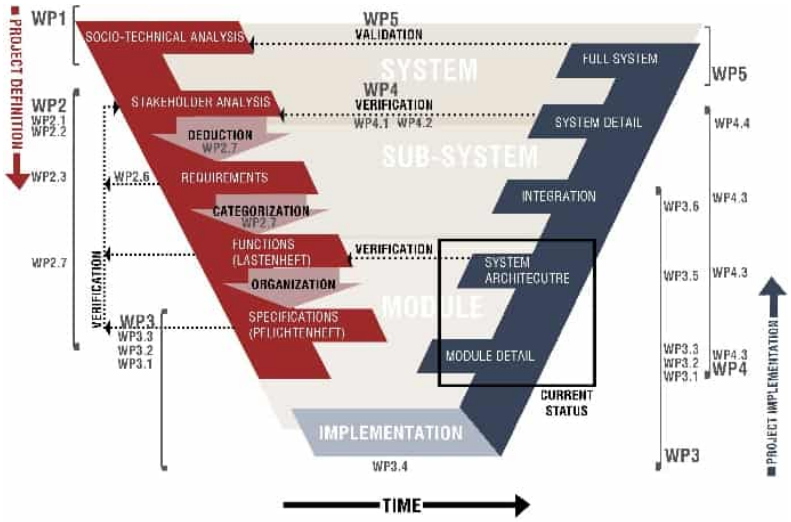

Figure 1. V-Model for the A²L-Mobilius project

Collaboration with the local stakeholders is critical to the success of any projects to regenerate informal settlements. Therefore, participation and feedback from stakeholders throughout the project is an important factor to be ensured. Thus, a methodology based on Requirements Engineering (RE) has been developed and followed, in order to find the optimum solutions based on environmental requirements and stakeholders' wishes. The structure of the methodology takes repetitive optimization loops into consideration to constantly monitor and optimize the stakeholder analysis and requirements analysis throughout the project. The aim of the requirements analysis, together with a technological feasibility study, is to identify concrete functions to be interpreted into design elements, and to establish a suitable system architecture to provide a common structure for the project (see Figure 2) [5].

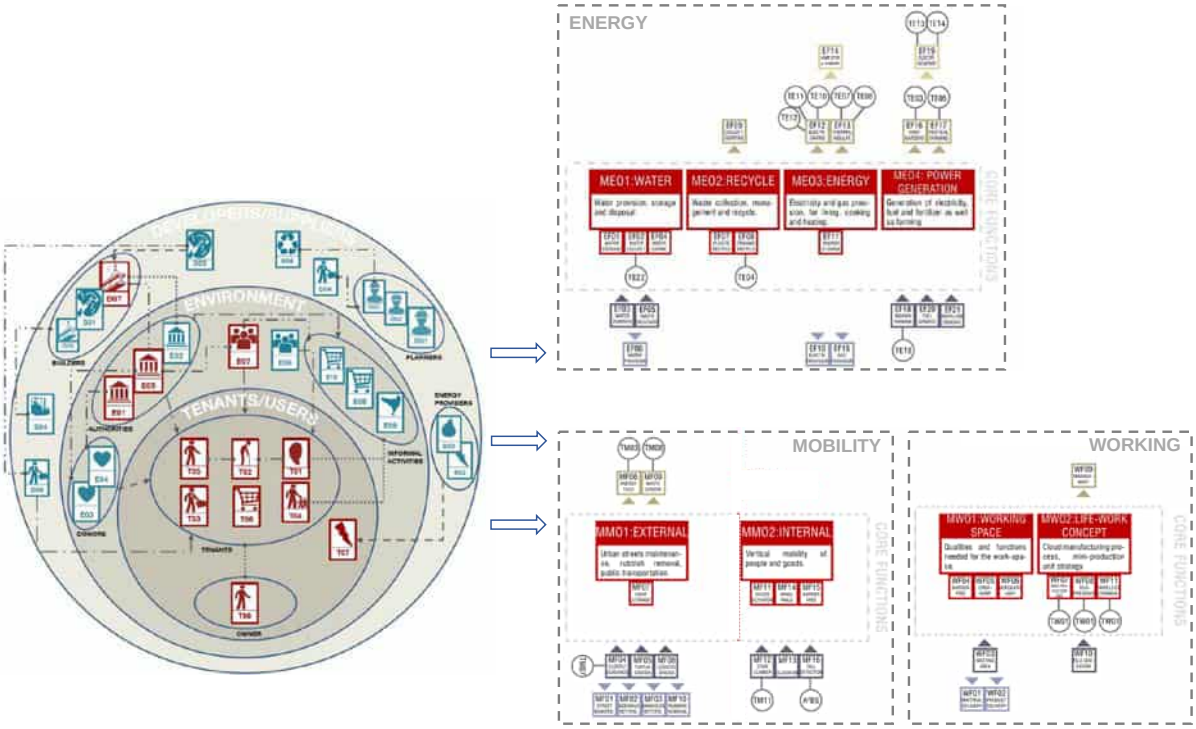

Figure 2. The results of stakeholder analysis (left) and requirements analysis (right)

3 Proposed building system

In this section, the Affordable and Adaptable Building System (A²BS) based on open building concepts is proposed, which can be easily prefabricated and assembled by unskilled workers. Meanwhile, Decentralized Processing Units (DPUs) tailored to the building system are introduced to enhance the working, energy, and mobility of people's life. Finally, a simulation of a regenerated house based on selected case study building is presented, which integrates A²BS and various DPUs. In addition, an appropriate business model for the future prosperity of the local communities is discussed in the context of Decentralized Industrial Village (DIV).

3.1 Affordable and Adaptable Building System (A²BS)

As illustrated in Figure 3, A²BS is a flexible and affordable building system composed of prefabricated elements. The system has been designed to fit the informal environment and adapt over time to the community's needs. The goal is to gradually replace the informal structures and thus "formalize" the built environment. The system is based on the principle of open building concepts, which consist of three sub-systems: the modular structural sub-system, the building envelope sub-system, and the service infill sub-system (including DPUs and services) [6]. It is highly standardized, customized, flexible, and affordable. The system is able to be implemented as various configurations and specifications to match client's requirements. More importantly, the system can be produced with basic tools both on-site and off-site which are affordable for wider groups of customers.

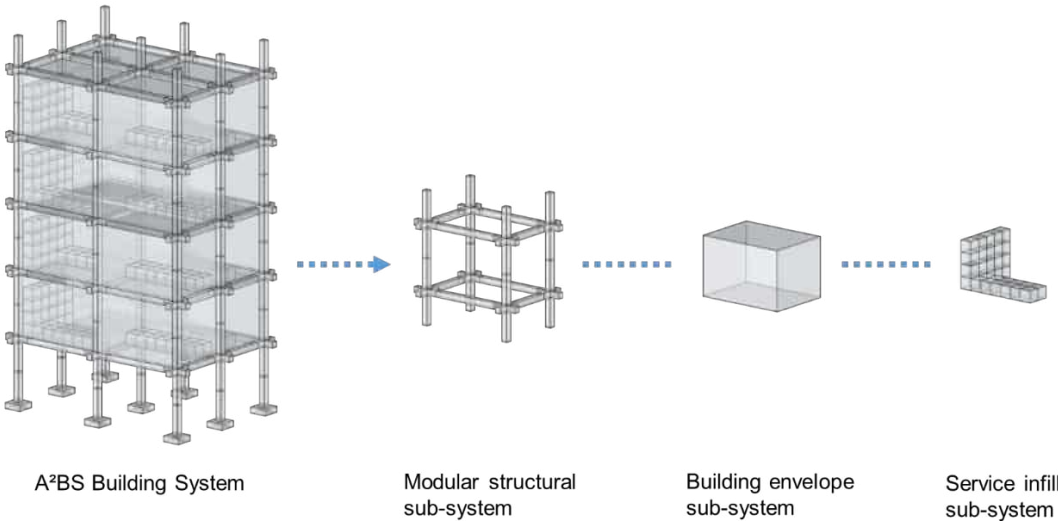

Figure 3. Schematic diagram of A²BS Building System

An easy-to-prefabricate modular concrete structural system is developed which has the ability to both vertically and horizontally extend. This proposed system can be easily made in a low-tech environment both on-site and off-site. The system consists of concrete elements and the connecting beams in between. As shown in the diagrams on the left side, there are two main dimensions for the beams: 2m and 3.5m in length, which will fit the common housing standards in Cairo (see Figure 4).

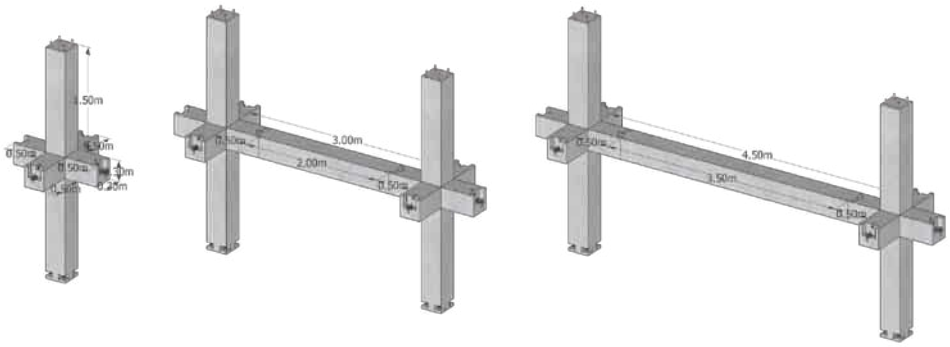

Figure 4. Modular concrete structural system

The principle of this system has indicated substantial potential to address the issues of rapid urbanization and urban poverty that the building can be erected and extended over time to ease the financial burden and to meet the needs of increasing population. Residents can choose whatever materials they have (such as bricks, aluminum panels, concrete, wood etc.) to fill up the reserved spaces. Meanwhile, the local residents are invited to participate in the building and extension process of their own dwellings, as the building system is designed in a user-friendly and low-tech manner. According to previous studies, when compared with conventional construction, the adoption of concrete prefabrication techniques could approximately save construction time by 20%, reduce construction waste by 28%, and decrease labor demand by 9.5% [7]. In the future, when further living space is demanded as the residents' financial status improves and the number of the family members increases, the

structure itself can also be vertically and horizontally extended with new-built structural elements. To achieve maximum flexibility and to allow the building to evolve over time, the building system is designed in an expandable and modular manner, eventually functioning as an organism for living. Figure 5 shows an instance of a 30-year development scenario of a building based on A²BS system.

Figure 5. 30-year development scenario of A²BS Building System

3.2 Decentralized Processing Units (DPUs)

DPU represents a prefabricated, self-sustaining, interchangeable, and standardized system that integrates a series of technological equipment that is needed for a household. It allows for a step-by-step upgrade of the informal settlements. The geometries of the DPUs are tailored to the dimensions of A²BS. The DPU includes three main subsystems (subsystem for energy collection, provision, wise use, and production; subsystem for improving mobility; and subsystem for life-work balance: Mini production unit or mini home office). The DPU itself with its subsystems will be easily integrated into the modular building system (i.e. A²BS), which is fully reusable in the future. Developed based on the aforementioned requirements analysis, DPU submodules function as decentralized components that work together as a whole. Therefore, users can decide the amount and types of DPUs, keeping the system affordable.

3.3 Decentralized Industrial Village (DIV)

Decentralized Industrial Village (DIV) is a concept developed throughout the project to describe a type of village, which contains decentralized manufacturing workshops that manufacture a series of components of a product or products, as in the case of a streamline, meanwhile preserving the existing urban context and local business. One way to reduce the unemployment rate, thus revitalizing the informal settlements, is to exploit profitable business model for the local people. Meanwhile, there have been a variety of existing local businesses and craftsmanship (e.g. carpentry and rubbish recycling). In order to promote innovative business model, part of the Cairo informal settlements can be transformed into DIV for innovative product manufacturing without undermining the intactness of existing local business. There are many possibilities of innovative product manufacturing within the DIV. For example, one of the possibility is to prefabricate the aforementioned modular building components which can be utilized in the regeneration of the local community. Generally, the procedures include rebar fabrication, formwork fabrication, concrete casting, curing, storing, and transport, which can be allocated in different households nearby (see Figure 6).

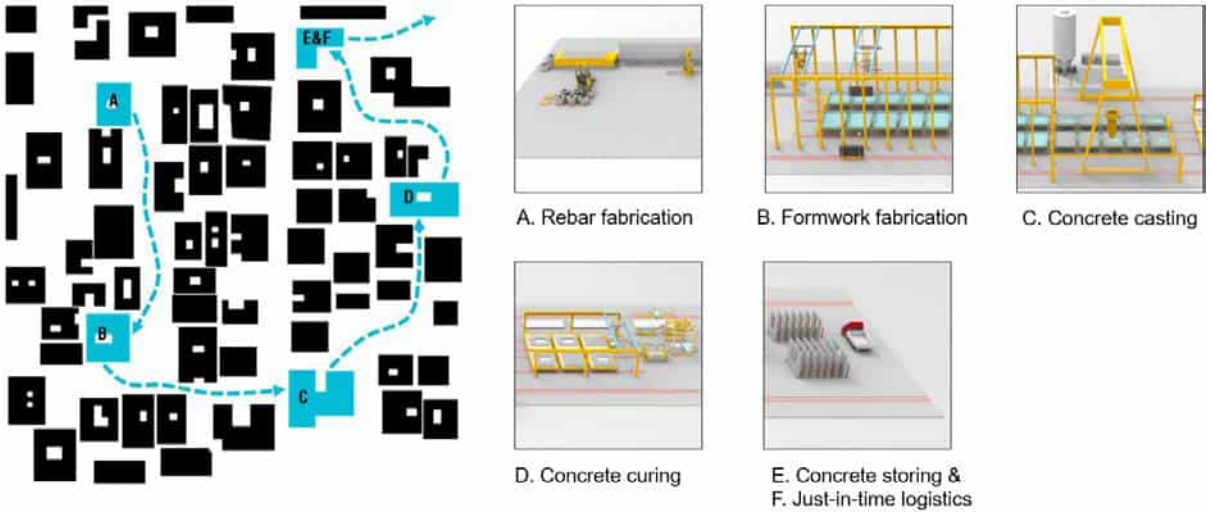

Figure 6. Exemplary business model in the Decentralized Industrial Village

4 Case study and simulation

In the Sakiat Mekki area located on the west bank of Nile River in Giza District, Cairo, a plot in Farahat Street is selected as the case study site. This informal area suffers from various issues. For instance, the street is usually overcrowded due to the limited number of roads; the building quality of the informal settlements are usually poor since most of them are undocumented constructions; the sanitation is also inadequate as garbage and puddles can be often seen on the street.

The selected building, which is owned by the tenants, is a three-story housing unit with one apartment of 45 m² on each floor. The ground floor is an active mechanical workshop. The tenant of the first floor flat is a single woman who lives alone and works at home making handicrafts. The flat on the second floor is a second home for a family of four who only stay here during summer. The flat on the third floor is unoccupied. Stairs are used as extra space for washing, cooking, and storage. These stairs have no handrails and the risers have height differences. The roof is utilized by the users as an extra gathering space. The housing unit suffers from problems such as lack of garbage cans, noise from workshops in the ground floor, lack of ventilation, no handrails in the stairs, risers of different height, sanitation issues, and space shortage. In addition, horizontal extension is not applicable in this case, since the width of the street is relatively narrow and the sidewalk is occupied by local vendors. In addition, concrete casting on site is not applicable as there is no sufficient space on streets for the casting process. Because of the unclear condition of the existing structural system, building extension on the existing structure is not applicable [8].

Therefore, in order to improve the living quality of the tenants and to tackle the above mentioned issues, an upgraded building simulation with A²BS system as well as a series functional DPUs is proposed in detail, based on the proposed building system and the analysis of the case study building (see Figure 7 and its detailed description in Table 1). The construction process would be rapid thanks to the flexible modular building system, and the relocation process during construction would be fast and easy since the single woman on the first floor is the only permanent tenant of this housing unit.

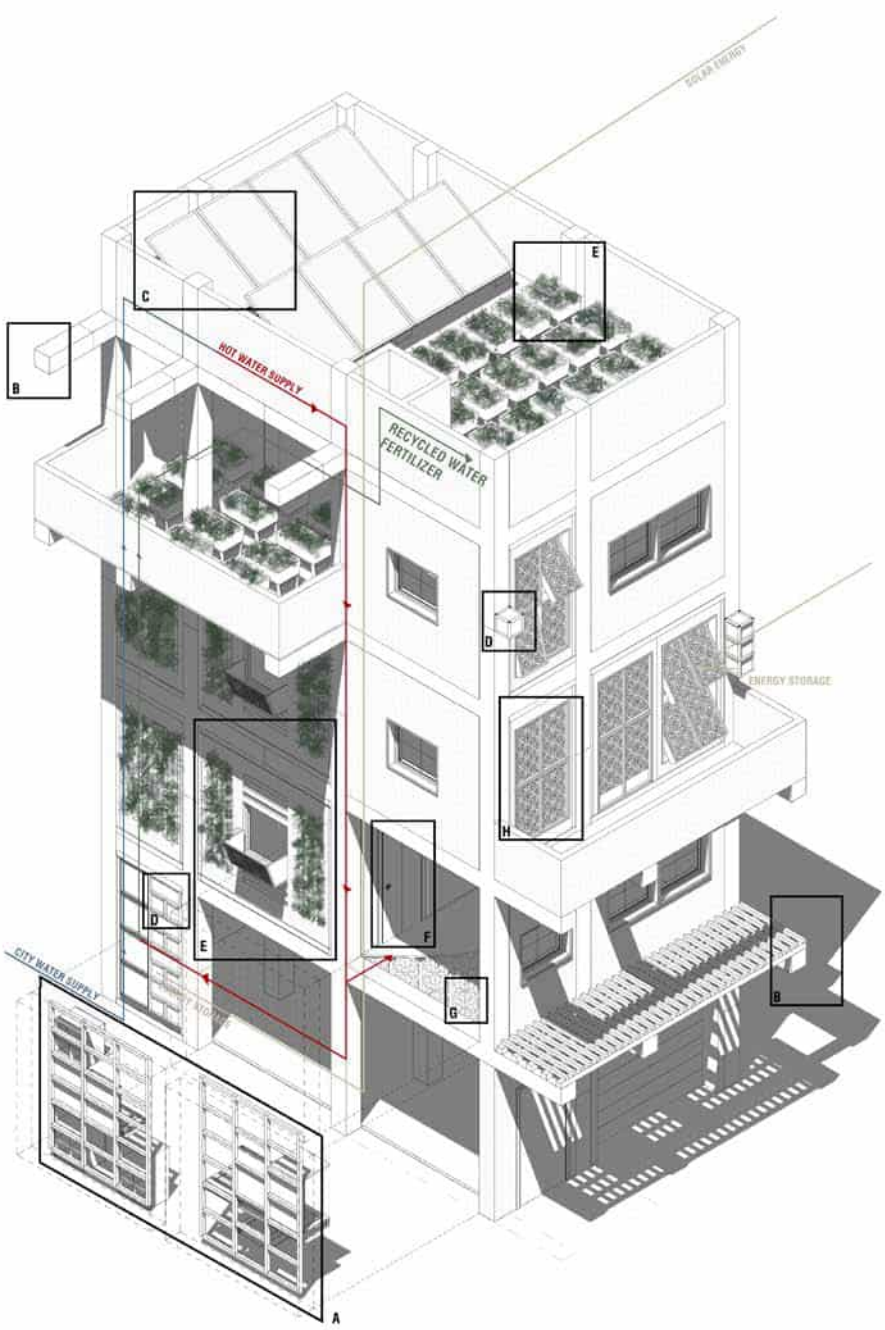

Figure 7. A simulation of regeneration based on the case study building

Table 1: Details of technologies integrated into the case study building

A. Work DPUs	The modular working station has been tailored to the case study to develop the business model [9]. The station proposed is divided into four main steps of production. The different workstations can be distributed in the settlements. They are conceived as equipped walls to save space and can be mounted directly on the A²BS system.
B. Open Building Concept	The concept of Open Building (OB), also known as Support / Infill (S/I), is now representing one of the most flexible construction principles. The building has been designed in different levels: support structures, infill system, fit-out, and appliances.

	These have been reinterpreted and updated to harness the benefits of state-of-the-art industrial production, emerging information and digital technologies, improved logistics, and changing social values and market structures.
C. PV Panels and Solar Heaters	Solar panel is a broadly known technology for collecting solar energy. Composed of small silicon cells, they convert solar energy into either electricity or heat. Nowadays at a relatively reasonable price, solar panels planned for the project are used for both purposes: some will be used to provide additional electricity that will be stored in the DPU cluster at the ground floor; some heat the water received from the city supply and warm it before it is distributed to the different apartments.
D. Modular Energy DPUs	The energy subsystem provides a reliable system that responds to the needs of the community related to collection, provision, wise use and eventual production of different kinds of primary resources such as electricity, gas, and water. The functions of the energy subsystem have been sorted into five main clusters, based on their scope: water, recycle, electricity, power generation, and ventilation. The function clusters try to address the most relevant issues related to energy consumption, collection, and saving. The DPU physical modules that accommodate the different technologies for this purpose have different shapes and dimensions. The picture above represents one of the one used, the “box” modules, which are to be installed alone or in clusters and to be attached to the A^2BS structure. The joints will make it feasible to easily install and detach the modules, making the system flexible.
E. Farming Modules	The project considers the use of aeroponics technology on the roof, which refers to a technology allowing plants grow without soil or other aggregate media. Plants are periodically irrigated with fresh air, water, and nutrients 24 hours per day [10]. Meanwhile, vertical farming is applied in the installation of green walls on building façades. Green walls are usually composed of a frame that hosts soil to grow climbing plants. There are many advantages of vertical farming, such as insulation, evaporative cooling, temperature reduction, and space saving [11].
F. Mobility DPUs	Firstly, one approach proposed for the mobility subsystem is a gradual modification of the interior in the form of Mobility DPUs, aiming to “infect” the environment and gradually upgrade it. Thus, stair and door modules have been elaborated to seamlessly integrate into the interior space. Secondly, exterior mobility is also considered. A typical instance of Egyptian small range mobility is the tuk-tuks, which are popular privately-owned vehicles that serve as public transportation. A similar concept is employed by the VOI electric motorcycle, developed by TUM Create [12]. Similar to a tuk-tuk, the vehicle can transport one passenger at a time. Moreover, it is equipped with an interchangeable capsule in the front, which hosts various pods. The functions vary from passenger transport to goods delivery. This approach would be ideal because the local streets are often overcrowded with insufficient space for mobility.
G. Modular Infill	The modular infill system is intended to be embedded as “second layer” of the building, while the modular structure as the “first layer”. It provides a framework that will accommodate different ranges of functional modules. The framework consists of the wall frame and floor module, that both are easily connected with the structure and detachable when replacement is needed. Basic electrical wiring and pipes will run through the framework, by internally adding a layer of plasterboard to provide a finished wall. The material of the wall frame can be locally sourced. The floor module is made of fire-resistant polystyrene material, enabling flexible installation of pipes

	and other services. The floorboards above the floor module can be easily removed, in order to gain access to the pipes and services.
H. Hybrid Mashrabiya Panel	Mashrabiya denotes a traditional architectural element especially used in Islamic culture with both aesthetic and functional purposes. Its functions include, but are not limited to controlling light and air direction, reducing temperature, and providing privacy. Size, pattern, and distance from balusters determine how extensively these functions are employed. The proposed solution has a hybrid approach of using photovoltaic with traditional Mashrabiya. The photovoltaic film is attached to the frame carved with the traditional pattern. Different technologies are considered for the film, which is required to be transparent, in order not to block the view from the window. The electricity will be stored in the DPU clusters on the ground floor, serving the whole building. The module appears to be highly efficient, according to a simulation to evaluate its feasibility in the context of informal settlements [13].

5 Conclusion and discussion

The informal settlements in Greater Cairo Region suffer from various aforementioned issues (e.g. overpopulation, high unemployment rate, land shortage, poor living conditions, inadequate infrastructures, environmental pressures, etc.). In order to tackle them, this research explores an integrated approach to improve the living condition of local residents, thus revitalizing the local communities. By investigating the status quo and urgent needs of Cairo's informal settlements with a scientific methodology, an Affordable and Adaptable Building System (A^2BS) based on open building concepts is proposed, which can be easily prefabricated and assembled by unskilled workers. Meanwhile, Decentralized Processing Units (DPUs) customized to A^2BS are introduced to enhance three main aspects of life (working, energy, and mobility). In addition, a simulation of regenerated case study building is presented, which integrates A^2BS and various DPUs. Furthermore, a suitable business model for the local communities is discussed based on Decentralized Industrial Village (DIV) concept.

The proposed system is favorable according to the local residents and stakeholders' feedback during site visits. The proposed system can be further adjusted according to the feedback (e.g. improved dimensions of the structural system, improved load distribution on the roof, optimized layout of the Decentralized Industrial Village, etc.). Future pilot projects will be helpful to validate the feasibility and efficiency of the proposed system. More in-depth cooperation with local institutes and industry is also crucial to the successful implementation of the proposed building system in the local context. In conclusion, this research raises public awareness of the challenges and opportunities in Cairo's informal settlements, provides a valuable reference to researchers, architects and urban planners in the related fields, and takes a step forward to improve the living conditions of informal settlements in Cairo and worldwide.

Acknowledgements

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AN ENTREPRENEURSHIP PROGRAMME FOR ARCHITECTS

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Abstract

This paper outlines a formal post-professional Master's Programme in architectural entrepreneurship and leadership. The Programme will use the Unit System method of teaching in architecture to provide a problem-based pedagogy on a blended learning platform.

In the latest edition of the American Institute of Architecture's *The architect's handbook of professional practice*, a call is made for increased prominence to be given to the need for 'an entrepreneurial approach' when starting a new firm. Elsewhere, university schools of architecture and others are recognising the need for entrepreneurship education, training or support for aspiring architectural practices. These include the DesignX initiative associated with the Massachusetts Institute of Technology's School of Architecture and Planning, Odile Decq's Confluence Institute in Lyon, the Archipreneur Academy and Entrearchitect.

The programme will be based on the results of a mixed methods study and discussions with prominent architects. It will be available to architects internationally and will use an international group of prominent architectural practitioners as advisors.

Keywords

Entrepreneurship, Leadership, Education, Architects.

1 Introduction

In 1920, the American Institute of Architects (AIA) recognised the importance of, and published guidance on, the business and administrative dimensions of architects' firms [1]. By 1962, the Royal Institute of Architects (RIBA) undertook a study titled *The Architect and his office* [2]. Their study identified a requirement for an increased awareness amongst architects of the significance of the business managerial aspect of an architect's firm. Despite the rather slow warming to the importance of business management in an

architect's firm, entrepreneurship, which is very different to business management, remained below the radar. Some books on 'starting your own firm' appeared. These include Chappell and Willis (1992) [3], Piven and Perkins (2003) [4], Littlefield (2005) [5] and Davis (2008) [6]. However, the link between architecture or architects' practice and entrepreneurship remained largely ignored until 2008 when Moreno [7] links the two, stating that "architects - indeed all entrepreneurs - must make enough money to stay in business and prosper". During 2010 Robert Gutman published an essay titled *Architecture the entrepreneurial profession* [8]. In it, he argued that architects should become more aggressive in "getting work and creating its own demand" [9]. In 2011 Nathan Richardson, in a paper titled *Architecture is entrepreneurship and (why) it matters [10],* states that "the changing nature of society and the issues it confronts should compel more architects to reconsider their expertise and the manner in which it is deployed." He says that "one key to exploring enhanced productivity for architects may reside in the profession's self-conception and its relationship to entrepreneurship". This was followed by his 2014 chapter entitled 'On enterprising architecture' in *Architecture in an age of uncertainty* [11]. Also during 2014, the International Union of Architects (UIA) concurred that societal changes resulted in a situation where the creation of the urban and built environment has become more complex and has forced architects to deal with an even wider range of urban, aesthetic and legal matters [12]. This resulted in a policy to "encourage and promote the continuing extension of the boundaries of architectural practice" and "the corresponding extension of the knowledge and skills necessary to deal with any extension of boundaries" [13]. This call for an expansion of the architect's field of operation was by its nature a call for more entrepreneurial attitudes by architects. During the same year the AIA, in the latest edition of *The architect's handbook of professional practice,* amplified the call by increasing the prominence that is given to the need for 'an entrepreneurial approach' when starting a new firm [14].

During 2015 Eric Reinholdt published *Architect and entrepreneur: A field guide to building, branding and marketing your start-up design business* [15] as a response to his own experience in searching for guidelines that would assist him in establishing his firm. Entrepreneurship in architecture is now gaining traction with Odile Decq stating that, "we have to train the students to become architectural entrepreneurs" [16]. Internationally, university schools in architecture and others have now started to recognise that a need exists for entrepreneurship education, training or support. An internet search on 28 June 2017 found four such examples. The first is the DesignX programme started by the Massachusetts Institute of Technology's School of Architecture and Planning in May 2017 [17]. DesignX represents an academic accelerator workshop which provides financial support to participants. They can use the support to develop their ventures. It also includes mentorship by experienced entrepreneurs, coupled to a program of lectures, visits to innovative firms, and networking opportunities [18]. The second example is Odile Decq's Confluence Institute in Lyon, France [19]. The third is the Archipreneur Academy, a programme that offers online video interviews with experts coupled with associated business model case studies [20]. The fourth example is Entrearchitect, constituting an online support site which provides business resources, live expert training and a support group of entrepreneur architects working together to grow successful businesses from small firm architects [21].

Despite the increasing recognition that architects need entrepreneurship skills, as far as could be established, no formal degree granting qualification is available for those architects

who are considering or are in the process of starting their own firms; or those have a need to acquire entrepreneurship knowledge and skills in order to expand their activities. This paper will describe the outlines of such a programme that the University of Johannesburg is developing, as well as the research that underpins it and the pedagogical model that will be followed in this regard.

2. Entrepreneurship Education and training

According to Valerio, Parton and Robb [22], Entrepreneurship Education and Training (EET) consists of both academic education and formal training interventions. They hold that the first broad objective of EET is to provide individuals with the entrepreneurial mind-sets and skills required for entrepreneurial activity and secondly; to boost, inspire and support participation and performance in entrepreneurial activities. However, like entrepreneurship, EET does not have a unified and accepted theory or definition [23].

EET is sometimes mistakenly confused with business management education. However, EET is distinctively different from general business management education [24]. The most important differences between entrepreneurship education and training and business management education is that EET *inter alia* aims at the development of specific mind-sets and skills required by entrepreneurs. Some of these skills are socio-emotional skills such as self-confidence, leadership, creativity, risk propensity, motivation, resilience and self-efficacy. Another difference is that EET, includes the perceptions associated with entrepreneurs and entrepreneurship. In addition, EET does include general business knowledge but it combines these with the skills and knowledge required to start and manage a business. This is distinctly different from general business management education which aims only to prepare students to function within established businesses and management structures as managers. Thus, a degree of overlap exists, but EET uniquely covers the conditions and problems related to entrepreneurial endeavour [25]. As such EET must also include creative thinking, negotiation and selling skills, complimented by leadership and people management abilities [26]. Hence the proposed programme will be a post-professional programme in architectural entrepreneurship and leadership. Figure 1 illustrates the relationship and difference between entrepreneurship education and training and business management education.

A review of EET literature found that considerable agreement exists that a phased approach should be followed and that the phases should be combined into a framework [27]. The first phase of such a framework should focus on changing perceptions, attitudes and mind-sets about entrepreneurship [28]. At the University of Johannesburg these outcomes already feature in the Professional Practice curriculum. The second phase should develop the required socio-emotional skills including self-confidence, leadership, creativity, risk propensity, motivation, resilience, self-efficacy and interpersonal relations. It is believed that these aspects are already developed by the rigours associated with the pre-professional programme and during the 'in-training' period that follows the professional degree. The third phase must then focus on becoming an entrepreneur and should develop the entrepreneurial orientation of learners and include the knowledge, skills and attitudes required to successfully start, develop and grow enterprises. The programme that is the focus of this paper will be aimed at this phase of the framework. Finally, a fourth phase providing a variety of support services, for instance mentoring, administrative support and technical assistance, could be added in future [29]. The literature reviewed furthermore

recommends that elements of experiential learning or learning by doing should form part of the framework [30].

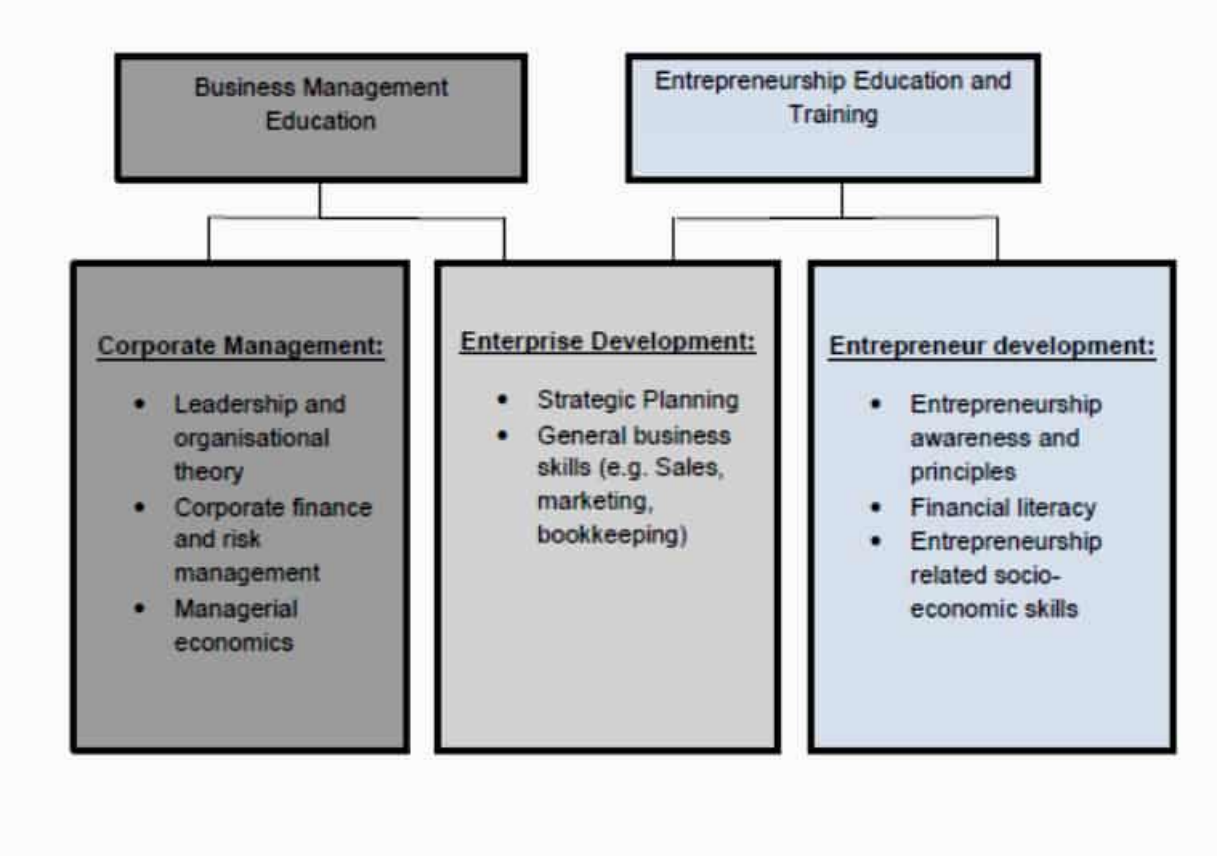

Figure 1: Entrepreneurship versus Business Management Education [31]

4 Research Methodology

The research was carried out in two distinct phases. The first phase was comprised of the research undertaken as part of the author's PhD study. This was followed by a second phase aimed at determining the format of the proposed course offering. The first part of the study comprised a literature review and an empirical study. The empirical study in turn consisted of a qualitative study and a quantitative study. A combination of quantitative and qualitative studies constituted a mixed methods approach or study [32]. Creswell [33] believes that a major benefit of the mixed methods approach is that it makes the combination of the strengths of both the quantitative and qualitative approaches possible. Furthermore, it makes a more comprehensive investigation of complex and multi-disciplinary problems possible. In addition, it offers more insight and an expanded understanding of the problems under investigation.

The empirical study comprised of a qualitative process using semi-structured interviews and two quantitative self-administered questionnaires. The empirical method of the qualitative study was a case study design, while that of the quantitative study was statistical surveys conducted according to Cooper and Schindler's descriptions [34]. The qualitative study comprised semi-structured interviews conducted amongst 26 'enduring' [35] South African architects' firms. The quantitative study comprised two questionnaires sent to all registered architects and candidate architects in South Africa.

Following the PhD study, a focus group discussion was held in July 2017. The focus group included the senior principals of a number of prominent and well-established South African architects' firms of various sizes, and representatives of the University of Johannesburg's Department of Business Management (which contains the University's Centre for Entrepreneurship), the South African Institute of Architects, the South African Council for the Architectural Profession and the Graduate School of Architecture (GSA) at the University of Johannesburg [35]. The aim of the focus group discussion was to determine the optimum way of structuring and presenting a post-professional programme in architectural entrepreneurship and leadership in such a way as to suit the needs of architects who are considering starting new practices or who have already started their own practices in the recent past. The programme has to accommodate architects from across the globe.

4 Findings

The qualitative part of the empirical study [36] probed the founders of the enduring architects' firms about advice to young architects considering starting a new firm. It found that they believe that start-up architects should:

- Undergo entrepreneurship and business management training.
- Such education and training, possibly in the format of a post-graduate degree and follow-up training courses, should amongst other things include the basics of managing a firm, elementary accounting knowledge, people skills, marketing skills, contractual knowledge, negotiation skills, building economics, assertiveness training and time management skills. Many of the pointers given fall within the following entrepreneurship related fields:
    a. Marketing Management
    b. Strategic Management
    c. Operations Management
    d. Financial Management
    e. Risk Management
    f. General Business Management
- A support system that can offer mentorship, financing, opportunities to gain experience, advice, legal support and a sounding board.

The quantitative study probed which topics architects and candidate architects would like to see as part of such a EET programme [37]. Their responses indicated:

4.1 Entrepreneurial Skills

The respondents indicated that a need exists for outcomes related to becoming an entrepreneur. They believe that, to this end, the curriculum should cover the following:

- Opportunity identification and exploitation.
- Business or venture planning as an introduction to strategic planning.
- Creating and growing a venture.
- Finding resources (financial and human capital, technological, information and communication infrastructure).
- Risk identification and mitigation.

- Rewards: financial and other (lifestyle), related advantages to owning your own business.
- The role of management and management structures.

4.2 Entrepreneurial Performance

The programme should include outcomes regarding assessing and improving general entrepreneurial performance. To this end, the curriculum should cover the following:

- Aims and objectives of entrepreneurs: is entrepreneurship only about making money for oneself?
- Moderators for entrepreneurial performance.
- Introduction to business strategy and strategic management.
- Measuring entrepreneurial performance.
- Performance criteria linked to entrepreneurial intentions.

4.3 Starting an Architectural Firm

Moving from the general to the specific, the general entrepreneurship education covered in the foregoing should form the basis for profession-specific outcomes. General theory and practice must now become more specific and the curriculum should cover the following:

- The entrepreneurial process in architecture how to prepare yourself and when to start your new venture.
- The architectural competitive context.
- Opportunity recognition.
- Market research and feasibility.

4.4 Firm Design

The programme should include outcomes that focus on the design of the individual firm: These should include:

- Formulating the firm's vision, mission and goals and how these influence future choices.
- Firm size and values including the advantages of small and large firms.
- Legal formats of practice and the advantages and disadvantages of each option.
- Firm archetypes.
- Firm strategy and possible competitive approaches.
- Positioning the firm.

4.5 Formalising Your Plans

Developing and implementing the initial plans. Here the curriculum should include:

- Architectural business models: what are the options, and what are the advantages and requirements of each model?
- The importance of continuous formal and informal strategic planning.
- The need for differentiation and how this can be achieved.
- Competitive positioning.

- The formulation and implementation of strategic decisions.
- Entry strategies: how to start off and survive until the firm turns profitable.
- Drafting a business plan.
- Choosing a fee strategy
- Finding the required resources.
- Marketing the new firm.

4.6 Developing Business Management Skills

Acquiring the skills and knowledge that will be needed to manage and grow the firm.

- General managerial functions (planning, organising, control, leading).
- Business management styles.
- Getting work including negotiation and fee determination.
- Opportunity recognition as an ongoing practice.
- Leadership and management styles.
- Managing a knowledge-based business.
- Client bases and client relationships.
- People management and conflict management.
- Risk management (both financial and professional liability).
- Financial management in an architectural practice.

4.7 Support

The value of various support initiatives and how to access these benefits.

- Mentorship: its value and benefits, choosing a mentor, how to be a mentee, what to expect from your mentor.
- Support groups and the benefit of peer support while starting and managing a firm.
- Experiential learning and how to optimise the value of lessons learnt.
- Continuous education.

These findings which reflect how education and training are viewed, must be interpreted from the perspective of South African architects' need to get entrepreneurial skills, because of their experience in practice. This indicates that architects have noted a paradigm shift caused by the dynamics of an economic system that is in the process of adapting to external pressures brought about by changes in the macro-economic environment. It is evident that the collective network-based (social capital) approach is no longer a reliable source of work. There is a definite change in the ways of acquiring work. As was shown earlier, there is a need for the profession to enter new territories so that sections of the population who don't usually benefit from the skills and knowledge practicing architects can offer, can do so.

The focus group meeting [38] made the following recommendations regarding the proposed programme:

- The programme should not exist in isolation and should build on related content included in the pre-professional programme.

- The need for more entrepreneurial content as part of the pre-professional programme was emphasised.
- The programme could run parallel to the two-year candidacy period.
- That potential candidates should be allowed freedom of choice regarding when they wish to follow the programme and that their decision should depend on a strong desire to complete the programme and to start their own businesses.
- Interaction between students and their employers can fulfil an important supportive role.
- An overly academic approach should be avoided and a hands-on approach should be followed.
- The programme must involve practicing architects.
- A one-year programme could suffice.
- Architects and architectural students are problem solvers and design thinkers, Hence a problem solving/design-based pedagogy should be followed.
- The programme must be differentiated from generic business management programmes.
- Theoretical input will have to form part of the content and the programme should include reading components.
- Teaching students how to define and describe problems succinctly will result in better solutions.
- Clearly defining the purpose of the programme will be important.
- The core focus should be on running a practice.
- The use of case studies should be encouraged.
- Students might use the content of the offering to also start non-architectural businesses.

5 A post-professional Master's Degree in Architectural Entrepreneurship and Leadership

The findings and recommendations from the two empirical processes and the focus group were synthesised, and after discussions with the lecturing staff of the GSA and the Department of Business Management at the University it was decided to adapt the 'Unit System' of teaching in architecture. This is the same pedagogical strategy used by the GSA in its professional Master's Programme for this purpose.

The Unit System of teaching in architecture was introduced by Alvin Boyarski, who was chairman of the Architectural Association from 1971 until his death in 1990. According to Rodger [39] the Unit System was, *inter alia*, in response to problems faced by architectural schools such as "growth in the number of students, to problems in obtaining state funding, and to a perceived lack of 'freedom of choice' for students". The Unit System comprises a system where instead of a standard curriculum followed for a whole year (as used traditionally at schools of architecture) a plurality of tutors construct their own separate

units. These units run in parallel, and even in competition, since the students get to choose which unit they should join (and under which tutor they will study).
Rodger holds that Boyarski's lead in establishing this system was particularly note-worthy because of his understanding that architecture is not simply a professional practice which requires a set curriculum in its education, but in fact comprises a wide-ranging practice, "and an artistic engagement which is nurtured by openness, experimentation, plurality, 'a process of ideological friction' and 'freedom of choice' for the students" [40].
It is proposed that each unit will have a minimum of two unit leaders or tutors, of which one will be from the Department of Business Management [41]. Unit leaders will choose a theme for the unit. Typical themes could include Sustainable Practice, Expertise-based Practice, Socially Responsive Practice, etc. The unit leaders will be supported by an advisory panel of local and international architectural entrepreneurs. The pedagogy will be one of problem-based research projects. Students will have access to a variety of support mechanisms such as pre-recorded academic content (lectures, videos, reading lists, etc.) and will be guided on their journey of discovery by the unit leaders. At completion the different assignments and research reports will be incorporated into a unifying portfolio. Assignments will be assessed individually and collectively once in the portfolio. The proposal is illustrated in Figure 2.

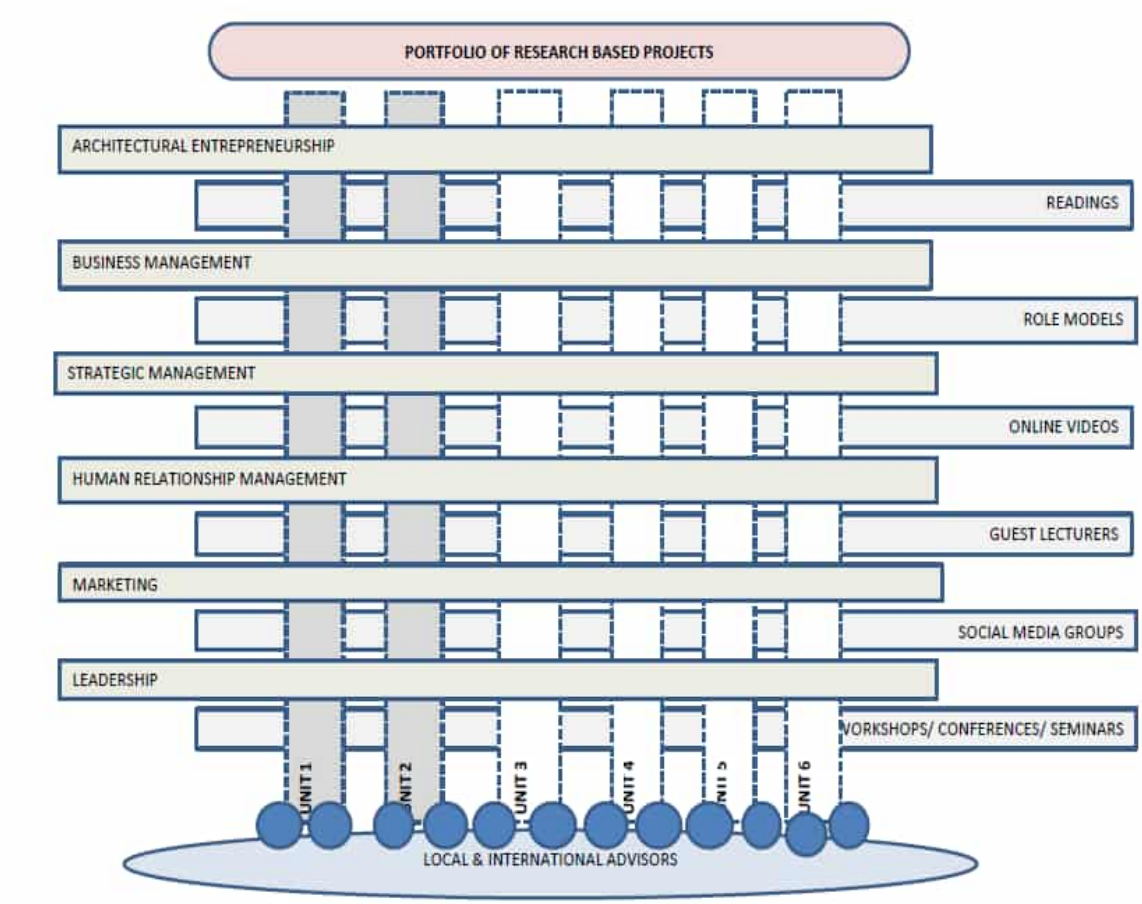

Figure 2. Post-professional programme in Architectural Entrepreneurship and leadership. (By author)

6 Conclusion

The proposed offering, currently in the official approval process, will be offered as a post-professional MArch degree specialising in Architectural Entrepreneurship and Leadership. It will function as the third phase of the Framework of Entrepreneurship Education and Training described earlier. To make it accessible to architects anywhere in the world, it will be offered on a 'blended learning' platform starting in 2019 or 2020. It is hoped that the final phase of the framework, aimed at providing a variety of support mechanisms will be introduced by architectural professional organisations.

Acknowledgement

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COMPUTATIONAL DESIGN TOOLS IN ARCHITECTURAL EDUCATION

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Abstract

Architecture is a discipline that continuously produces information through research in the field of education. The process of ''knowledge generation'' is influenced significantly by the act of developing new technology and digital tools as well as by an interdisciplinary approach to architecture. In the framework of digital technologies, Computational thinking methods and digital tools provides an innovative alternative to design researches. This method makes it possible to design innovative forms and building systems based on environmental data. In addition to this, computational thinking helps us understand the architectural outcomes within a different perspective by using digital tools and make appropriate design decisions.

Digital tools influence today's architecture, from the design process to investigating materials and from collecting environmental data to understanding relevant sources. Thus, this method makes the designer think in a more integrated framework with simulation, visualization and the spatialization of outcomes. The reflection of this interaction in architectural education is inevitable. Besides, in architectural education, analysis-oriented design studies that are compatible with the built and natural environment are essential phases. But, such studies can only be possible with a holistic view. An architectural education based on this method allows us to understand the qualitative and quantitative results of a design process. In other words, such studies in architectural education give the future architects the possibility to design with a holistic view. This holistic view has potentials to integrate theoretical courses with architectural design studio.

In short, the aim of this paper is twofold; the first one is to introduce the ''Computational Design'' as a learning methodology. And the second one is to investigate the pros and cons of this methodology on the architectural education.

Keywords

Architectural education, Computational design, Design research, Digital tools, Database

1 Introduction

Throughout history, the curricula of architecture schools have been generally structured around three fundamental pillars: theoretical courses, architectural design studios and, internship. The architecture education is shaped around the architectural design studio; accordingly, the knowledge from the theoretical courses is put into practice in the studio by learning by doing. However, as a learning methodology "learning by doing" is an important approach not only for design studio, but also for other theoretical courses in architecture education.

In the architectural design studio, students learn the methodologies and approaches of the design process. At the same time, they get a chance to practice the information gain from theoretical courses. It cannot be expected that all architects have deep knowledge in every subject, but they has to deal with different issues in the architectural design process from an intellectual point of view. The feature of design studios is that the target to be reached at the end is not taught directly as information, but the synthesis of these information from other courses is to be expected [1][2]. An efficient design process that supports creativity needs to be designed by responding complex problems with different parameters of close relevance. Therefore, one of the fundamental competencies that an architecture student should gain is to be able to shape the design process by taking design decisions appropriately. The achievement of this skill by the architecture student is closely linked to the awareness and intellectual approaches to the different fields connected with the architecture as ecology, history, biology, climatology, geospatial science etc…

The most fundamental problematic in the historical development of architectural education has been the definition and teaching of "design". In the Ten Books on Architecture *(De Architectura)*, Vitruvius explains that the architect who deals with the natural environment should be educated in a wide range of context including social and cultural contexts, artistic trends and building technologies [3].

In addition, it is not sufficient to provide only a wide range of training in architectural education; an architecture student should learn how to use and analyze/evaluate all this information in the design process. It is necessary that architecture schools learning methods should not be based on the "memorization of information", but should be based on "to be able to develop methods to reproduce the structural requirements by the appropriate information depending on the design problem". In order to be able to increase their ability to make appropriate decision making and creativity in the design process, it is necessary for architecture students to establish a strong link between the information that they have learned in the theoretical courses and the design process.

However, the architectural education interpreters in different ways, in different institutional frameworks, in Europe and in other countries. Turkey is a significant example of them with the scientific research results. Under the frameworks mentioned above, the main question of the research is as follows: "Could the architectural departments in Turkey be influenced by computational thinking and tools to strengthen the interaction between architectural design studios and theoretical courses in which fundamental architectural knowledge is included in the curriculum?" In order to achieve the research goal, we choose two fundamental theoretical courses: environmental control and history of architecture as well

as urbanism. The main focus of the research is to analyze the effects of an integrated computational thinking exercise with the chosen theoretical courses.

2 Computational Design and Architectural Education in Turkey

In 2017, a recent scientific research was conducted on how computer-aided design in architectural education in Turkey is addressed. The research results from these two studies on architectural education and computational design in Turkey are below [4]:

- In the course contents that are related to computational design, topics such as ''information'' and communication technologies (ICT)'', ''digital manufacturing techniques'', ''building information modeling (BIM)'', ''graphic coding'', ''technical drawing, visualization and presentation'' and ''computer support in the design process'' stand out. It can be said that the course contents mostly include drafting, visualization and presentation techniques when deliberate these topics in the course content.
- It is observed that even in the ''coding and design'' training where the concepts of algorithm and parametric design are expected to be included, the computational thinking and methods are not sufficiently understood by the students.
- In addition, architecture students cannot integrate the potentials of computational thinking methods and tools with their design studio processes other than drafting techniques.

According to these research results, computer-aided or computational design courses need to add their curriculum that computational design tools have possibilities for use beyond quick drafting techniques, solid modeling and presentation.

In addition to the computer-aided design courses, there are various studies on the effects of computational thinking and design exercises on architectural design education in different architectural schools in Turkey [5][6]. It can be understood with the following examples:

Research conducted at Gazi University compared the traditional and digital drafting, and visualization tools. In addition, researchers also compared the digital visualization tools among themselves. According to the research results [5]:

- Alternative design variations can be created by using less effort compared to traditional methods by digital methods.
- Digital visualization techniques can express inputs such as three-dimensional (3D) expression, space perception and light better than conventional methods.
- It was emphasized that object-based software is the most advantageous visualization technique, and should be included in the syllabus of computational design courses in architecture schools.

However researchers point out that the fundamental architectural courses such as technical drawing should be given in the traditional context. Yıldırım [5] suggests the integration of design, construction and other architectural education courses, and digital technologies in the upper semesters.

In the first year of architectural design education, three different methods have been tried in education by using the researches of computational & digital design applied in the studio in Yıldız Technical University [6].

Mentioned three methods are below:

- 3D visualization possibilities of the computer are used from the initial phase of the design
- Computational methods includes integration between design and production by focusing on the nature and system structure of the material
- Learning methods based on computational thinking

The research results are below [6]:

- The majority of students reported that they could convey their thought faster and clearly through 3D modeling. In addition to this, they perceived better in the third dimension and decreased their fear of making mistakes.
- It has been observed by the studio instructors that students have also partially gained self-criticism.
- An important issue for researchers is that the architectural design studio acquires a process-oriented structure rather than a product-oriented one.

In addition to computer-aided design courses, all these studies show how computational thinking methods and tools can be integrated into architectural design studios and theoretical courses. These interactions and new learning methods have been made to look at the effects on the architecture student, and similar studies still increasing widespread in the universities in Turkey.

In this context, we are organizing workshops with architecture students in Turkey to research on the possibilities offered by computational thinking and digital tools for the architectural design studio and theoretical course integrations.

3 Use of Computational Thinking Exercises to Integrate Theoretical Courses with Architectural Design Studio

For the last thirty years, the world has undergone a comprehensive transformation process that is called in several ways as “information” or “digital” age. Within architectural education, the basis of this conversion lies into two main phenomenon: computational thinking methods in design process and developing computational design tools [7]. Therefore, the “information” or “digital” age presents a challenge for architecture educators in this context. Consequently, some important questions in this field showed up as follows [8]:

- How will architecture schools teach their students - future architects - computational thinking methodology as the new way of design process?
- How does computation fit within the subjects that architecture schools already must teach, especially when curricula keep growing in scope due to new requirements?

Widespread use of computational thinking methods and tools are forces the traditional architecture education and pedagogical methods to change. Yazar [7] argues that although there is a general acceptance of the idea that architectural thought patterns and design tools are transforming in parallel, there is no generally accepted educational model about how these transformations should be addressed in architectural education institutions today.

Within architectural design studio methods, the conversions caused by computational thinking and technologies in architecture design process (Figure 1) should be integrated, as Wing [9] states that computational thinking must be a fundamental part of everyone's education. Computational design is, increasingly, becoming important within the architectural discipline. In today's profession, CAD and 3D modeling alone are not enough to address the need for more economically and ecologically sustainable buildings. Computational thinking methods such as parametric models, generative algorithms, simulations, and digital fabrication are not only aesthetically innovative, but performative as well [10].

In the field of architectural education, computational design approaches can be tackled into two folds [4]:

- A methodological approach that transforms the cognitive processes of design activity as it can be called computational thinking method.
- The use of tools that enable the human mind to receive data from a wider, interdisciplinary perspective.

To use the computational thinking methodology and tools as learning methodology, we should create a framework for architectural design studio based on these phases.

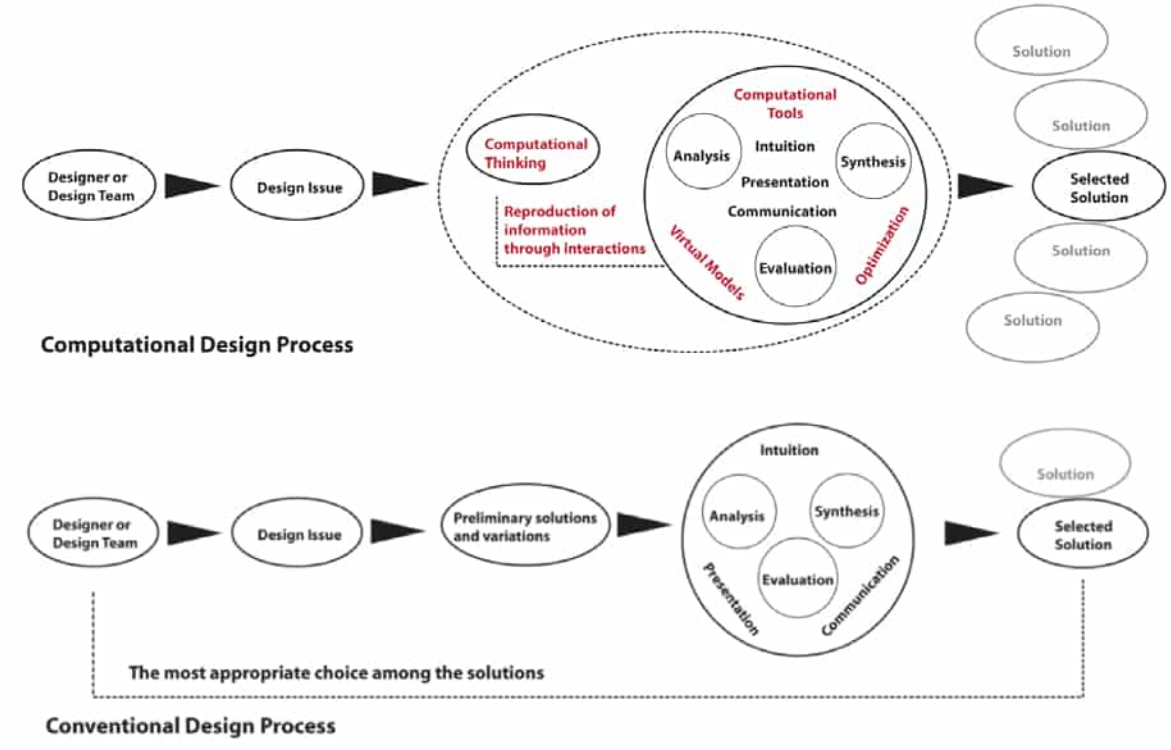

Figure 1. Comparison of computational design process with traditional design process [4]

3.1 Computational Thinking Exercises in Architectural Design Process

Csizmadia [11] defines computational thinking, as a cognitive process involving logical reasoning by which problems are solved and artifacts, procedures and systems are better understood. Computational thinking includes the ability to think algorithmically, in terms of decomposition, in generalizations, identifying and making use of patterns, in abstractions, choosing good representations and in terms of evaluation [11]. Therefore, this methodology can be applied to a wide range of artifacts including: systems, processes, objects, algorithms, problems, solutions, abstractions and collections of data or information.

Architecture can be defined by a process of problem solving and creativity in which the data from multi-criteria and multi-disciplines that are addressed for building a social and cultural structure. Computational thinking describes a system that produces information with applicable abstractions [12]. The methodological and instrumental interaction of these two research areas has important potentials for learning methods in architecture education.

For this research process, in the organized workshops, algorithmic, data based and interactive contextual maps were used as a tool in order to practice of computational thinking and design for the students and for their architectural design process. From the initial phase, students created an interactive, integrated and data based contextual map as an algorithm of their design process.

The following steps were taken to implement computational thinking to students with a defined layout:

- The concepts of computational thinking are explained with examples in the context of fundamental definitions and their effects on design process.
- Students are asked to classify the constraints, possibilities and criteria that they reveal about their own architectural design processes.
- The required data on the constraints, possibilities and criteria that students classify are accessed by means of computational tools chosen by student. Students are asked to add these data to their contextual maps.
- Students are asked to organize contextual maps that contain visual data so that the relationships between the classified and derived design criteria are integrated, relational and step-by-step.

The algorithmic contextual map, which is based on the exercise that makes computational thinking the fundamental framework of the design process, offers the opportunity to reproduce knowledge and make decisions interactively.

3.2 Computational Design Tools

Senske [8] mentions that the software and techniques changes constantly. It is more important for students to gain the ability to keep up with changing techniques, to choose most convenient software for their project, rather than learn how to use existing and most used or popular software. Thus, the courses on computational thinking methodology should be included in the curriculum before the software teaching. The core idea for the architectural curriculum is that the computational design courses are not focused on developing fluency in particular kinds of software tools, but rather computational thinking.

Holzmer [13] mentions that designers take advantages of tool ecologies in order to find the must purposeful way of connecting processes that inform morphological design and associated building performance. Therefore, the ability to set up logical connections of design parameters across different digital applications becomes ever more relevant in a tine where the proliferation of computational tools has led to a fundamental transformation in architecture education [13].

Ability of architecture students to organize the use of different design tools in accordance with their purposes and in combination, has a potential to change their cognitive abilities about their design process and decision making activities.

3.3 Integration of Environmental Control and Architecture Design Studio

The subjects of the environmental control course are important for the student to be implemented within the architectural design studio. Environmental control subjects are already considered as important criteria within the scope of the architectural project studios. However, conversions of digital tools make environmental data more accessible for architecture students. Architecture students can concentrate more on the environmental factors added to the project design criteria when s/he synthesizes the information gained from environmental design courses and the data obtained from the digital design tools. Computational thinking exercises and digital tools have a potential to ensure the gap between the environmental control courses, and architectural design studio is covered and integrated.

With the developing Internet network and diversifying plug-in technologies, the digital tools provide the possibility to get important data in different environmental control issues. For example, modeling programs have highly advanced tools for sun-shadow analysis, not matter if it's Building Information Modeling or Computer Aided Design software. Also, designers have chance to analyses the energy gains and losses of the design in different stages of the project process.

In August 2017, a two-week workshop was organized for a PhD Thesis research on architecture education, ecology and computational thinking at Chamber of Architects İstanbul Metropolitan Branch as "Computational Design Research Workshop" [4]. The students were asked to design a living space of 30 m^2 within a university campus they determined. The first week of the workshop was evaluated as ''control process'' and the second week was evaluated as ''computational thinking process''. In the control process, participants from different universities of Turkey were told to work with their own traditional design methods without any manipulations. In the second week, presentations and exercises were held on computational thinking and usage of computational design tools.

During the last days of both first and second week of the workshop, students presented their weekly works. Decoding the presentation registrations of the participants, the development between the two versions could be investigated. The deciphered texts were converted to mind maps by qualitative methods and the differences were evaluated. Besides, the individual interviews with participants were also recorded and evaluated. All participants presented their first design decisions and projects in the first week of the 10-day workshop period with their own chosen presentation techniques. In the second week, they formed their contextual maps that would reshape the design processes. Then, they have critically looked at their own initial designs and added them to the design criteria by determining the

context, possibilities, and constraints they found missing. In addition, the data about the design criteria gathered from the taught programs are added to the contextual maps. Due to the short duration, in the second week's presentations, it was observed that there was no time for new design solutions, although, the contextual maps and critiques of their first and second week decision processes were taken into consideration. Results were assessed not by the participants' designs, but by the new approaches and the usage of digital tools in the design process to relate the bond that they have established with the built and natural environment.

By comparing the mind maps of participants, it can be observed that there is a relation between to have the perception of integrative and relational thinking based on computational design logic and to take into account of environmental data (Figure 2).

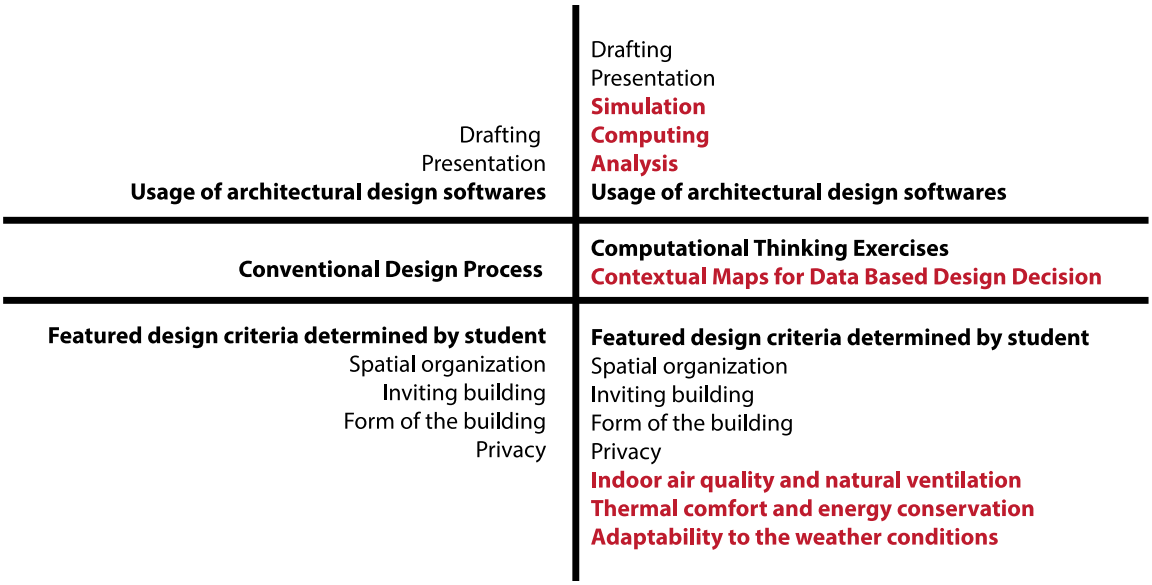

Figure 2. The Process and Results of "Computational Design Research Workshop" [4]

Computational thinking exercises on a relational and integrated framework have led the student to practice their environmental control knowledge in architectural design process. In addition to this, researchers observed that the students who mastered the digital tools were more productive and inquisitive in their project process [4].

3.4 Integration of History of Architecture and Architecture Design Studio

As we were standing before, the use of CAD and BIM software has become commonplace in architectural and design practice, particularly in the design stage where it allows creating holistic and integrated design process. Knowledge of urban and architectural history is a crucial factor to design a comprehensive project by conserving and grasping of Cultural Heritage. When we go a step further, in the architectural history and its context, the visualization or three-dimensional reconstructions of buildings and archaeological sites is not only valuable in an archival respect, but also allow researchers to compare buildings across the globe and access virtual representations of sites in what would otherwise be inaccessible geographical locations [14]. The intellectuals mention that using digital platforms has become main-stream in the context of Cultural Heritage. The developing technology enables the integration and preservation of data in multiple formats. It has become possible to

preserve or recreate contexts by linking digitized information around historical environments [15].

The contribution of digital tools in the framework of ''historical research'' can help in the understanding the relationships of the cultural assets within historical values and in re-thinking cities as part of the Cultural Heritage [16]. This contribution presents an important and valuable data on how the Cultural Heritage and conservation approach will be addressed in the architectural design process.

The usage of digital tools in the historical research as a methodology combines the use of Geographic Information System (GIS) and 3D modeling techniques. These tools are easing the make a comparative study rectifying different base maps and data information prepared in different years in the same accuracy. Those data usually have a location in a spatial reference frame and can be located both in local or cartographic coordinate systems. This opportunity opens the door to new interpretation ways by transforming the digital tools in a real instrument to support and ease the research.

A brief description of this combination as a methodology can be divided as follow:

- Revival of project ideas that have not been realized for various reasons in the past and evaluation of their results.
- Virtual reconstruction of the historic buildings and its original context that have been destroyed by natural or man-made hazards.
- Interpretation of the urban transformations or possible results of interventions on historical areas with 3D simulations, animations ecc. Thus, it can be predicted in advance how the texture of a historical site will change by a new project or intervention as an qualitative observation.
- Physical space and social layers of data/information can be organized in the digital platform to produce quantitative analysis by using GIS.

This combination brings a supportive approach to historical research process by presenting qualitative and quantitative observations at the same time. Especially, in the multi-layered areas, analyzing of historical and cultural values should be *sine qua non.* Turkey is, and has always been the architectural and cultural stage of international exchange. The stratification of the Greek (Hellenistic), Byzantine, Ottoman, and finally Republican Period is a remarkable value. This multi-layered accumulation is manifested especially in İstanbul. Considering the present intensive discussions of historic urban transformation in İstanbul as well as Turkey, it should be underlined the crucial importance of the integration of computational thinking methods to future architects' education. In other words, it is important that the architectural design studio acquire the ability to decide how to approach a historic area in the process. In order for this decision to be taken in accordance with the principle of preservation of historical information, the student must be able to obtain, as clearly as possible, a complete historical overview. By computational thinking exercises and the use of digital tools means to obtain/evaluate data together with direct and indirect sources. Moreover, design process of architecture students in the studio has a potential to integrate and practice the information of architecture history with new design issues.

4 Conclusion

The research is ongoing. Although a workshop on the integration of architectural history and urban planning with the studio by computational design thinking and the use of digital tools have been strategic but have not been realized and included in this paper, the remarkable results are clear. As a result of the researches and workshops, we reach the following points:

- It has been observed that the students who work with computational methods and approaches are more inclined to approach their projects with a more critical perspective and to develop their projects with data.
- Computational methods and contextual maps have resulted in students being more creative about design ideas.
- Students working on a data basis in the design process were more successful in terms of the design principles they had initially decided. They also use the digital tools not only as drafting tool, but also receive data from the software.

In addition to all of these results, contextual maps as a computational thinking methodology makes design process of students, more integrated with the information they gained from theoretical courses. Architecture students lead their architectural design process that is more ecologically and historically connected to their environment. In other words, this methodology helps to get awareness in order to make decisions by protecting the built environment.

As a result, there are two main steps for the use of computational thinking methods in order to enable the integration of theoretical courses and architectural design studio. First, it is necessary for the student to understand the computational thinking and organize the project process in this frame. Then, they need to be competent to use digital tools together, not just as drawing tools, but also according to their superior features.

Computational thinking methods for architectural design processes have also influenced the cognitive processes of students. We aware that it is important to continue working in this area for an extended period and to have the computational thinking more integrated in our curriculum. As a final word, the necessities that Turkey's architectural education continues to catch up with the era, as well as further developments, are the expectations through the future's research projects.

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ARCHITECTURE ... WELL-BEING FOR ALL

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Abstract:

Society is becoming more inclusive of handicapped persons. Architecture must move with times and accommodate the requirements of both the able-bodied and those with special needs. Modern designers must create space that allow for maximum autonomy for all individuals. Despite the growth in the number of tools, techniques and regulations accessibility today, inclusive design is still poorly known by architects. We must take a more human approach to architecture starting with a will to understand disability and the needs of the disabled. As we will discuss in the following paper, a handicap is the result of a mismatch between the person and the space. Architecture is the art and responsibility of designing for all of us.

Keywords:

Inclusive design, accessibility.

Preamble

At a time when the world is changing, when the notion of Well Being for everyone - whether at work or in everyday life - is paramount and the word "human" is returning to its place through values such a sharing, exchange and listening, inclusive architecture is obvious.

The work of the designer and architect - ranging from object to building space - is essential to everyone's participation in daily life. Architecture must take into consideration diverse and varied needs of people. With the progress of medicine and the aging of the population, the able-bodied men standing 1.83 meters tall represented in old anthropometric models is no longer representative of our time.

The individual is both plurality and singularity for whom we must create spaces that allow everyone to work, move, feel comfortable, feel safe, move independently, have access to recreation and housing, etc.

Accessibility, mobility, autonomy and respect for people as sensory beings (allowing everyone to participate) is central to the daily life of everyone.

This is the central idea of my speech.

Introduction

The stakes are high and solutions to improve accessibility to the built environment for everyone are more and more numerous.

Among these responses, we find:

- rules and regulations: over the last few decades, accessibility has become a social and political issue. People, in all their diversity have at last become the focus of society through debates and round tables which have led to several regulations. For example in France, since 2005, the laws have taken into account all types of disabilities, not just motor impairment. Applications are very long and difficult to implement; deadlines for implementation are not always met, but they are an important step towards inclusive architecture.

- grassroots participation: with the rise of social networking and grassroots participation, whether it be through associations, foundations, "living labs" or crowd founding, we observe an individual commitment to the collective well-being and the emergence of innovative concepts in terms of accessibility and co-creation.

- technical and technological aids: technical and technological aids resulting from research, ideas - sometimes generated at a grassroots level or from professionals doing research and development- are constantly growing in number.

Innovative solutions are constantly being produced: technical aids, compensation material, etc.

We have arrived at a paradigm of universality to which our current responses are many.

These tools are part of the response to accessibility for all; they are complementary. However, during my diagnoses and studies, I noticed that they were not always used or not used correctly. It is not uncommon to note that some buildings are still designed by taking into account the accessibility standards of a single disability. Other impairments being largely

ignored. The reasons for this, ascertained through interviews with designers and users, often have their origin in a lack of knowledge concerning disability. The application of these tools is therefore more effective with an understanding of the use and the user. To accomplish this, it is first essential to understand the individual in his or her diversity, and in his or her relation to the environment (the handicap and the route travelled). As we will see later, accessibility concerns everyone and we - as designers – are responsible for the everyday well-being of everyone.

The stakes are high and should no longer be neglected.

1. People and their environment

There can be no design or architecture except in relation to the individual. Remove this link and design loses all meaning. Design by definition helps to improve the lives of everyone. But then, what a responsibility! Whom are we creating for?

Designers through history have created for the average person (who has been identified as an able-bodied man standing approximately 1.83 meters tall) with all his senses intact. How lucky for him! But this majority (or what in the past was perceived as a majority, handicapped persons not being taken into account) with the advance of medicine, the increase in life expectancy, comprises a greater multitude of singular beings.

It is important that we do not consider just one disability and that we are careful that we do not create new "disabling" situations for others. I have encountered projects, some of them having won awards for excellence in accessibility, which were only usable by able-bodied persons and those of reduced mobility, but where the visually impaired person has largely been forgotten. Designing for accessibility to everyone it taking into account all disabilities, temporary or permanent, eternal, as well as able-bodied people.

It would be a shame to create buildings accessible to some at the price of making them inaccessible to others. This is the risk to avoid.

The difficulty therefore lies in designing for use by everyone, everywhere. This is the ambitious title given to my lecture. It is towards the realization of this ambition that research advances. In my opinion, it does not lie just in realizing an accessible place or object, but in taking into account all possibilities.

Is there then a solution? Responding to all needs is difficult of course. The plurality of the individual makes this task difficult. The solutions, like the needs of individuals, are many and varied. To find the solution, it would seem important to begin by once again posing the question: “for whom?”

"There is no design or architecture except in relation to the individual".

2. Architecture for all

Talking about inclusive architecture implies the notion of diversity, including people with disabilities, ill people, people of small size, but this notion also includes anything related to a specific situation that may be a momentary disability: for example, a broken leg requiring crutches making it difficult to open heavy doors or a heavy suitcase making it difficult to

climb stairs. The object of inclusive architecture is - as the name suggests - to include everyone, or to try to exclude as few cases as possible. Where does this notion come from? Architecture participates in the daily well-being of everyone. Anthropometric models, mainly due to increased life expectancy and advances in medicine, have changed. Mentalities have evolved towards general well-being, and notions of disability and impairments - among others - have been clearly defined. These, in addition to the concepts of disability and handicap, were the subject of an international classification by World Health Organization in 1980. We are not interested in establishing a perfect medical knowledge of these notions, but in understanding what disability is, in order to give the best appropriate architectural answer.

2.1. Handicap and disabling situations:

The word “handicap” dates back to the seventeenth century when it was part of the vocabulary of games of chance. The most widespread use of the term was in horse racing in the eighteenth century. Weights or increased distances were applied to stronger or faster horses in order to level the playing field. By extension, the word has come to be applied to anything that makes a task more difficult or put one person at a disadvantage in relation to another. The idea of relationship is important: the current definition of “disability” includes the relationship of the individual to his or her environment. Handicap results from an interaction between a disability or a deficiency and the inappropriate environment. The “deficiency” can be temporary or not. This includes people with disabilities, as well as those with reduced mobility resulting from a number of causes: a broken leg, use of a cane, carrying heavy luggage or bags, cognitive impairment, advanced age and its resultant infirmities, mental illness. All of these are part of our society today. Daily life belongs to all of us, the young, the old, the able-bodied, the disabled. By this definition, we are all, at one point in our lives, confronted with a handicapping situation. Our role, as designers, is to try to compensate for these disabling situations by creating an environment which is accessible to as many people as possible. In this context, a well-designed environment can allow a person with an impairment to see his or her disability lessened. The environment compensates for the disadvantage.
To illustrate this point, I offer the example of a personal friend confined to a wheelchair who told me that, when she drove her specially equipped car (showing the importance of technological aids) she felt able-bodied. The notion of an accessible environment is essential. In order to provide accessibility, we must insure full autonomy and complete safety, without creating obstacles, for the entire route that may be taken by a disabled person. To avoid creating obstacles, it is important that we anticipate potential obstructions.

It is often apparent that working to ensure accessibility for the most severely handicapped will benefit the entire population. This is not systematically applied but we will try here to understand how to make the environment accessible to the majority in its diversity.

To do this, we must first have an approach to different disabilities.

2.2 Disabilities:

The idea of this paper is not to provide a solution to accessibility for all disabilities, because the list cannot be exhaustive. This list is not fixed and will evolve with time and additional knowledge.

I'm not able to give a lesson in anatomy; my current knowledge (which is most certainly not all-encompassing) has been gleaned from books, rubbing elbows with experts, and, in short, from research. There are four of disability groups. These can be broadly outlined as: visual, auditory, cognitive / mental, motor.

Most projects which represents themselves as "accessible" have focused their efforts on physical disability. This is a good first step which leads us to take a second, which deals with others disabilities.

2.2.1 Visual impairment (or blindness)

This group concerns those who are visually impaired or blind. The relationship to space and the objects which occupy it is created with the other senses, including touch and sound. For visually impaired people, visual contrast and light intensity are paramount. People with visual impairments usually use a cane. With this in mind, let us remember to design appropriate spaces.

The cane serves as a link between the individual and his or her environment which is logical given that there is an environment of landmarks and reference points. Guidelines on the floor or the ground are a first approach, provided they are continuous, well located, protect the person from obstacles and do not pose a hazard to others. There is still work to be done on designing for the blind.

2.2.2 Hearing loss

I think it's the most difficult to integrate in the design. People who are hearing-impaired or deaf will be guided by visual information (so do not forget to work on the signage so as to make it as clear and simple as possible) , direct views and technical supports. These supports - essential technological tools - are also used in other cases. The most comon technical support for hearing loss is the BIM: magnetic induction loop. Not to be confused with BIM: Building Information Modeling; the first BIM is a listening aid for the hearing impaired.

2.2.3 Mental disability or intellectual disability

The WHO (World Health Organization) defines mental disability as a "cessation of mental development or incomplete mental development, characterized by a deficiency of faculties and overall level of intelligence, particularly in terms of cognitive functions, language, motor skills and social performance. To reduce this deficiency, it is important to "make it simple": a clear understanding of the space, precise information, both succinct and complete, make it possible to better understand the space. Work on signage with the use of pictograms is an invaluable asset in the readability of the space as well as insuring direct views which can help the person orient him or herself.

I remember an anecdote that was told to me recently which I find relevant to understanding mental handicap as a misunderstanding of the space: a traveller who gets lost abroad

without knowing the local language or alphabet may have difficulty finding his bearings. This environment places us in the situation of having mental handicap; we are lost. It is important to avoid this. It can be fun to get lost but this can also cause feelings of insecurity. Allowing everyone to find their bearings and to understand the surrounding space is important if we want to avoid creating a disabling situation and allow the use of the space in complete autonomy.

2.2.4 Motor impairment:

This concerns people in wheelchairs and extends to all the difficulties of mobility. This encompasses many people. Mobility difficulties may be permanent or temporary. They may concern the lower and / or upper limbs. Essentially, they are a hindrance in moving, gripping, and manipulation. They require us to revisit the basic anthropometric model. For example, when we realise that a petite woman is on average only 6 centimetres taller than a tall man in a wheelchair, it is time to review the old anthropometric models.

In the category "reduced mobility", we can include the elderly, people suffering from breathing difficulties (and who get quickly out of breath), people with crutches, with a stroller, a big suitcase (yes, I know all too well this situation) or those whose suffer mobility is reduced by the space.

What are the compensation methods put in place then? They concern first the flatness of the ground, the quality and stability of the paving. It is important to understand that people who use wheelchairs must be able to roll easily, and avoid steep slopes. We must getting to account that getting around in a wheelchair requires certain strength, and there must be no obstacle or holes. You need a path which is easily accessible as possible. Knowing that the footprint of a wheelchair is an average of 70 x 130 cm, it is easy to imagine the space we need to allow for movement and half-turns. We must allow for enough space for the use of furniture, cabinets, etc.

The compensation methods also concern taking into account high and distance for gripping and reaching. Being in a wheelchair means not being able to bend down and up in the same way as an able-bodied person. The movement is different, it is our duty to think about these differences. Physical disability is however - in the example of recent audits of existing building - generally well taken into account. Maybe we can identify more easily with this mobility problem. Indeed, who has not had or known someone "restricted in his or her movements due to back pain, weight, heavy bags? Once again, we are all disabled at some point in our lives.

Doing studies on the consideration of impairments is a long undertaking. The subject here is just to remember the 4 missing elements which I remarked in my audits. These disabilities which that can be encountered in the men and women of today.

I am not forgetting other pervasive developmental disorders such as autism, mental handicaps, poly-disabilities, etc., however the object of this article is just to raise awareness: architecture is for everyone, whether able bodied or disabled, possessed of all senses or lacking some, temporally or permanently.

The first prerogative (not "solution" which would be pretentious) for universal inclusive design is an awareness of impairments in order to avoid creating a disabling situation. In order to adapt the environment to the individual, it is important know the user of today.

Once this knowledge has been acquired - even in a succinct way, the use of standards seems more obvious and the setting up of technical aids better adapted. We know beforehand whom we are creating for.

As an architect, it is difficult to have complete medical knowledge about these impairments. I prefer the idea of encouraging creativity to that of drowning the architect in lots of rules and regulations which must be apply in other areas (thermal, fire, etc.). A simple change of perspective on disability can already lead to "accessible" thinking.

But the autonomy that is sought when working on inclusive design requires the consideration of a second factor: the continuous route.

I have seen that this obvious concept is often forgotten. That's why I'm going to give a reminder.

3. Architecture for everyone ... everywhere: the continuous route.

The second important thing to take into account is the notion of continuous progression in complete autonomy. I begin to speak about it in a chapter on disability, but it seems important to remember that, to be accessible, a space must be accessible everywhere. Or at least try to be. In all spaces, whether it be our habitat, our place of work, our activities or the links that unite these spaces. This is what is called the travel chain. Without continuity, there is no longer autonomy. I have seen so-called accessible places where some of the accessibility had been forgotten. For example, a ramp to access the front door and two steps in the entrance hall. What a pity to invest in "semi accessibility" that ultimately does not work.

From the city to the building, exterior and interior environment, connecting these points independently is one of the keys to inclusive architecture. Outside, the work will be done on the city, the external paths, the accesses, the transport and access to the transport (intermodality or not). Inside, the work will be done on the projection of possible routes, from the outside to all interior spaces which are to be used. At the scale of the object: design of the city, the building, the object takes its place everywhere. Urban furniture, work space furniture, controls, lights, technological tools etc. Without thinking about the design of the object, accessibility would be incomplete.

The designer has, we see again, a significant responsibility in improving the lives of everyone. From the scale of the object to that of the city, the chain of movement as a physical "link" is also a "social" link, it allows everyone to participate in the life of the city. So yes, it is a major responsibility and a great issue and a challenge for all of us.

4. Towards a well-being for all

Taking into account all disabilities everywhere, seems a somewhat complex exercise at first. Standards have - in many countries - been created for all cases and I will not go over them.

However, just having knowledge of the standards does not seem to me sufficient to design in an inclusive way. This explains, I think, in large part, the errors I have encountered in my audits. A standard is a medium in which to work; it is the rulebook. The knowledge of disabilities added to common sense makes it possible to take into account the notion of "continuity", autonomy and accessibility.

So how to integrate the notion of inclusivity in design almost automatically?

I think that encompasses several factors:

- Education, training, information

- Creativity, innovation

- Collaborative work.

Education, training, information: first, knowing the senses that people possess and then understanding them. We must know whom we are designing for. This begins with information: how is it that in 2017, so few architectural schools teach accessibility? This is forgetting one of the basic values of architecture: the user. Then with the public authorities, "contractors" and buyers. It may be more expansive up front to make buildings accessible to a larger public but in the long run, this will be more profitable due to the increase in the number of users.

So, what if, instead of seeing accessibility as an obstacle to design, ,an additional difficulty in the many standards and regulations in which it is easy to drown , it were regarded more as a challenge and as an asset in creating more beautiful architecture for all ?

Conclusion

Creativity, innovation, not to setting limits on solutions, saying that everything is possible: once we understand the individual as a sensory being, we can think globally.

Creativity is central to a designer; I will not dwell on it. Exchange, collaboration: I usually say that I learn something new every day from what I see, read, and from what I exchange with other people. Who better to talk about blindness than a person whose is blind or whose job is to work with the blind? Who can better communicate what we do not know? And unless one is completely cut off from his or her neighbor, and / or devoid of empathy, collaboration is, to my mind, an inseparable factor of well-being for everyone, everywhere. And is not that the basis of inclusive design?

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ADAPTATION OF HYPERBOLOID STRUCTURE FOR HIGH-RISE BUILDINGS WITH EXOSKELETON

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Abstract

In this paper implementing a hyperboloid structure as the exoskeleton of a high-rise building is studied. A DiaGrid exoskeleton with straight lines from the ground to top is used to set up the structure of the building and determine its hyperboloid architectural form within a parametric environment. The resulting structure is later subjected to lateral loads and linear-static structural analysis. The results demonstrate that the lateral drift of the structure with hyperboloid shape will become as low as half of a cylindrical shaped building with similar architectural and functional properties and the same structural system under similar loading conditions. The results of the preliminary analysis of the structure in the parametric environment are further verified with a more sophisticated structural model under seismic loads with static equivalent seismic loads and response spectrum modal analysis.

Keywords

Parametric Modelling, DiaGrid Structures, Tall Building Design, Hyperboloid Structures

1 Introduction

The relationship between the architectural form of buildings and their structural behavior has always been of great interest both among architects and structural engineers. This matter becomes increasingly important in the design of high-rise buildings. This relationship becomes maximal when dealing with buildings with exoskeleton structures, where all or the majority of the load-bearing capacity of the structure is located within or peripheral to the building's envelope. In this paper which is part of an ongoing research project on the effect of the external shape of buildings with external structures and exoskeletons over their structural behavior, adopting a hyperboloid structure as the exoskeleton of high-rise buildings is investigated and comparison has been made with similar buildings with cylindrical shapes.

The hyperboloid exoskeleton of the structure is generated following a process through which corresponding nodes on the top and bottom circular sections of the building floor plans are connected with straight line subsequent to a 90 degrees shift. Thus, making an orthogonal diagonal grid (DiaGrid) for the exoskeleton structure of the building. In this fashion not only

all the structural members of the exoskeleton become straight lines, but also all the connecting structural elements at every joint will become coplanar.

Having considered that investigating the structural behavior of exoskeleton buildings with the curvilinear external surface may only be possible in a 3-dimensional environment; parametric design strategy has been incorporated in the design and structural analysis of the buildings. The resulting structure is then subjected to lateral loads, and following a linear static analysis, the structural response is generated for different values of design parameters such as total constructed area and height.

The comparison is later made with the response of similar building with cylindrical shapes and equal gross floor area. The results demonstrate that although the buildings with hyperboloid shape experience greater values of overall drift than their matching cylindrical ones, the values of the member forces remain significantly lower.

In order to verify the structural results obtained within the parametric environment, one of the models generated within the parametric environment is further investigated in a non-parametric structural analysis software. It is observed that although the response of static linear analysis shows the acceptable similarity between the two environments, the results of the response spectrum analysis show significant differences with static equivalent analysis.

2 Exoskeleton Buildings

Typically the structure of a building is designed to remain hidden within the architectural components of a building, however, in exoskeleton building, it is completely the other way around. In exoskeleton buildings, the structure overpasses the building envelope and becomes an essential part of the building architecture determining not only the buildings schematic shape but also the ornamental detailing of the building's exterior.

In an exoskeleton building, the structure is situated over the building exterior or within its envelope, and besides its expressiveness as an architectural feature of the building, it provides the advantage of the higher flexibility of internal spaces due to a reduction in spatial constraints within the interior spaces of a building. Among the most common structural system of exoskeleton building are DiaGrid structural systems, figure 1 shows some highlight examples of buildings with DiaGrid structures.

Figure 1. a) Hearst tower, New York. b) CCTV Headquarters, Beijing. c) Shukhov radio tower, Moscow.

2.1 Dia-Grid system

Diagonal Grid structural system – or DiaGrid system in short – is a type of exoskeleton structural system in which the structure of the building is composed of tension/compression members constituting a network of triangular, rhombus or parallelogram bracing all over the exterior of the building, hence the name DiaGrid. The behavior of DiaGrid modules is similar to the typical bracing frames used for lateral stiffness of steel buildings with the exception that the modules are not necessarily coplanar and the components and connections of the DiaGrid system are usually exposed. Another difference is that the diagonal members in DiaGrid systems are no more constrained within the structural frames, but rather through maneuvering around the building and covering the entire surface of the building exterior they will become a self-supporting structure, used to support both lateral and gravitational loads.

It is noteworthy to mention that origins of DiaGrid structures can be found in the works of Vladimir Shukhov [1] the Russian Architect/Engineer whose name is also among the list of pioneers of hyperboloid structures.

3 Hyperboloid structures

Application of hyperboloid forms for building and construction structures and their elements dates back to the late 19th century with Antoni Gaudi's experiments with different geometrical forms for architectural spaces and architectural elements [2]. Even then the functional properties of hyperbolic forms, such as added stability, were evident along with their aesthetical characteristics. But it was through the works of the Russian polymath Vladimir Shukhov and his employment of this non-Euclidean geometry into the skeletal forms of structures that the full potential of hyperboloid structures in terms of stability and lightweightness was revealed [3]

Also, the ability that such double-curved surfaces can be generated from an orthogonal net of straight linear elements brings further attention to these types of structural forms since it will eliminate the need to curve the structural members.

Hyperboloid structures have traditionally been used as communication towers and industrial structures but during the past decade adaptation of hyperboloid forms for high-rise buildings has become of interest among architects and in some the hyperboloid shape of the building has taken a significant role in its structural behaviour, the most significant example being the almost 600 meters high Canton tower.

3.1 Negative Gaussian curvature

One important aspect of hyperboloid shapes is that all over the surfaces of a hyperboloid the Gaussian curvature has a negative value, meaning that at every point on the surface if you draw two perpendicular routs, while one is twirling in the inward direction the other twirls in the outward direction and vice versa.

Usually the negative Gaussian curvature is considered as an advantage against local buckling in the shell structures compared to surface shells with zero or positive Gaussian curvature under in-plane pressure [4]. this is mainly because while the in-plane pressure in one direction tends to terminate local stability by inward buckling in the other direction there exists a

tendency for outward buckling and the reducing effect that these two have on each other will result is further resistance in the shell member to avoid local buckling. This is the main reason for the hyperboloid shape of very large cooling towers were the absence of internal structural elements within the external shell of the tower increases the chance of failure due to local buckling. And since in the exoskeleton buildings the structural responsibilities are focused on the external surface of the building and through analogy with the aforementioned behavior it is assumed that the stability of the structure is increased by benefiting from a hyperboloid structure which will be later demonstrated in lower values of lateral drift.

4 Form generation process

The form generation process of the hyperboloid tower is similar to the technique used by the well-known architect Antoni Gaudi to create hyperbolic shape 3D ornaments, which is by connecting two circular rings with a set of strings and subsequently rotating one of the circular rings around its axis (Figure 2a).

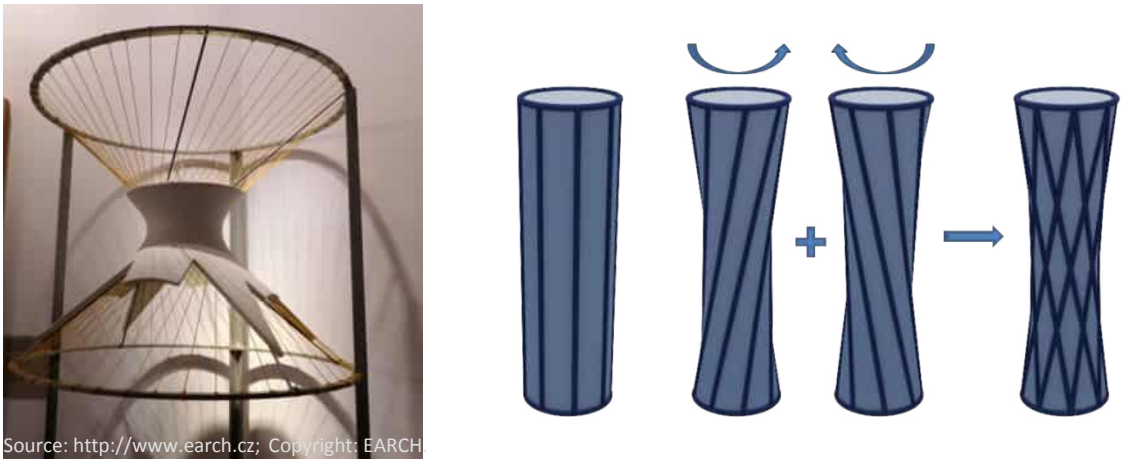

Figure 2. a) Gaudi Hyperboloid ornamentals. b) Form generation for hyperboloid tower.

In the case of the hyperboloid tower, the top and lower circles respectively represent the roof plan and the ground floor plan of the building. Having divided each of them into 32 segments, results in 32 inclined but yet straight columns which shape the form of the building. The same process is again repeated but this time the direction of rotation is in the opposite direction. Superimposing the two hyperboloid forms generated through the aforementioned process (Figure 2b) will result in a hyperboloid shaped tower with 64 inclined yet straight columns that pass through one another at every connection point and create an orthogonal net with semi-regular rhomboid modules in the form of a DiaGrid structure that make up both the architectural form of the building as well as its structure.

As for the functional parameters of the building under study in this research; the top and bottom circles – constituting the roof and ground floor – each has a diameter of 47 meters and are with a distance of 154.8 meters from each other providing room for 36 stories with a height of 4.3 meters. This in total results in a total constructed area of 43244 m^2.

For evaluating the behaviour of the hyperboloid structure generated by the above approach, a similar building with identical functional properties such as total constructed area, total height and number of storeys, and with the same structural system (exoskeleton DiaGrid) but with cylindrical for is also modelled and the results of the structural analysis of the two

structures has been subject to comparison later in this paper. In order to obtain the same functional properties for the two structures, the diameter of the cylindrical structures is considered to be equal to 38.6 meters resulting in an almost equal 43297 m^2 total constructed area. The area of every floor and the total sum along with other data related to the horizontal loads applied to each structure is presented in table 1.

5 Structural analysis

For the purpose of variations in the form and geometry of the buildings, the entire process of generating the building form and its structure has been performed within the parametric environment of *Grasshopper 3D* [5] plug-in for *Rhinoceros* [6]. This not only facilitates the creation of the 3D complex model, but also serves the broader objectives of this ongoing research, which is to investigate the effect of shape parameters such as; ratio between width and height; ratio between ground floor and roof diameters; horizontal and vertical segmentation of the DiaGrid system and etc. on the structural response of the building to lateral loads.

A linear static analysis is then performed on the generated structural model using *Karamba* add-on for *Grasshopper*, which is a Finite Element three-dimensional software with the ability to model beam and shell elements and working in *Grasshopper* parametric environment [7]. The linear analysis performed with *Karamba* is later verified in one case with an identical numerical model constructed with the software *SAP2000*; once subjected to a similar static linear analysis and once with a semi-dynamic response spectrum analysis. This will be further discussed in section 7 of this paper.

5.1 Structural mapping

As described earlier in the previous section the definition of the structure of the hyperboloid tower is carried out simultaneously along with the form generation process of the building architecture and there is no need for mapping a structural system over the designed building, nevertheless, there is still a need for an internal structure. In this research it is assumed that the exoskeleton DiaGrid explained in the previous section is solely responsible for resisting the entire lateral loads applied on the building. However, for the sake of a realistic design approach and avoiding extremely large interior spaces without vertical support within the building (with distances varying from 33 up to 47 meters), a secondary internal structure is added just to withstand vertical and gravitational loads and evading extremely large internal spans. This secondary structure is composed of 16 vertical columns in a circular arrangement with a diameter of 17 meters and situated in the center of the building with the non-rigid connection between the vertical columns of the secondary structure and the floor beams (Figure 3).

For the case of the cylindrical building, the same segmentation has been applied to external DiaGrid structure. The 32 horizontal segments at every story are situated with half a phase shift with respect to adjacent stories and a zigzag connection from bottom to top at every segment create the entire exoskeleton of the building. The same internal structure for vertical loads is also positioned in the middle of the building and identical structural elements are used in both structures (Figure 3).

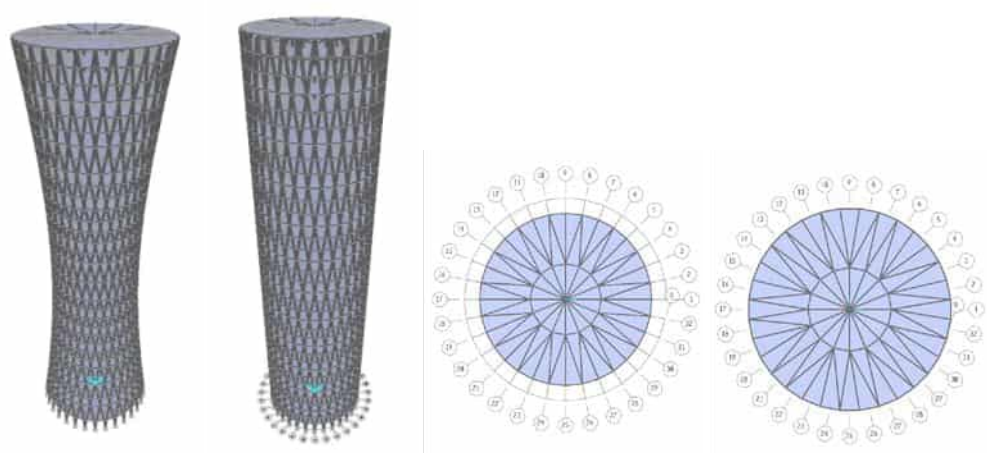

Figure 3. Structure of the Hyperboloid and Cylindrical structures.

Besides transferring the vertical loads, this will offer an internal core for positioning vertical access such as elevators and staircases as well as building services. Figure 4 demonstrates the arrangement of the secondary structure as well as its role in the architectural plans. It needs to be further emphasized that due to the non-rigid connection between the internal columns and floor slabs the play an insignificant role in the building's lateral response.

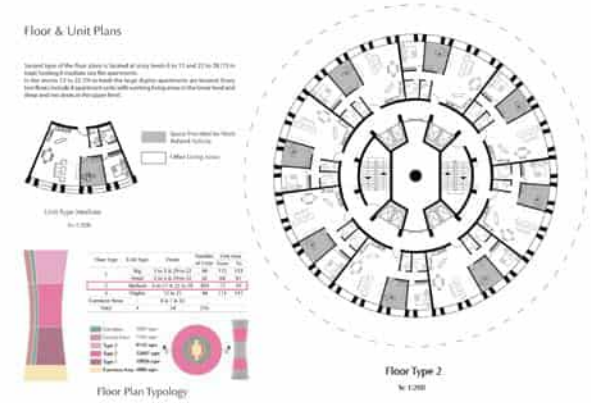

Figure 4. Architectural floor plan of the Hyperboloid tower.

For both the DiaGrid structure and the internal columns a steel tube section with an outer diameter of 80cm and thickness of 2cm has been assigned. And the radial floor beams of the building are a generalized section with a cross-section area of 250cm^2 and moment of inertia equal to 7400cm^4. The total weight of the steel structure of the two buildings with described profile sections is presented in table 2 along with the results of the structural analysis performed.

5.2 Application of lateral loads

For the linear static analysis of the structure, a total horizontal load of 60'000 KN is applied on the structure representing the likely seismic load. This value is derived from the assumption of a total mass of 60'000 tons participating in seismic action (1.3 tons pre-meter square) and a base shear coefficient of 0.1. The 60'000 KN base shear which is the total lateral load acting on the structure is distributed in accordance with the assumptions of "static equivalent seismic load" and following the equation below:

$$f_i = \frac{W_i h_i}{\sum W_i h_i} V \quad (1)$$

Where f_i is the applied load on the i^{th} floor, W_i is the weight of the i^{th} floor and h_i is the height of the i^{th} floor from ground level and V is the total horizontal equivalent seismic load acting on the structure. Table (1) shows the value of the loads applied to each structure at the center of every floor level.

Table 1: constructed area and applied load at every story level

		Hyperboloid		Cylindrical				Hyperboloid		Cylindrical	
floors No.	height above ground	Floor area	Seismic load	Floor area	Seismic load		floors No.	height above ground	Floor area	Seismic load	Floor area	Seismic load
	m	m^2	KN	m^2				m	m^2	KN	m^2	
0	0	1724	0	1170	0		19	81,7	869	1272,21	1170	1711,71
1	4,3	1637	126,2	1170	90,09		20	86	874	1348,02	1170	1801,80
2	8,6	1550	238,96	1170	180,18		21	90,3	890	1439,93	1170	1891,89
3	12,9	1462	338,18	1170	270,27		22	94,6	908	1538,99	1170	1981,98
4	17,2	1389	428,12	1170	360,36		23	98,9	932	1651,75	1170	2072,07
5	21,5	1317	507,73	1170	450,45		24	103,2	961	1778,50	1170	2162,16
6	25,8	1245	575,9	1170	540,54		25	107,5	996	1918,48	1170	2252,25
7	30,1	1189	641,73	1170	630,63		26	111,8	1036	2076,25	1170	2342,34
8	34,4	1131	697,39	1170	720,72		27	116,1	1082	2250,92	1170	2432,43
9	38,7	1082	750,31	1170	810,81		28	120,4	1131	2440,85	1170	2522,52
10	43	1036	798,56	1170	900,9		29	124,7	1189	2658,58	1170	2612,61
11	47,3	996	844,13	1170	990,99		30	129	1245	2879,49	1170	2702,70
12	51,6	961	889,25	1170	1081,08		31	133,3	1317	3147,93	1170	2792,79
13	55,9	932	933,6	1170	1171,17		32	137,6	1389	3424,94	1170	2882,88
14	60,2	908	979,36	1170	1261,26		33	141,9	1462	3719,97	1170	2972,97
15	64,5	890	1028,52	1170	1351,35		34	146,2	1550	4062,39	1170	3063,06
16	68,8	874	1078,41	1170	1441,44		35	150,5	1637	4416,91	1170	3153,15
17	73,1	869	1138,29	1170	1531,53		36	154,8	1724	4783,41	1170	3243,24
18	77,4	862	1195,85	1170	1621,62							
Total Sum									**43245**	**60000**	**43298**	**60000**

6 Analysis results and comparison

Having applied the horizontal loads to the hyperboloid and cylindrical shaped buildings according to table (1) and performing the linear static structural analysis, it can be observed that the horizontal displacement of the structure under lateral loads at the top floor in the hyperboloid structure becomes equal to 0.776 meters, which is about 60% of the 1.291m displacement at the top floor of the cylindrical structure subject to the same amount of horizontal action. This concludes that the lateral stiffness of the hyperboloid structure is 1.66 times the stiffness of the cylindrical shaped building with DiaGrid exoskeleton structure.

Although the considerable difference is witnessed in the stiffness of the two structures, there has not been a considerable difference in the value of the resulting forces in the structural members of the two structures. While the maximum utilization ratio (resulting force in the structural member divided by its load bearing capacity) of the diagonal members of the cylindrical structure at the lowest storey level reaches a maximum of 148%, the same value for diagonal members of the hyperboloid structures is up to a maximum of 139%, which is only 6% smaller than that of cylindrical tower.

The resulting data of the maximum displacement, maximum utilization ratio, maximum tensile and compressive forces, and maximum story drift ratio (relative displacement between adjacent stories divided by the story height) for the two structures are provided in table 2.

The displacement of the floor center of each structure due to lateral loads is also presented in figure 5.

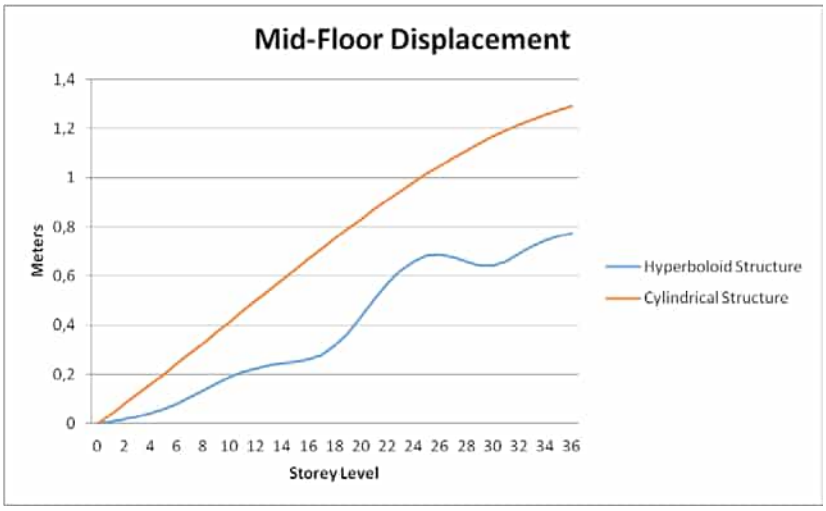

Figure 5. Mid-floor displacements for Hyperboloid and Cylindrical Structures subject to lateral loads.

7 Verification of structural analysis

In order to validate the structural analysis performed in *Karamba* in the parametric environment, both the hyperboloid and cylindrical structures where again modeled in *SAP2000* structural analysis software. The same section properties have been assigned to structural members and analysis with static equivalent seismic load with a base shear coefficient of 0.1 and modal response spectrum analysis have been performed. The input data for the response spectrum analysis are as follows: design ground acceleration 0.4g; spectrum type 1 of Eurocode 8, 2004; ground type B; and target mass participation of 99%. The resulting base shear for each analysis is presented in table 2.

Table 2: Analysis results and comparison data for Hyperboloid and Cylindrical buildings

		Weight of Structure	Constructed area	Maximum displacement	Total horizontal load	Maximum resultant force in structural members
		kg	m^2	m	KN	KN
Hyperboloid Structure	**Parametric Analysis In Karamba**	12,64 e6	43244	0,776	60000	9823
	Static Equivalent Seismic			0,732	59015	
	Response Spectrum			0,495	49792	
Cylindrical Structure	**Parametric Analysis In Karamba**	12,07 e6	43297	1,291	60000	16164
	Static Equivalent			1,218	61407	15522
	Response Spectrum			0,884	49100	11770

Also, the displacement of a center point at every floor level for analyses performed in Karamba, Static equivalent force in *SAP2000* and modal response spectrum analysis for both structures is presented in figure 6.

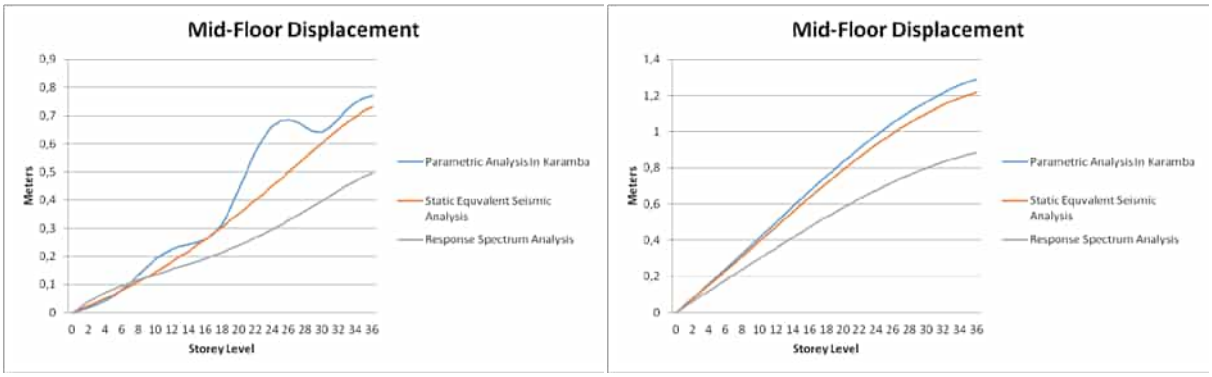

Figure 6. Mid-floor displacements for a) Hyperboloid Structure and b) Cylindrical Structure in different analysis environments.

8 Conclusions

In this study, based on the findings and experimentations of Architect/Engineers of the early modern era, Shukhov and Gaudi, with hyperboloid forms, a form generation process for tall buildings within the parametric environment is presented that simultaneously determine the shape of the building and its supporting structure. Further on, static lateral loads representing

seismic actions have been applied to the structure, and the behavior of the structure against lateral loads investigated. The comparison has also been made a cylindrical shaped tall building with similar functional and architectural properties and structural system. It was observed that while significant difference does not occur in the resulting forces of the structural members of the two structures (no more than 6%), a considerable increase in the lateral stiffness of the structure can be observed in the hyperboloid structure in the order of 60%. Finally, the analyses performed in *sap2000* software for evaluating the structural analysis executed in the parametric environment demonstrated that the results of the analysis performed in parametric environment are in very close proximity with the results of the analysis with static equivalent seismic forces with base shear ration equal to 0.1, and in close range of semi-dynamic response spectrum modal analysis.

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TRANSFORMATION OF THE KITCHEN WITHIN YOGYAKARTA CULTURAL CHANGING IN INDONESIAN HOUSING

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Abstract

The significant development of kitchen forms occurring in the western state from time to time has led to a distinct phenomenon that gave rise to new regulations in the design of residential kitchens. This phenomenon is not only influential in the western state, just as it is with Indonesia the form of the kitchen began to evolve and change in accordance with the needs and desires of society.

Changes in the shape of the kitchen in Indonesia itself is said to be seen from changes in the size and layout of the kitchen caused by residential size that changes from time to time. Which can also affect the depth value of a kitchen space due to changes in the location of the kitchen on the map of occupancy. This depth value is measured by data analysis method using space syntax which ends in unit value of depth of a certain space. By analyzing the size and location of the kitchen between the relationships between other spaces obtained significant data can change in accordance with the value of depth of space in the kitchen in every home in each generation.

Keywords

Kitchen, Transformation, Space Syntax

Introduction

According to a writer Toby S. Jenkins (2011)[1] the kitchen is a space which is very complex where cultural life happens indisputably, people have a sense of belonging to the kitchen space, because many have a beautiful memory of the pleasure of the processed food of their own family kitchen respectively. According to Jenkins (2011)[1] the kitchen has so values can

become cultural space. The five main components of the kitchen as a cultural space are as follows:

1. Spaces with a sense of belonging

2. Space of creativity and resistance

3. Communion Room

4. Comfort room

5. Space excellence

Therefore in Indonesia itself the kitchen can be identified as a place people gather to do cooking activities to add family ties between each member. So the suitability of kitchen area can be calculated from the needs of human space that will perform the process cooking in a kitchen.

Kitchen or *pawon* in Javanese language contains two meanings: first,house buildings specially reserved for cooking and cooking activities secondly, can be defined as a furnace. The word *pawon* comes from the basic word *awu* which means gray, got the prefix-pa and the suffix-an, which means place. Therefore,*pawon* (pa + awu + an) which means the place of awu or ash[2]. According to Daldjoeni in 1985 in general kitchen buildings are additional buildings, and usually the kitchen building is made after the house is finished so the kitchen does not considered as a staple or essential building, and kitchen construction is very simple. According to Santosa (2000)[3], *pawon* or kitchen is the back room of the inline building tasks at home. With almost the same size as building *omah*, *pawon* is a joint facility for all family members to share the stove and share the food. A large *amben* is usually located at middle of the room. That's where the women of this family spend some of it from time to time to work everyday or just rest. Around the *amben* are usually composed of stoves, shelves, sinks and other kitchen utensils.

The development and changes that occur between the kitchen at home traditional Javanese with the development of kitchen with the western world is that making a contradiction because of different cultural concerns from period to time in each region. A very significant difference can be seen from the kitchen development information is the meaning of kitchen for Java dwelling house with Western homes, where in Java the kitchen is a place should be covered from the outside and should only be known by family members in particular women are different with the development of the kitchen in the West is more important the meaning of the kitchen as a family bond so that the location and extent of the kitchen is used as a benchmark in the design of residential houses.

Space Syntax

The book The Social Logic of Space by Ben Hillier and Julienne Hanson (1984) is a study that discusses the spatial point configuration. In in this book mentioned that space syntax is the

principle of the configuration of that space how to build a generalization pattern of a space relationship. The concept of space syntax itself has three-dimensional analysis techniques that include connectivity, integrity, intelligibility and axial line concepts (hillier et al: 1987).[4]

The concept of distance in space syntax itself is called the depth (depth) measured in a step called a topological distance or distance (hillier et al: 1987). So step depth here can be defined as the distance between two space connected directly. In the picture below, the distance between a-b includes 1 step depth as well as space spacing b-c and for a-c space spacing has a value of 2 step depth.[4]

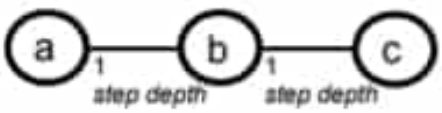
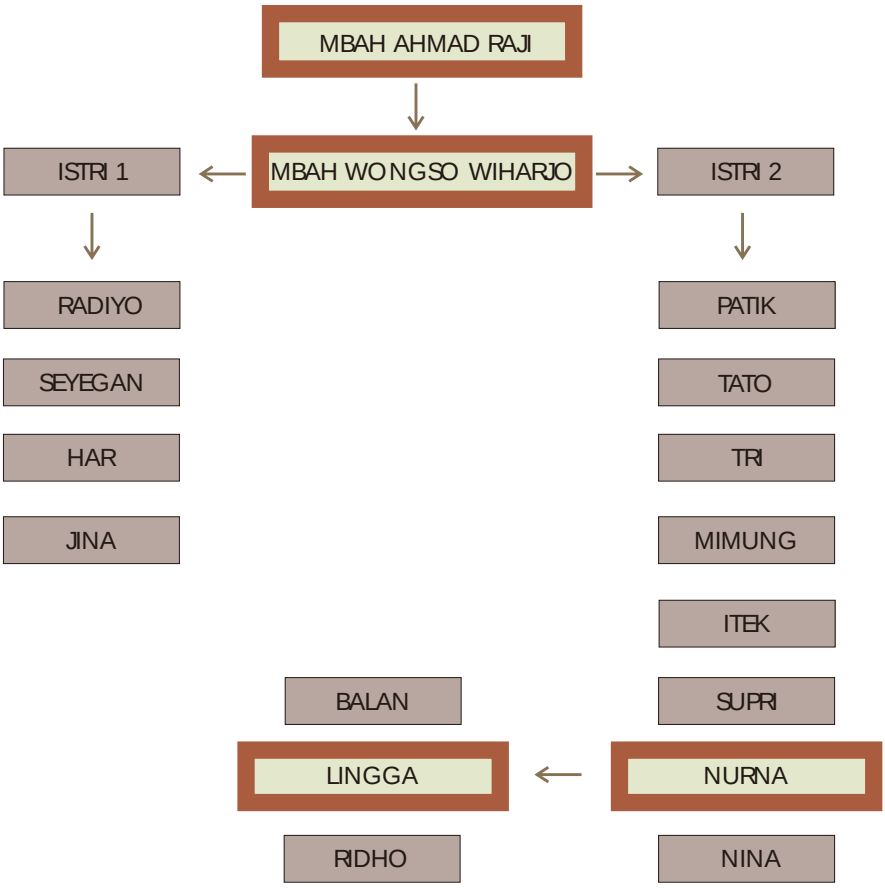


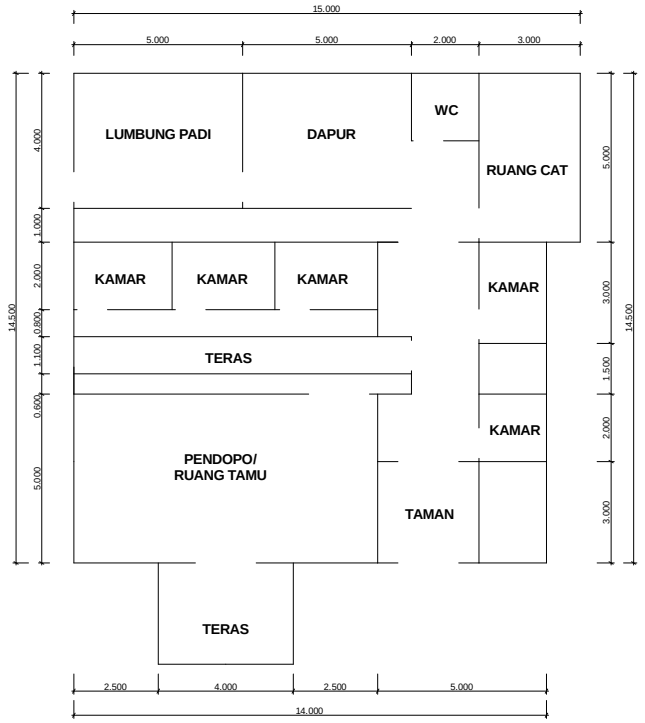
Figure 1. Step Depth Concept



Data

This study was conducted with observing the respondent and the house live repondent, chosen because of related to research. Respondents is 4 people from 4 generations who different in the original 1 offspring Yogyakarta.

Figure 2. Respondents Data



1st Genneration Home Data (Mbah Ahmad Raji)

Figure 3. 1st Generation Home Floorplan

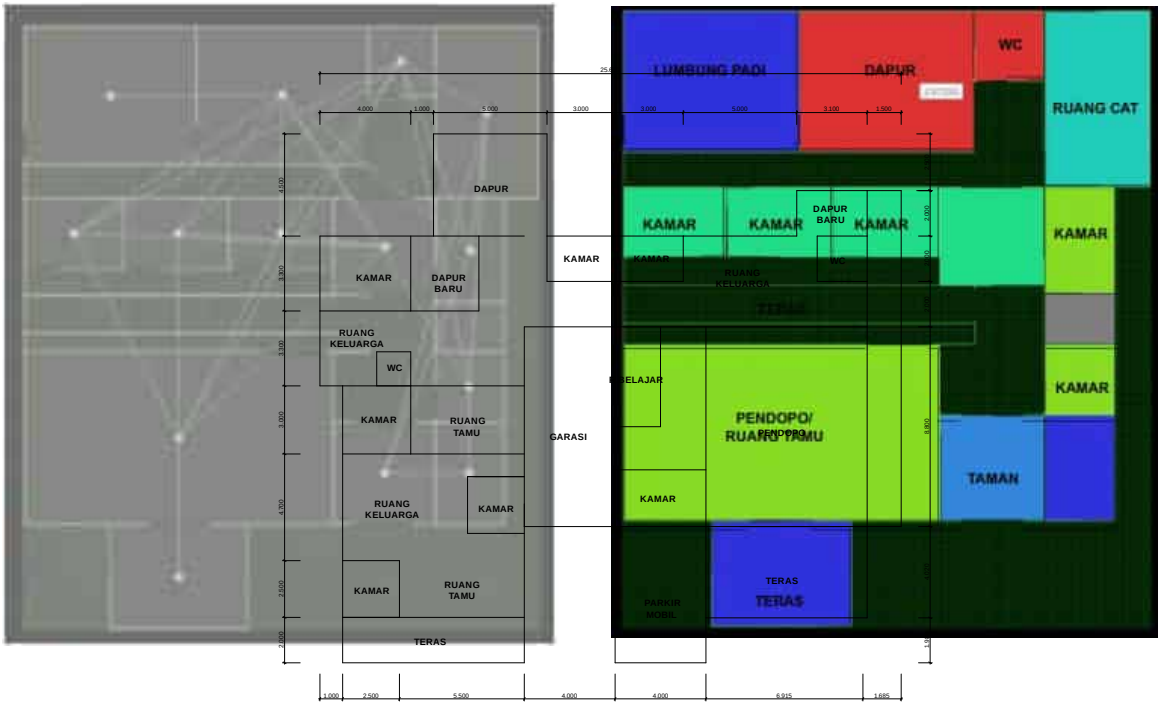


Figure 4&5. Space Syntax value 1st Generation Home

The value of the kitchen syntax space on 1st generation home is **2.9** which has a value highest compared to other space functions on home.

2nd Genneration Home Data (Mbah Wongso Wiharjo)

Figure 6. 2nd Generation Home Floorplan

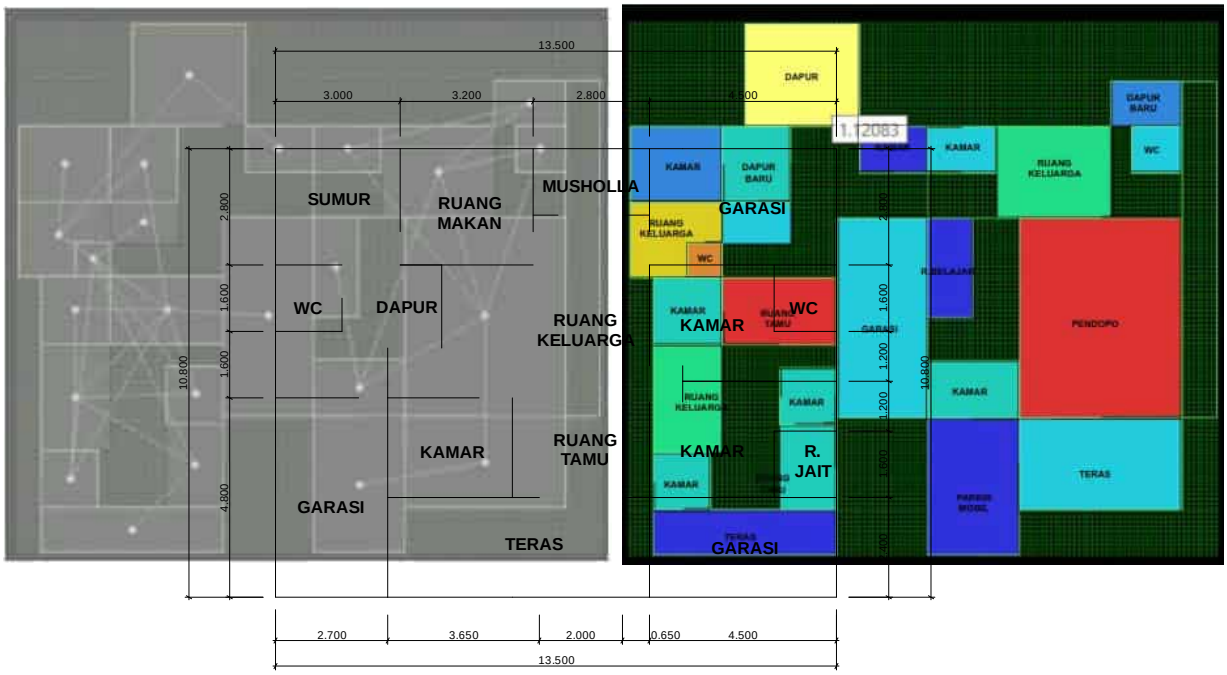


Figure 7&8. Space Syntax value 2nd Generation Home

The value of the kitchen syntax space on 2nd generation home is **1.1** which has a value highest compared to other space functions on home.

3rd Genneration Home Data (Nurna)

Figure 9. 3rd Generation Home Floorplan

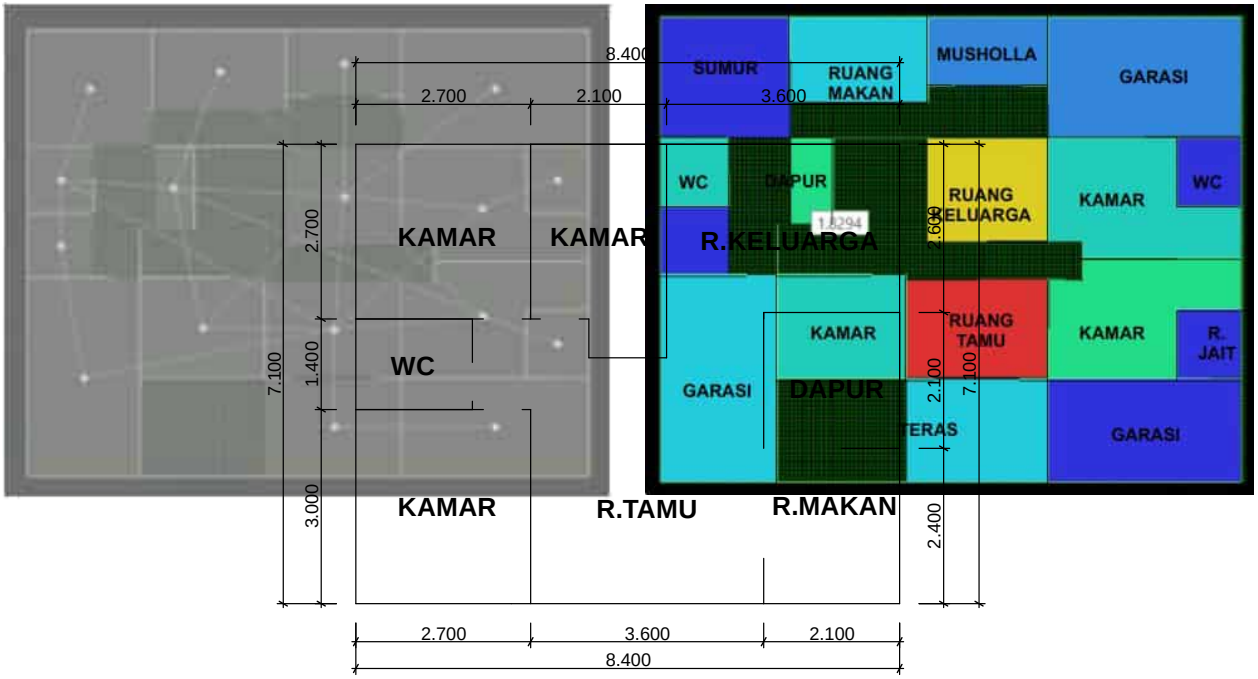


Figure 10&11. Space Syntax value 3rd Generation Home

The value of the kitchen syntax space on 3rd generation home is **1.8** which has a value highest compared to other space functions on home.

4th Genneration Home Data (Lingga)

Figure 12. 4th Generation Home Floorplan

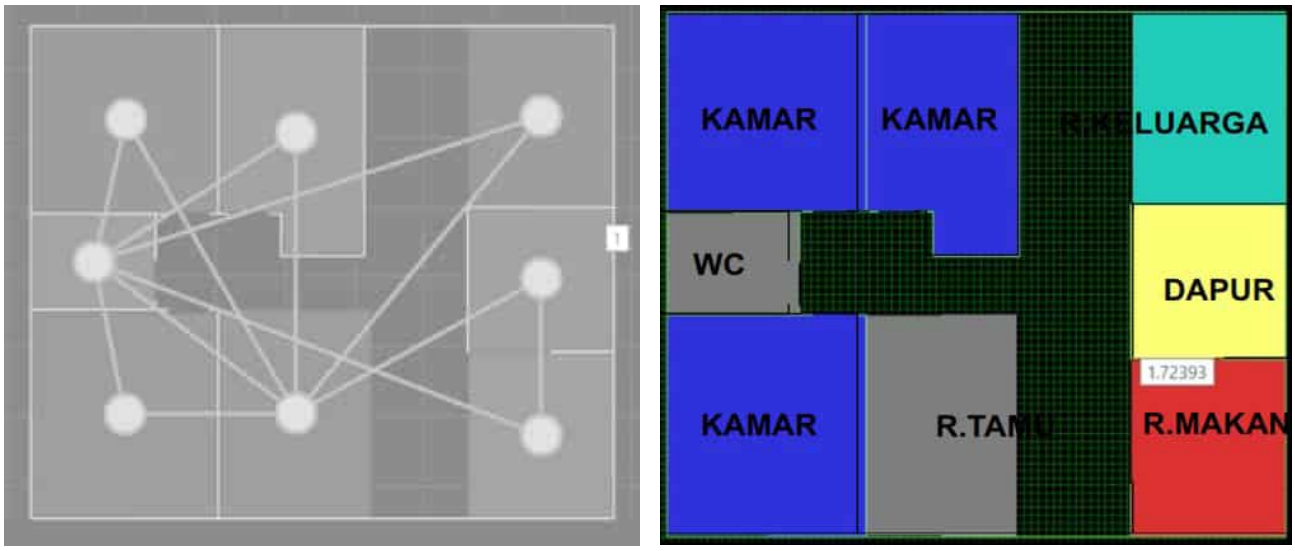


Figure 13&114. Space Syntax value 4th Generation Home

The value of the kitchen syntax space on 4th generation home is **1.7** which has a value highest compared to other space functions on home.

Conclusion

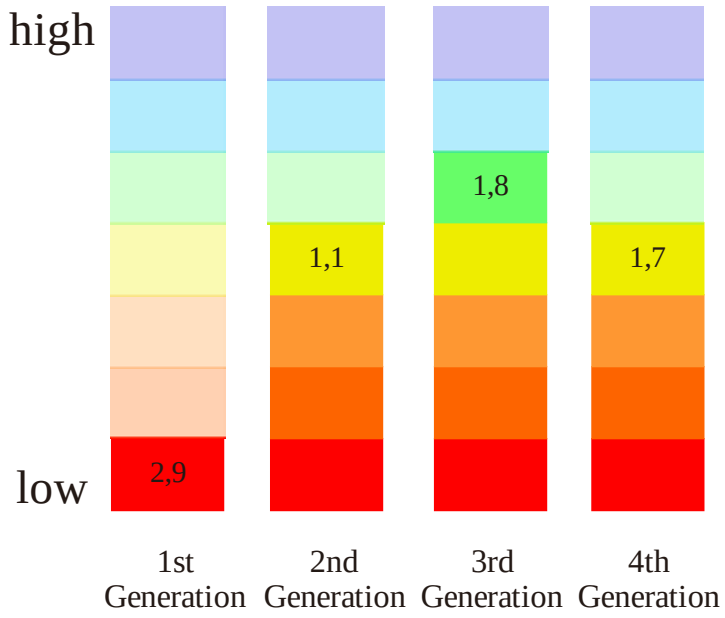


Figure 15. Space Syntax value diagram Generation Home

From the data above the 1st generation house has the highest depth of space value that is 2.9 and then the 3rd generation home is 1.8 and the value of 1.7 for the depth of space in the 4th generation house and the last value 1.1 for the 2nd generation house. From this it is found that the home area of each generation affects the space syntax value of each home. Type of house with a smaller area will have low space syntax value which here can be said that the change of each house from the floor plan, layout and wide of the house greatly affect the value of space syntax. The transformation of the homes in each generation is also attributed to the number of family members who live in the residence and the number of people in the house is getting smaller so that it does not require the width of the house that is too large.

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HOSPITAL ARCHITECTURE QUALITY- EXPLORATORY OBSERVATION ON THREE CONTINENTS

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Abstract

Aim: This study is an investigation of non-clinical areas in hospital case studies in multiple locations in Europe (Norway, Denmark, UK), Asia (Thailand, Singapore) and North-America (Canada). The purpose is to explore the similarities and differences in spatial arrangement and the use of them. Architectural quality, usability and cultural context are investigated regarding the design and use of the non-clinical areas of the hospital because the areas are commonly used by patients and relatives. The aim is to examine whether a building assessment method could determine and explain the connection between people and the use of non-clinical areas in the different cultural contexts. How local culture influence the use, social interaction and the Usability and Architectural quality of the non-clinical areas of the hospital.

Methodology: This study is conducted as a walk-through evaluation, collection and documentation of first observation impressions at multiple hospital locations worldwide, with focus on concepts of Usability and Architectural quality. Further analysis methods include semantic differential scheme evaluation and narrative mapping with architectural drawings. The generic model and local sensitivity in each specific context are described with the use of culture and cross-cultural behaviour theories. Finally, phenomena that occur in specific non-clinical areas of the hospitals are explained with the implementation of Pattern Language concept.

Results and discussion: This evaluation of hospital non-clinical areas in multiple cultural contexts gives fundamental understanding of the influence of culture and well-being of patients to the design of hospitals and perceived quality and usability of architecture. Even though the hospitals are located on different continents, they share similarities as the specific types of use in the non-clinical spaces. The significant similarity in the use of those non-clinical spaces correlate with the usability concept where users and their satisfaction are the most important aspects of design and architecture quality of hospital buildings. The results from the multiple case studies form the discussions to what are the current universal typologies that form high quality hospital architecture.

Keywords

walk-through evaluation, hospital architecture, non-clinical areas

1 Introduction

Hospitals are a matter of interest in most societies. This paper presents the results of exploratory observation of hospital architectural quality on three continents in order to map the quality of architecture together with the cultural differences and propose universal typologies of hospital non-clinical spaces, where architecture can promote health and well-being.

Hospital architectural design concepts have evolved rapidly since the beginning of the twentieth century. The ideal hospital was designed upon the concept where care facilities followed the needs of hospital functions (Singh & Biswas, 2018). Nowadays due to the raise of patient focused trends the concept 'design follows first patients, then functions' has been adopted. Designers, including architects are now focusing on integrating the needs of patients, hospital functions, and functionaries in hospital design (Singh & Biswas, 2018). There is also a growing body of rigorous studies to guide healthcare design regarding the improvement of patient outcomes. One of the aspects that should be focusing during the design processes is the improvement of non-clinical areas (Ulrich, Zimring, Zhu, Dubose, Seo, & Choi, 2008).

Main question of this study has been raised due to the rigorous research focusing on the relationship between the architectural quality of the hospital and patient outcomes. What are the similarities and the differences of the use of non-clinical areas in hospitals in different contexts? The investigation of several hospitals in different contexts has been conducted to explore the limited and opportunities of the implementation of the patient focused design concept but only focusing on 'non-clinical' areas. Another thorough question that has been raised for this study is; What can each hospital learn from each other and how can the knowledge of non-clinical hospital design, focusing on patient needs be exchanged between those hospitals?

This study is an investigation of non-clinical areas in hospital case studies in multiple locations in Europe (Norway, Denmark, UK), Asia (Thailand, Singapore) and North-America (Canada). The purpose is to explore the similarities and differences in spatial arrangement and the use of them. Architectural quality, usability and cultural context are investigated regarding the design and use of the non-clinical areas. In this study it means any area in the hospital that which is not a clinical or medical ward. of the hospital because the areas are commonly used by patients and relatives. The aim is to examine whether a building assessment method could determine and explain the connection between people and the use of non-clinical areas in the different cultural contexts. How local culture influence the use, social interaction and the Usability and Architectural quality of the non-clinical areas of the hospital

2 Theoretical framework

Architectural design of hospitals can be supported by a comparison between different spatial design solutions and evaluation of best practice cases and simulations. Few evaluation methods are specifically designed for hospitals, but many include relevant techniques (Fronczek-Munter et al, 2017).

The theory consists of three main categories: healthcare building evaluation theories and methods, as Post Occupancy Evaluation; the Evidence Based Design (EBD) and finally the theoretical frameworks regarding the relationship between architectural quality and users, Usability and Pattern Language.

2.1 Evaluation methods for buildings

The most known evaluation methodology for buildings is POE – Post Occupancy Evaluation. According to the definition of Preiser et al. (Preiser et al, 1988; Preiser, 1989; Preiser, 1995), Post Occupancy Evaluation is "the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time". As building performance and usability assessments are complex, they require multi–method strategies using a triangulation of methods and evaluations with multiple perspectives (Lindahl, Hansen, Alexander, 2012). Further research showed that hospital projects use various evaluation methods for different reasons (Fronczek-Munter, 2013, 2017). Newest research sees POE as “one of the suite of tools to measure building performance and should be used in conjunction with other methods to evaluate all aspects of a building, including the social, psychological and physical” (Deuble & de Dear, 2014). They suggest a combination of objective building performance data and subjective satisfaction ratings to achieve a valid and reliable evaluation of a building.
There are over 150 POE techniques available worldwide (Blakstad et al, 2008; Bordass, 2006; Bordass & Leaman, 2005; Leaman, Stevenson, & Bordass, 2010; McDougall et al, 2002; Stevenson & Leaman, 2010). The numerous existing methods often have one focus area that is evaluated more accurately than others. That fact is shown in Evaluation focus flower model (Fronczek-Munter, 2013), where many of the existing evaluation methods for buildings have been mapped according to their main focus. Figure 1 provides an overview of some of the evaluation methods, grouped and placed on the Evaluation focus flower (the USEtool, POE, narratives, Semantic evaluation). The methods chosen for this evaluation are described in methodology section.

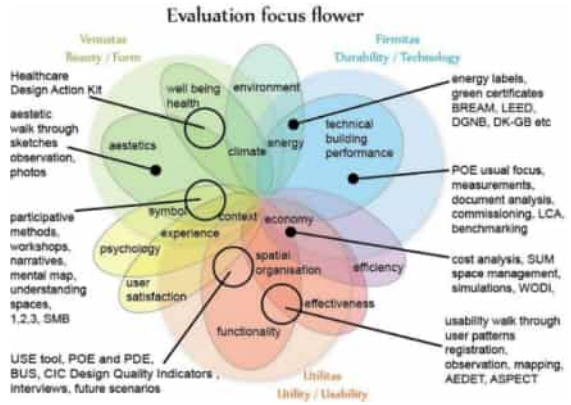


Figure 1. Evaluation focus flower model (Fronczek-Munter, 2013), with examples of evaluation methods and their main focus

2.2 Usability

Usability is a concept similar to functionality, but usability depends on: subjective view of users, context, culture, situation and experience (Fronczek-Munter, 2016, 2017). Most research on usability focuses on evaluating products or facilities with users, after they were developed or built. Usability evaluations of buildings are one of the ways to understand the connection between architectural solutions and the users needs, thus create better architectural design for supporting the users.

2.3 Pattern Language

The term 'Pattern Language' was introduced by an American architect, Christopher Alexander, where the theory is focusing on human-centred design in term of physical and social relationships. A Pattern Language is a method describing generic design practice that can be adapted in different contexts and culture. A Pattern Language (C. Alexander, S. Ishikawa, and M. Silverstein, 1977) expresses that every element of architectural function holds a general used called 'pattern' and every element can be connected from large to small scale (urban planning to ornament of room). As each society there is a particular pattern but these patterns overlap and share some similarities. The languages we used in this investigation are (1) the degree of publicness (2) healthcenter (3)circulation realms (4) hierarchy of open space (5) common areas at the heart (6) sequence of sitting spaces (7) reception welcomes you (8) a place to wait (9) half private place (10) eating atmosphere (11)window overlooking life (12) structure follows social spaces (13) natural outdoor and window.

2.4 Evidence Based Design - healing architecture

The development of Evidence-Based Design (EBD) concept started with a publication by Roger Ulrich in Science (R. S Ulrich, 1984) with a self-explanatory title: “A view through a window may influence recovery from surgery”. Ulrich provided the definition of EBD: “the design process, which is guided by an empirical understanding of the effects of health-care physical environments on safety, efficiency, and clinical outcomes” (R. Ulrich, 2006). Ulrich presents the strong scientific foundation with over 700 rigorous studies, which gives evidence that “good design of a hospital’s physical environment promotes better clinical outcomes, increases safety, and reduces stress for both patients and staff” (R. Ulrich, 2006). He presented examples of a number of parameters from research, giving evidence that architecture affects health. Similarly, healthcare design is paying attention rigorously on the needs and well-being of patients (R. Ulrich, et al., 2008).

A few examples of the EBD parameters and typical remedies are summarised below:
1) Noise, stress – remedy: single-beds, sound absorbing ceilings, 2)Safety and reducing infections (airborne and contact) – remedy: single rooms, filtration, air changes, separation of patients, wash basins and gel dispensers close to staff work paths in visually prominent locations 3) Staff fatigue – remedy: floor layouts with decentralised nurse charting, observation stations and supplies dispersed close to patient rooms, viewing windows – visual access to patients 4) Depression and pain – remedy: higher daylight exposure in patients’ rooms, via effects on serotonin, building orientation, view of nature and or people with positive facial expressions.

Nevertheless, many of those elements are present in Scandinavian architectural long traditions of designing with access to daylight and views to nature.

2.5 Culture

Culture can play important role and influence the style of each individual architectural building (Rappaport, 2004). Culture, architecture, and design are three elements that architects, designers, and facilities managers should consider when working on an architectural complex project for example a hospital. The main purpose of design, in general, is to create environments that suit the users and is, therefore, user-oriented (Rappaport, 2004).

As this investigation is focusing on the observation of hospital non-clinical areas in several locations, we considered the cultural dimensions. One or the main cultural differences is the degree of individualism (M. Minkov, V. Blager, G. Hofstede, 2013; G. Hofstede, 2013). The fundamental issue addressed by the individualism dimension is the degree of interdependence a society maintains among its members. Northern European society is more toward the individualist while South-east Asian is more of a collectivist (G. Hofstede, et al, 1991; M. Minkov & G. Hofstede, 2012). In the individualist societies people's self-image is defined in terms of 'I' and they are supposed to look only after themselves and their direct family, whereas in collectivist societies people belong to 'we' or in groups that take care of them in exchange for loyalty (G. Hofstede, 2012; M. Minkov &G. Hofstede, 2012).

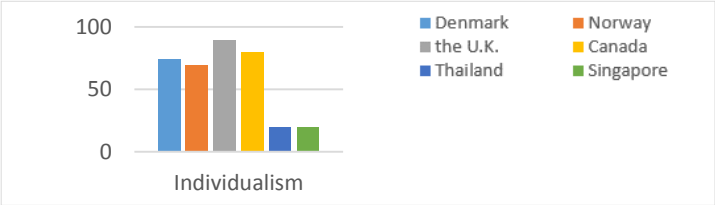


Figure 2. Cultural index scores of individualism dimension of Denmark, Norway, the U.K. Canada, Thailand and Singapore (G. Hofstede, 2013)

Another aspect that has influenced on the investigation is the healthcare system of each country. What is the first approach before patients reach the hospital and how patients access the hospital? There are vast differences in how healthcare system and medical insurance are organised. An example is Thailand, where there are no general practitioners (GP) therefore, everyone can directly access the hospitals while other countries GP is the gate keeper before patients reach the hospital. Other interesting aspect is the healthcare system whether the system is insurance based or fully subsidized by the government system. Denmark, Norway and Canada are fully or partially subsidized by the government, Thailand is a mixed system between government coverage scheme and insurance based system whereas Singapore and the U.K. is insurance based system.

3 Methodology

This research is conducted with qualitative research methods. The study is an empirical observation and investigation of the use of non-clinical areas of hospitals in different context. The approach of the study is inductive - particular examples are used to reach general conclusions. The case study methodology is chosen for the examination of details, for seeking answers to how and why questions and reaching conclusions from existing practices (Yin 2003). It allows testing ideas and theoretical concepts based on empirical data (Ragin and Becker 1992).

This research project began with literature review and development of the theoretical framework to review the collection of data and analysis of the study. After selecting the case studies, the investigation was conducted as a walk-through observation by one or both authors, to collect and document the first observation impression at 9 hospitals with multiple locations worldwide; (1) St Olavs Hospital Trondheim, Norway (2) Sudheds center, Copenhagen Denmark (3)Rigshospitalet, Copenhagen, Denmark (4) Maharaj Nakorn Chiang Mai hospital (5) Chulalongkorn Memorial hospital Bangkok (6) Khoo Teck Puat Hospital, Singapore (7) St Bartholomew's (Barts) Hospital, London, UK (8) New QEII Hospital, Welwyn Garden City, UK (9) Bridgepoint Hopsital, Toronto, Canada. Data was collected and analysed using a combination of methods.

The similarities and differences of the architectural quality of non-clinical areas at the hospitals were compared and analysed. The study is aiming to explain the specific phenomenology regarding the use of non-clinical areas at each hospital and describe the current universal typologies that form high quality hospital architecture.

3.1 Combination of evaluation methods

We applied a combination of different evaluation methods: USEtool walk-through, Reflexive photography, Narratives, pictorial narrative mapping and Semantic differential scheme. This merge of methods appears to cover multiple topics and provide better explanations and understanding of architectural quality.

USEtool (Blakstad et al, 2009, 2010), is an evaluation method with five stages, including a systematic general usability mapping and a walkthrough with more in-depth qualitative studies of specific usability topics. We use the walk- through stage with the usability focus, which gives valuable information in the usability theme and focus areas: functionality, spatial organisation, effectiveness, efficiency, user satisfaction. The result is a broad overview of the facility and the observations are well structured.

Reflexive photography is a generic method, seen both in research and practice, but also part of hospital evaluations by Maben, et al (2015), proposed for hospital staff. Reflexive photography is a type of photo-elicitation technique where research participants take photographs – formed the focus of 'reflective' discussion. The approach allows the participant to talk about the significance and meaning of photographs, which represent their perspective on the topic in question.

Reflexive photography can generate a visual record of the work environments and encourage research participants to critically analyse the ward layout, environment and facilities. It was used to prompt deeper consideration of positive and negative aspects of the spaces. The narratives were personal short explanatory written stories, combined with the photos. Additionally, we added the third method- the semantic differential scheme, which can be used as generic, but here a specific example is used (Cold, 2013), with 8 parameters as: complexity, originality, pleasantness.The results are capturing the immediate experience and evaluation of places, comparisons. Focus areas on Evaluation focus flower model are: beauty, aesthetics, symbol, psychology.

Describe why this room is so positive/negative for you?

Right at the entrance of the building there is a canteen, pleasant atmosphere, large glass facade with the view to the main square and lively like a city, enjoyment. Feels like a cafe in the city, open to all, but visited by many medical students.

	Very	Little	=	Little	Very	
Varied			x			Simple, monotonous
Chaotic					x	Regular, odrered
Pleasant, attractive	X					Unpleasant, rejecting
Open, spacious	x					Closed, tight
Heavy, maskuline					x	Light, feminine
Exciting, original			x			Typical, standard, boring
Has affection value		x				Indifferent
Formal, fine (fint)				x		Popular (Folkelig)

Figure 3. Example of evaluation at canteen, using three methods: Reflexive photography, narratives, semantic differential scheme

4 Description of hospital case studies

The case studies have been chosen from multiple locations in Europe (Norway, Denmark and UK), Asia (Thailand, Singapore) and North-America (Canada). The overview is presented in Table 1.

Hospital name Location	Overall view	Architectural Layout	General Information
St Olavs Hospital, Trondheim, Norway			**Function**: Teaching hospital and regional hospital **Client:** St Olavs **Size**:180,000 m2 **Bed:** 1,366
Sundheds center, Copenhagen, Denmark			**Function:** Health center **Client:** Copenhagen municipality **Size:** 3,200 m2 **Bed:** no inpatient departent
Rigshospital, Copenhagen, Denmark			**Function:** Teaching hospital and regional hospital **Client:** Rigshospitalet **Size:** 150,000 m2 **Bed:** 1,120
Maharaj Nakorn Chiang Mai, Thailand			**Function:** Teaching hospital **Client: Maharaj** Nakorn Chiang Mai Hospital **Size:**108,500 m2 **Bed:** 2,000

King Chulalong-korn Memorial hospital Bangkok, Thailand			**Function:** Teaching hospital **Client:** Choolalongkorn University and Thai Red Cross Society **Size:**220,000 m2 **Bed:** 1,433
Khoo Teck- Puat Hospital, Singapore			**Function:** Yishun district hospital **Client:** Khoo Teck Puat hospital **Size:** 110,000 m2 **Bed:**550
St Bartholomew's (Barts) Hospital, London, UK			**Function:** Teaching hospital, specialist cancer and cardiac centre **Client:** Bart's Health NHS Trust **Size:** 204,387 m2 **Beds:** 388 **Dates:** 1123 - 2014
New QEII Hospital, Welwyn Garden City, UK			**Function:** NHS local **hospital:** primary, acute and social care **Client:** NHS **Size:** 8500 m2 **Beds:** only outpatient
Bridge-point Wells Hospital, Toronto, Canada			**Function:** Specialist hospital **Client: Bridgepoint Active Healthcare** **Size:** 63,170 m2 **Beds:** 480

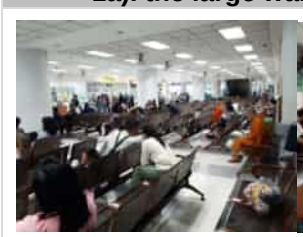
5 Development of Typology, Evaluations of types of rooms

Their comparisons helped us develop the Architectural typology of waiting areas, where examples are presented together with our evaluation and suggestions for high quality architecture, based on scientific literature and our observation. The typology is structured in seven following groups:

1. the large waiting area
   1a) large waiting area without zoning similar to airport waiting area
   1b) large waiting providing zones,
2. the long corridor waiting room with chairs along
3. the small area aside corridor
4. the waiting space next to window
5. the outdoor waiting, relaxing
6. the food place and canteen
7. the unplanned waiting space

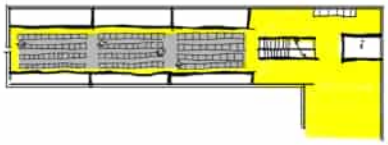
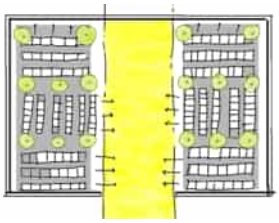
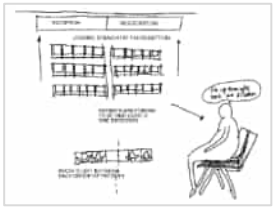
Architectural typology of waiting areas

1a). the large waiting area like airport




Maharaj Nakorn Chiang Mai Hospital | Rigshospital | St Bartholomew's hospital

Analysis drawings

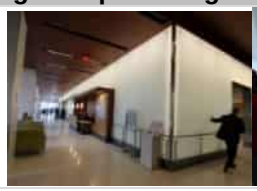
Maharaj Chiang Mai - the large waiting area serves the registration, cashier and pharmacy in the same waiting areas. The feeling is airport-like, crowded, stressful. The materials are plain, no activity or zones provided.

*Maharaj Chiang Mai ward waiting area – There is a n*ice overview over the registration desk, light and good standard materials, but it feels crowded and there are no zones, just chairs along the walls, no daylight or view, too many posters and signs, resulting in clutter.

Rigshospital - Waiting areas for blood sampling registration. It is not a very large area but it looks like a waiting area in the airport with chair placed in rolls. Patients are waiting for the registration and have their blood taken. This also includes all the patients in the 'inpatient' department.

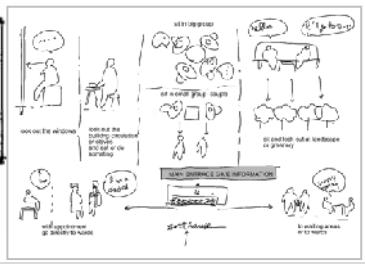
Bartholomew's Hospital, London - Large waiting areas in the covered atrium - Daylight from glazed roof, large airport-like feeling, large scale, seating facing many directions and provided small tables, trees, colours and high quality materials, interesting architectural design to observe

1b). the large waiting area providing zones,

Rigshospital | Bridgepoint Wells hospital | St Olavs hospital

Analysis drawings



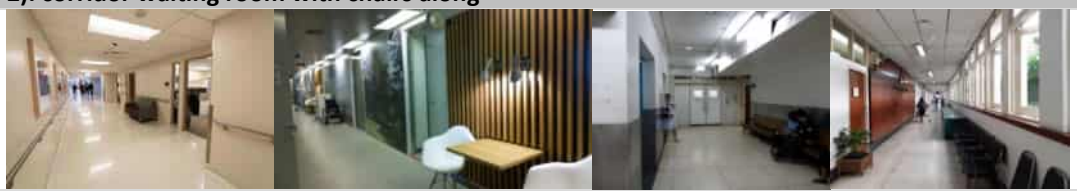
Rigshospital, Copenhagen - Waiting area in the hospitals main entrance hall – There are large windows with view to main entrance and city, seating is divided into zones, small scale seating facing many directions, small tables, relaxing atmosphere

Bridgepoint Wells, Toronto - *E*ntrance with information/registration desk and waiting area with comfortable sofa seating at the side, along corridor, with large window and park view, partially enclosed, taken to side of the corridor with semi-private feeling. Feels both open and private.

Bridgepoint Well hospital - *E*ntry ambulatory- natural circulation overview, register, relax at comfortable sofa/bench, with large windows and view over the registration desk, open, organised

St Olavs - Ward bevegelsessenter waiting area - Good overview over the registration desk, spacious, light and large glazed view to garden, seating zones, sculptures, plants, pleasant relaxing atmosphere, open, feels like art museum

2). corridor waiting room with chairs along



Bridgepoint wells hospital Rigshopitalet Maharaj Narkorn Chiang Mai hospital

St Bartholomew's hospital St Olavs hospital New QEII Hospital, Welwyn Garden CityK

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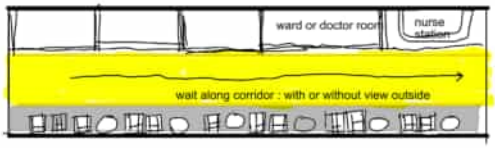

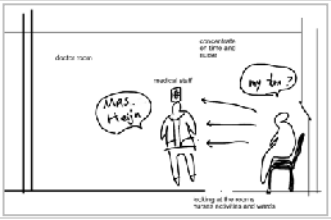

Bridgepoint Wells hospital - long corridor with small seating space - Functional, light colours, feels spacious but a bit sterile and exposed

Rigshospital Copenhagen, Small table with two chairs - Small open corridor area made comfortable, relaxing and cosy by light, wooden materials and designer lamps and chairs, feels less stressful and more like home or hotel, feels a bit dark, no views to outside

Maharaj Nakorn Chiang Mai Hospital, Waiting along the wall next to elevator in front of Surgical intensive care unit -

Easy to find, right out of elevator, feels very exposed – everybody walks here and looks, no daylight, plain colours and materials, no activity just waiting

Maharaj Nakorn Chiang Mai Hospital, Long corridor waiting at directors floor – Log row of windows providing daylight, view of garden, space, relaxing

St Bartholomew's Hospital, London, Waiting along the wall next to elevator and windows - Easy to find, right out of elevator, exposed, but walls turned aside and small tables provided, daylight, strong colours and different materials, busy but pleasant

St olavs, long corridor waiting – seating aside the open corridor, with daylight, sculptures, plants, view to garden, natural, light materials, open, calming atmosphere

New QEII Hospital, Welwyn Garden City, UK, - long corridor waiting, large windows providing daylight and view of garden, space for seating open to corridor, but hidden in a zone along a wooden frame, feeling private and undisturbed

3). small area aside corridor

St Olavs hospital Rigshospital

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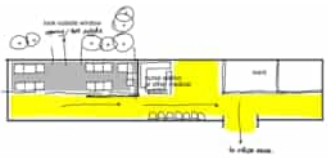
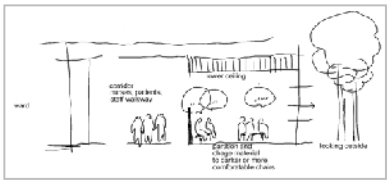
Analysis drawings





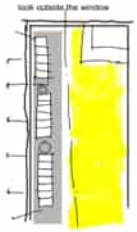
St Olavs Hospital, aside corridor waiting- seating aside the open corridor hidden in a "cave" with lower ceiling, but provided daylight and view of garden, space, zone for kids, comfortable chairs looking at corridor or garden

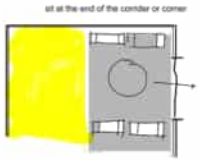
Rigshospital, aside corridor -seating taken a bit aside and hidden away from the corridor, comfortable armchairs and tables, zones, colours, no daylight, feels comfortable, but dark

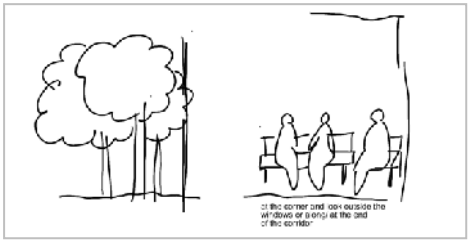
4). the Space Next to window used for waiting

St Olavs hospital Maharaj Nakorn Chiang Mai hospital

Analysis drawings







St Olavs hospital- the area is used for both entry, registration, canteen and waiting, with many zones and differentiated seating materials and colours, art pieces on the walls and free-standing sculptures, large windows with view and daylight, light natural materials, seating by the window popular

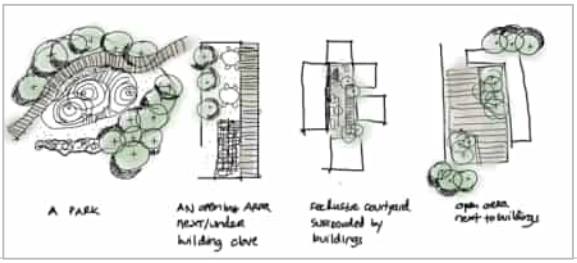
Maharaj Nakorn Chiang Mai Hospital – large corridor space with a window, popular seating on a bench next to window, overview of space, view out, daylight

5). the outdoor garden relaxing

Khoo Teck Puat Hospital St Bartholomew's hospital St Olavs hospital

St Olavs hospital Bridgepoint wells hospital Sundheds center

Analysis drawing



Khoo Teck Puat hospital - Entrance and central square with garden. Feels relaxing, very green, surrounded by plants, birds, butterflies, water, feels like in botanical garden, lowering stress, calm, beautiful

St Bartholomew's Hospital - square with large fountain , trees and seating, historical site, belonging, open and inviting

St. Olavs hospital - central square between medical centers, providing seating areas, trees, sculptures, different zones for seating, feeling busy - as part of the city, busses, cars, and people passing by

St Olavs hospital -garden outside – large garden, feeling in nature and relaxing, calming atmosphere, used by patients, relatives, staff and open to public, feeling of neighbourhood and public area

Bridgepoint Wells Hospital, Toronto -terrace garden - View over city and nature, relaxing, large, open

Sundheds center, Copenhagen - Stunning architectural quality: beauty and functionality, small intimate places to sit and rest, talk with someone, look at trees and plants, interesting and surprising shapes, small scale, high quality

6). the food place and canteen




St Olavs hospital Chulalongkorn Memorial Hospital

Analysis drawings

St. Olavs Hospital, Kunnskabssenter, canteen - Open, light, large full-height windows with views to outside street, open to all, both visitors and medical staff, easy accessible, located at the groundfloor

St Olavs , ward canteen at Mother and Child center, busy but cosy atmosphere, light and with large windows, different chairs, materials and colours, healthy food, natural materials, plants

Chulalongkorn Memorial hospital, patient and staff canteen – busy, with large windows with views, large variety of healthy food, simple plastic seating, plants

Chulalongkorn Memorial hospital, restaurants between buildings. The concept of these small food vender imitated from Thailand street food concept, using spaces between buildings previously used by homeless, small, narrow and busy, but cosy spaces, covered by transparent roofs, providing healthy food, easily accessible to everyone

7). the unplanned and informal waiting area


Maharaj Nakorn Chiang Mai hospital

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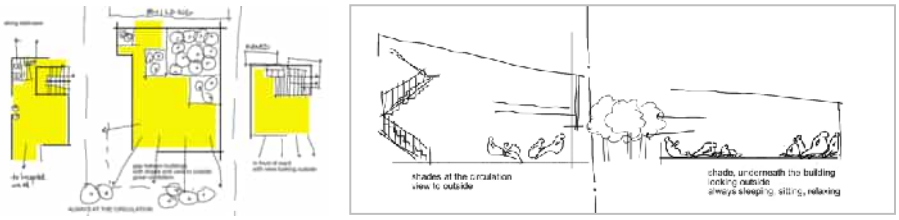
Analysis drawings



Maharaj Nakorn Chiang Mai hospital- Waiting at the staircase - it is colder (positive in Thailand), light, view, wind breeze, privacy. It is not allowed to stay here because of fire safety, solution could be to plan for waiting areas with those qualities and find them in other places

Waiting in the entrance area under a high building – areas used for waiting and eating by large groups of family members of patients

6 Discussion

The presented Architectural typology of waiting areas at hospitals gives an overview of current state of spaces and evaluation of their architectural quality, based on data collected from the multiple hospital case studies and analysis based on scientific methods.

It is easy to spot differences between the hospitals on different continents, with different sizes and cultures. The main cultural difference we observed are different healthcare organisations, the family structure and collective culture, resulting in for example the large waiting rooms, feeling like airport. But more striking is the similarity of both the typical hospital spaces of high architectural quality and usability, and the challenges, as prioritizing efforts and ensuring evacuation routes, user-friendly signs, space shortages, beds and equipment stored all possible places.

The observation of case study hospitals resulted in developing of the Architectural typology of waiting areas, with the seven common types of spaces, with examples as: large waiting area like airport, the long corridor waiting room with chairs along, the outdoor waiting etc.

We found many of the spaces evaluated as pleasant, beautiful or relaxing and of high quality had a few common features, many known from Evidence Based Design, as: large windows providing daylight and view to green areas with trees, interesting seating spaces next to windows, often organized in zones, providing flexibility and choices of specific place to wait.

We found examples of successful waiting areas even along the corridor, especially if there could be organized some shelter from the traffic, in form or spatial recession, turned walls, armchair seating or locating of the seats in groups rather than along the walls.

In some of the cases we found the unplanned waiting spaces, where the location and qualities of space, as shelter from sun, view to park; were inviting the hospital visitors, especially large groups of family members, to rest and wait there, even when there was no official seating provided. The needs of the relatives have so far not been met with any particular attention, even though the nurses tell that relatives and social support are important for the patient's wellbeing and recovering process. This discussion is also known at European and American

hospitals, where changes in the patient groups are changing the demand for the secondary areas.
The study also investigated how culture is an influential factor on the experienced quality of a space design.

The combination of evaluation methods, as USEtool walk-through, Reflexive photography, Narratives, pictorial narrative mapping and Semantic differential scheme, helped in comparing and structuring the results from the observations at the hospitals and in comparing and describing the architectural quality of the specific spaces.

7 Conclusions

This evaluation of hospital non-clinical areas in multiple cultural contexts gives fundamental understanding of the influence of culture and well-being of patients to the design of hospitals and perceived quality and usability of architecture. Even though the hospitals are located on different continents, they share similarities as the specific types of use in the non-clinical spaces. The significant similarity in the use of those non-clinical spaces correlate with the usability concept where users and their satisfaction are the most important aspects of design and architecture quality of hospital buildings. The results from the multiple case studies form the discussions to what are the current universal typologies that form high quality hospital architecture.

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IMPLEMENTATION OF INNOVATIVE METHODS FOR THE DIGITAL MANUFACTURING OF ARCHITECTURAL MODELS

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Abstract

Various methods of Digital Manufacturing (DM) have been available for the manufacturing of physical architectural models for several years. This paper highlights the advantages of 3D printing for digital manufacturing of detailed architectural models. In particular, the representation of architectural details and textures is treated. Furthermore, two new methods are being developed in order to improve the conditions for the application of digital manufacturing of architectural models. The first method makes the production of models with very detailed textures and interior rooms possible. While these architectural models allow the representation of a variety of details, they are usually rigid, i.e. not scalable in their size.

In order to allow to overcome this disadvantage this paper develops as a second method a parametrized CAAD model that allows boundary conditions to be modified and adapted while complying with the scale. The necessary parameters are defined in a multi-step process, then the relationships are described and implied. The parameters take into account the restrictions from Digital Manufacturing, but also the shape of the building and the texture. A variation of the scale or the texture of the architectural model is thus possible within a very short time. Within two case studies is demonstrated in which the developed methods are applied in order to implement detailed but also scalable architectural models.

Keywords

CAAD, Architectural models, additive manufacturing, redesign, parametrization.

1 Introduction

The implementation of digital technologies in architecture has rapidly advanced in recent years. Thus, a series of tools are available today which support all phases of the virtual development of architectural projects from the design to the construction to the realistic representation with embedded environments. To date, several technologies have been developed for the Digital Manufacturing (DM) or 3D-Printing (3DP) of architectural models based on CAAD data. A common feature of the technologies is that the physical models are created directly from the virtual 3D-Computer Aided Architectural Design CAAD-model [1]

The physical 3D-models are manufactured generatively, i.e. the models are created layer by layer by adding material. The application of these technologies for the manufacturing of architectural models provides a number of advantages over conventional technologies [2]. For example, it allows models to be created in minimum time with a greater degree of details. Furthermore, the reproduction and variation of drafts are also simplified considerably. Another advantage in addition to this implementation speed is the low costs for the systems and materials used, resulting in a considerable reduction of the model costs.

The use of DM is already established for standard models in the architectural sector. However, these applications are subject to some restrictions. Complex buildings, which have a variety of different rooms, superimposed stories, or even filigree design elements, have to be subjected to expensive pre-processing so that they can be produced as an architectural model using DM. In addition, these models have the disadvantage that they are generally only designed for only one specific scale. Thus, a scaling of the models is not possible, since their physical implementation is no longer possible due to different restrictions.

Through the collaboration of digital development processes and digital manufacturing, the advantages of the disruptive development of the two technologies can be sensibly combined and further developed in recent years. In this contribution, therefore, the requirements and restrictions in the DM of architectural models will first be explained. Two methods are then developed to overcome these obstacles today by means of a smart subdivision and parameterization. The application of this methods is demonstrated and evaluated within several case studies.

2 Literature Review

About 30 years ago, the first process of digital manufacturing was developed with stereo lithography (SLA). To date, a large number of procedures has been established, all of which are characterized by the layer-by-layer design of the components and the direct implementation of CAAD using 3D printing. The methods used differ primarily in the joining technology of the layers as in the building material used. The application of the methods of digital manufacturing to implement architectural models has been investigated for several years. For example, a very comprehensive investigation of the different technologies showed that despite the still high costs, rapid prototyping through the direct manufacturing of the models can significantly influence the design [3]. However, at this time the models were often still evaluated as insufficient in size and appearance [4].

In the meantime, significantly larger DM systems are available and the costs have also decreased dramatically, mainly due to competition among the OEM of 3d printer but also 3D print service providers. For this reason, the number of additively produced components has risen sharply in recent years [5]. At present, the current range and performance of the different methods, also for the representation of architectural concepts show a wide range [6]. For that reason, a selection process using various criteria to find the best suitable method of digital manufacturing architectural models is developed [7]. The advantages of DM are particularly important when complex shapes (such as filigree supports or organic shapes) are to be created as models. Thus, it can be shown impressively how digital manufacturing can be used in the production of models with organic forms from the topology optimization of bridges [8].

In addition, the integration of DM into the design education of architects is an important approach to driving this technology forward. The use of Digital Manufacturing technologies to train students is being examined in architectural design education. The advantages when using design versions are especially emphasized in this [9]. It was shown in a comprehensive study on the impact of this new technology on the training of architects that students are more integrated into the design process and also become more creative. Additionally, they are enthusiastic about the new ways in which models and prototypes can be generated and benefit from direct feedback through the physical, and therefore "tangible", models [10]. The use of DIY kits for 3D printers can provide students with a practical insight into the technology. Students can learn how to create architectural and landscape models in a short time [11].

3 Process Chain from CAAD to Physical Architectural Model

The basis for the development of the models in CAAD are the specifications. These contain both restrictions of the geometry of the model as well as process-specific specifications, which depend on the digital manufacturing process involved. In all DM technologies, the 3D CAAD data are then imported in preprocessing and 3D Printing is prepared. A system-specific software is available for this purpose. This is followed by the actual "slicing" of the model in layers. Finally, the models must be post-processed, e.g. to remove support structures or improve the strength of the models. Since many architectural models consist of several parts, an assembly is required at the end of the process (see Figure 1).

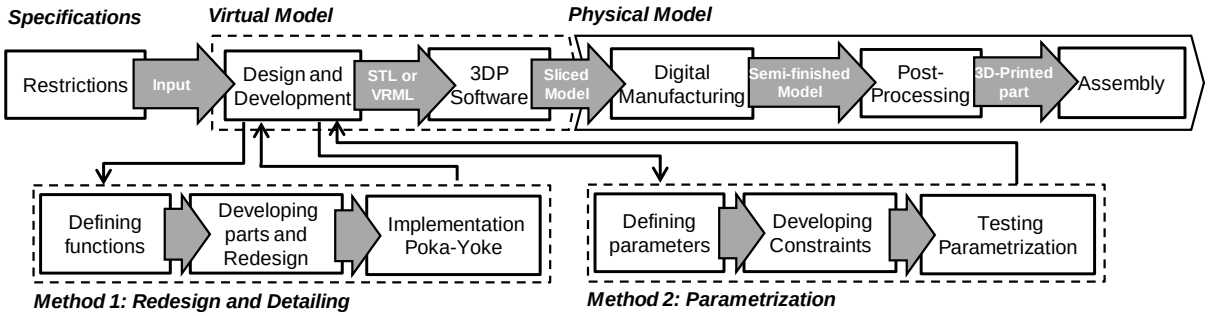

Figure 1: Process chain in DM of architectural models with two innovative methods

3.1 Digital Manufacturing Technology for Architectural Models

The Fused Layer Modelling (FDM)-technology utilises a heated nozzle where a plastic filament is inserted, molten and finally extruded. Each layer is produced through material deposition in the necessary areas. The printed object is therefore created by stacking layer onto layer. A nozzle is limited to handle one material as well as only one nozzle can actively extrude material. Dual extruders are common for most printers, thus two materials can be used in one print job (usually model and support material).

The PolyJet Modelling (PJM)-technology makes use of several print heads, each containing an array of several nozzles. As material resins (photopolymers) are used which are cured via UV-lamps after the deposition on the build platform. State of the art 3D-printers (e.g. Stratasys J750) can handle up to six materials next to the support material. There are rigid, rubber-like,

transparent as well as coloured materials available, which can be mixed among each other to create application specific materials. This offers a wide colour palette as well as an adjustable hardness. The model and support materials are printed simultaneously.

In the binder jetting process (BJ) a powder mixture of plaster and polymers is used. This powder is applied by means of a roller in thin layers. Then the powder is sprayed with binder so that it bonds. Actually, the models produced in this way are monochrome white. In addition, the jet nozzles can be used to color the models so that colorful models with textures and logos can be created. After the DM process, the excess, loose powder is removed by means of compressed air. During post processing the models still need to be infiltrated with a resin to increase the strength of the printed models and the brilliance of the colors. An additional support material is not required because the powder bed carries the models.

3.2 File Formats suitable for Digital Manufacturing

The most common file formats are STL (Standard Tessellation Language) and VRML (Virtual Reality Modelling Language). Basically both formats can be utilised to create multi-coloured models, but there are differences and restrictions regarding the pre-processing of the files. Also native CAD-file formats can be used instead of STL, allowing to skip the STL-conversion process. The necessary pre-processing remains unaffected. To print highly detailed textures (e. g. wallpapers, floor tiles or parquet floor) the VRML-format is recommended because image file can be used. The focus of the pre-processing is the creation/preparation of the textures using a suitable software. The textured volume is imported as a single volume. The restrictions only allow a fixed colour palette based on black, white, cyan, magenta and yellow. Other combinations including adjustable transparency or hardness are not possible.

The main focus on the pre-processing for STL-files is the separation of the original volume into several sub-volumes. Theoretically a comparable amount of detail like in the VRML-file (with its image files) could be achieved, through the separation into infinitesimal volumes. But the necessary amount of time to do this would not be justifiable, thus STL-files usually have a lower amount of detail. The sub-volumes are imported into the pre-processing soft-ware as an assembly. There are different colour- and material-combinations that can be assigned to each single sub-volume. Transparent windows as well as geometries with arbitrary hard-ness are possible. There are no restrictions regarding material properties like in the VRML-format.

STL and VRML-files have to be printed separately, for example the textured floor as VRML and an assembly of walls and windows as STL. Printing a combination/assembly of STL and VRML is not possible. After the print job the objects have to be assembled by hand.

4 Case Study for Redesign and Detailing of an Architectural Model

In this case study, a detached house is chosen as an example. In order to assign different materials, it is necessary to separate the original volume into several sub-volumes and add non-existing volumes (e.g. windows). Figure 2 left shows the original volume without modifications. According to the customer's wishes and the restrictions of the PJM-technology the volume has been separated into several sub-volumes, shown in Figure 2 right. The floor was textured afterwards and therefore the VRML-format was used. Everything else was in the STL-format. During the separation the subsequent manual assembly after the print job should be kept in mind in order to prevent unnecessary iterations.

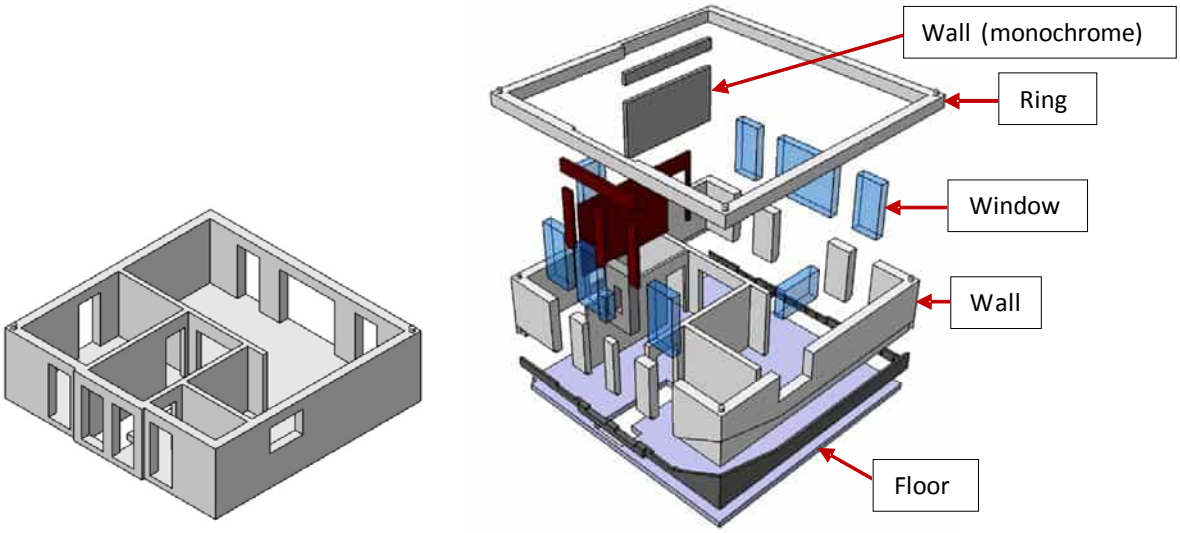

Figure 2: Separation of the ground floor (left) original volume, (right) Redesign with separated and coloured sub-volumes (exploded view)

To achieve best possible results there should be further modifications in regards of the used printing method as well as the pre-processing software (see Figure 3 a to d). Experienced users with the necessary rights can modify parameters in the software in order to prevent specific functions. Regular users usually do not have the rights to access these areas in the software and therefore the following steps are based on structural approaches.

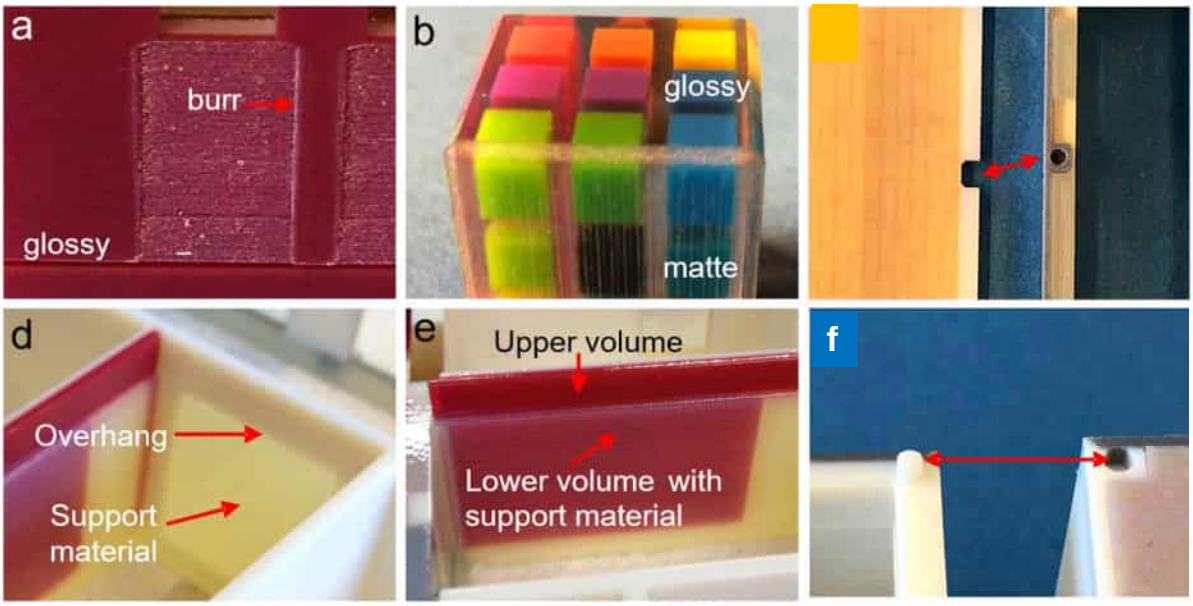

Figure 3: Details: (a) matte and glossy surface finish, (b) transparent material in matte and glossy, (c) notch in floor plate and corresponding counterpart (d) overhangs with support material, (e) accumulated support material, (f), pin and hole between structural levels

The Poka-Yoke method was originally developed in Japan and means to prevent inadvertent errors from the user [12,13]. In order to ensure a faultless assembly of the models dedicated geometries where implemented. Notches in the floor plates only allow the assembly with the corresponding structural level in the correct orientation, see Figure 3 c. Pins between the structural levels only allow one orientation, see Figure 3 f.

The assignation of colours and material properties was done in the pre-processing software GrabCAD. The majority of the windows where chosen to be transparent while a mixture of transparent and white material was assigned to single windows in order to create opal glass (see Figure 4). Due to the utilisation of the flexible material it is possible to create haptic impressions. For example, a pattern of very small cubes or pins, with flexible material assigned, can mimic the feel of a carpet.

Figure 4: Printed models: FDM (left), PolyJet Modelling (right)

5 Digital Manufacturing of Scalable Models using Parametrization

When implementing virtual CAAD data in physical models, different process steps are executed. First, the CAAD data are transferred to the data preparation software via an STL-interface. This format uses simple triangles for the representation of geometry. During preprocessing, various tests are performed. For example, is tested whether all triangles in the STL-data are correctly aligned and whether there are "holes" in the model. It is also checked whether the minimum wall thickness for 3D printing is sufficient. This can lead to the fact that a 3D printing is not possible, especially with models of very small scale. Many software packages offer automatic correction of the data in such cases. Subsequent changes, e.g. the scaling of certain areas (for example, only the wall thickness, but not of the supporting ceilings) or the cutting out of certain areas is either not possible or is only possible with great effort.

Furthermore, a return of the changed data to the CAAD system is only possible to a very limited extent since only simple geometry information is transmitted in the STL format. Because the STL format is not a native format of a professional CAAD software system, complex information, e.g. the construction history, design-features, textures or materials, can no longer be traced back to this format. The result of this data preparation is therefore a "rigid model", which can only be printed on one scale and can only be changed to a very limited

extent. This is transferred as print data to the 3D printer and can then be built up layer by layer. The model of the detached house presented before in Figures 2 and 4 is an example for such a "rigid model".

To overcome the disadvantages of "rigid models" a parameterized model was developed. All the essential dimensions of the virtual model are already provided with parameters in the CAAD system so that they can be varied independently of each other. Thus, when the scale of an architectural model is changed, the outer dimensions can be scaled. However, the wall thicknesses are not scaled to the same extent in order to ensure the manufacturability by 3D printing.

A four-story university building with an integrated experimental hall is used as an example for the use of parameterized models. On the one hand, the difficulty consisted in the fact that a particularly small scale was chosen. Thus many details had to be adapted or changed [14]. In addition, a special texture of the façade was required. In this example, the wood paneling of the façade should be made visible. Also some details of the experimental hall (for example, roof construction, roof structures and visitors' balconies) should be presented despite the strong reduction. In addition, however, it should also be possible to produce the model on a larger scale without having to significantly rework the CAAD model.

Parametrization makes it possible to select specific dimensions and to vary them. This allows the details of the building to be changed according to the chosen scale, so that the requirements from 3D printing are met. In addition to the simpler feasibility, parameterization also results in cost advantages, since the parameters can be adapted to different scales within a few minutes. The change of a rigid model in the CAAD or the data preparation usually requires several hours.

6 Case Study for the Implementation of Parametrization: Scalable Model of a University Building

In practice, parameterization is carried out in series of process steps. In the context of parameterization, all necessary parameters are first selected and implemented as such in the CAAD system. It is then possible to define which parameters are to be changed during scaling. These parameters are then linked using relationships to the scale or to each other.

When the scale is changed, the parameters are automatically adjusted using the relationships. Finally, extensive tests are carried out to check whether all necessary dimensions are adapted using the relations according to the specifications. In addition, these tests are needed to detect errors in the formulation of the boundary conditions and then to rework the affected formulations.

For illustration, a multifunctional building, which has both offices and laboratories, was created using the new method. The particular challenge in this case is that a very small scale of 1: 500 should be implemented. The Binder Jetting was used as DM technology in this case study. This technology allows the manufacturing of coloured models. Due to the use of polymer gypsum as a construction material, these models are cheaper than PJM models. Furthermore, because of the powder bed additional material can be dispensed with. This also significantly reduces reworking during post processing. As a disadvantage, only the low resolution due to the higher layer thickness must be accepted here.

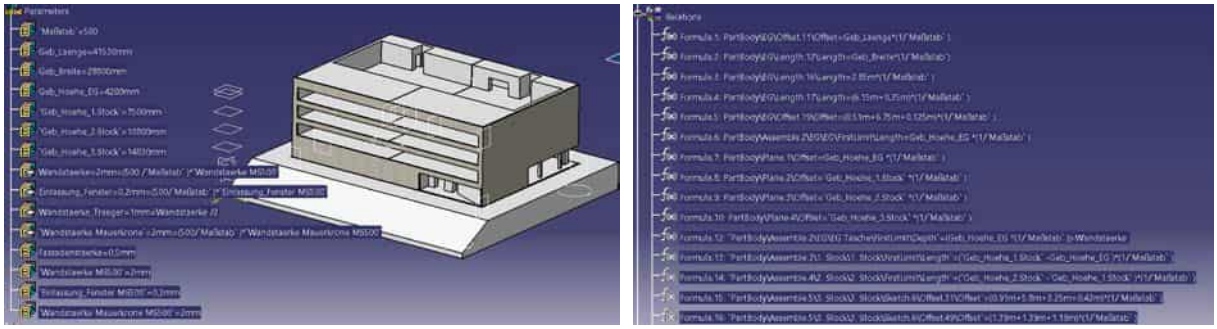

Figure 5. Screenshots from CAAD Software: CAAD model and list of parameters (a), List of boundary conditions (segment) (b)

In this extreme case, many details cannot be represented due to the small dimensions. On the other hand, certain minimum wall thicknesses must be maintained in order to ensure the printability. The model was divided into two parts to be able to remove in the inside powder during post-processing. Due to this partition in the CAAD software (see Figure 5 a) the user of the model has the possibility to open the model and recognize the internal structure of the building. In addition, a bed plate has been developed which serves as a receptacle for both building parts.

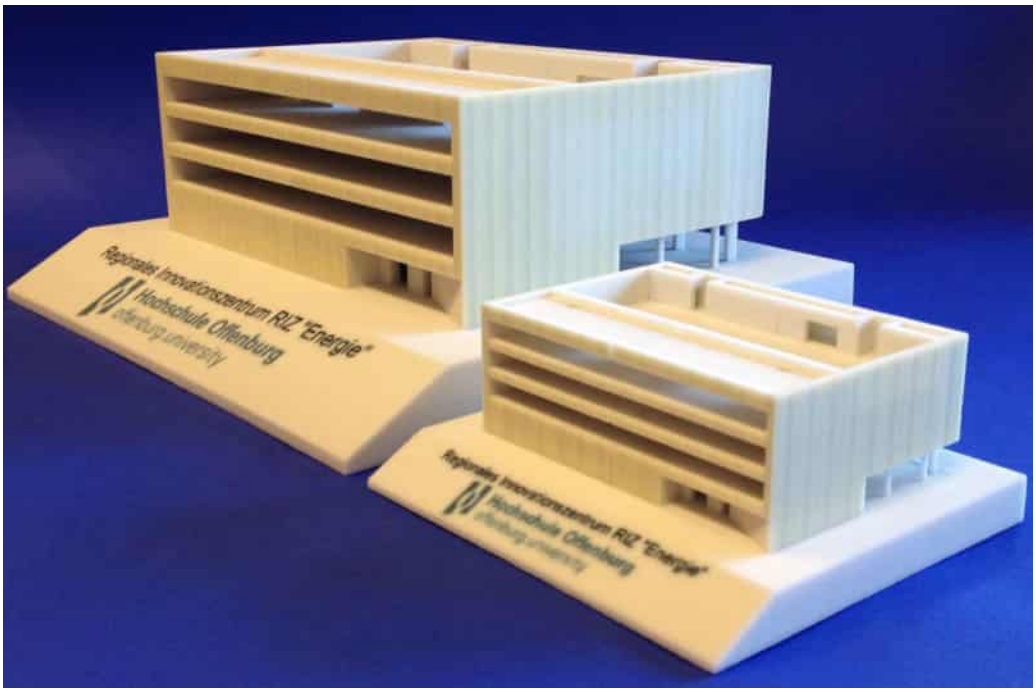

Figure 6. Parametrized architectural model in scale 1:250 (left) and scale 1:500 (right) manufactured by Binder Jetting

A total of 15 independent parameters were defined during parameterization. In addition, the façade should be presented in a particularly realistic way. For this reason, as a separate sub model was developed that provides special parameters in order to be able to individually adjust the facade's texture. The total of approx. 290 relationships allow a very detailed

adaptation of the CAAD model to different scales and requirements. The creation of the parameters and relationships means an extra effort of approx. 25 hours. This effort is justified, however, since the change of one of the parameters, namely the scale, adapts automatically all affected dimensions in the model, since these are connected by relationships. As an example of the application, the multifunctional university building, that is uses as regional research enter for renewable energies, is shown in Figure 6 in the two different scales 1: 500 and 1: 250. In the implementation of the architectural model, the method of binder jetting was applied, since a color representation of the wooden texture on the façade is possible.

7 Conclusions and Outlook

Today, digital manufacturing processes offer a highly developed technology to produce architectural models. Therefore, these technologies are used in many areas of the design of buildings and bridges, but also in the training of students. In order to be able to depict even larger buildings with complex internal structures, this article presents a method which allows the models to be split up. Individual floors and structures can be made visible. The assembly of the individual parts of the models is simplified by the Poka Yoke method. In a case study with a two-story nursery, consisting of 10 individual parts, the application of these methods is successfully demonstrated.

The models are usually limited to a certain scale. A simple scaling, in particular a reduction in the scale, is not possible since important criteria for the feasibility (for example, minimum wall thickness) are not met. In this contribution, therefore, a further method is developed, such as the application of a parameterization, this disadvantage can be overcome. For this purpose, a certain number of parameters are defined. All dimensions of the CAAD model that are important for digital manufacturing are then linked via relationships. Depending on the complexity of the design, a large number of relationships may be necessary. By means of a case study, it can be shown that the scaling of the architectural model can be easily implemented when this new method is applied. In both case studies an additional effort in the CAAD is necessary during the development phase of the virtual model.

In the further development of the method, the focus is on the inclusion of further DM technologies. Thus, the restrictions in various processes are quite different (e.g., support structure is necessary or not). Furthermore, the relationships must also be adapted to these restrictions. In addition, the establishment of relations should also be simplified. Today, this is still carried out experimentally today. It should be investigated to what extent the use of methods from computer science and numerical mathematics (for example, generic algorithms and data mining) may reduce the effort.

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CUSTOMISABLE SHELTER SOLUTIONS: A CASE STUDY FROM ZAATARI REFUGEE CAMP

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Abstract

The population of people living in temporary settlements after disasters is in the millions and the average stay in these settlements exceeds a decade. Available temporary shelters solutions follow either a top down or bottom up system. This paper sets out to analyse the benefits and deficiencies of both systems, highlighting their limitations. The generic nature of refugee housing often does not adapt to the variety of cultures and individuals represented. We propose addressing these limitations with customisable and adaptable solutions. The benefits of such approach on the well-being of the displaced population are discussed. Using Zaatari refugee camp in Jordan as a case study we analyse the adaptability and potential for personalisation of typologies of temporary shelters for refugees used in the camp. Zaatari Refugee camp in Jordan is home to nearly 80,000 Syrian refugees, some of whom have been there since the camp opened on 29th July 2012. At the time of writing the residents of Zaatari will have been living in basic caravan shelters for up to 5 years. Over this time the majority of occupants have adapted and personalised their given shelters in order to regain a sense of normality. This is despite the fact the shelters provided were rigid in nature.

Keywords

Refugee camps, Shelters, Temporary housing, Jordan

1 Introduction

The United Nations Refugee Agency (UNHCR) estimated that an unprecedented 65.6 Million people were displaced worldwide in 2018 due to conflicts alone [1]. Moreover, researchers predict that by 2050 there will be 200 million climate-induced refugees [2]. Unfortunately, these situations are not short term, more often than not, refugees and internally displaced people can end up living in displacement for years or even decades [3]. Temporary shelters are often used in mass displacement scenarios as a housing solution. The emphasise on temporariness of shelters is often the result host governments being reluctant to offer permanent settlement solutions for refugees. This means that the available temporary shelters are inadequate as a long term solution. In addition, social and cultural needs are rarely

met, as the main drive is to house displaced populations and provide protection from the elements and basic amenities as quickly and cheaply as possible [4].

Temporary shelters come in two brands, top-down and bottom-up constructions. Top-down solutions consist usually of prefabricated, standardised and mass produced units provided by governments and non-governmental organisations (NGOs) [4]. Bottom-up solutions are built on site by the displaced populations or local workers using locally available materials under the supervision of local authorities or NGOs. Both solutions have their limitations, in this paper we explore these limitations and present an alternative solution using a case study of Zaatari refugee camp in Jordan.

2 Top-down solutions

Top-down solutions are shelters that are designed and manufactured abroad and then shipped to site when needed. These solutions usually require complex transport systems, where the unit is either shipped as a whole or divided into few parts and assembled on site. A lot of research efforts has been invested into developing innovative transportable shelter systems. For example, Ikea developed flat packed shelters under the initiative 'better shelter' that are currently used in Ethiopian refugee camps among others [5]; Exo stackable shelters [6] were developed by Reaction Housing which come in two parts, a stackable shell compromising the walls and roof, and a base for the floor. A summary of current research on transportable shelters was presented in [7].

One of the main benefits of such approach is that it allows for robust and engineered solutions; for example, thermally insulated shelters or units that are fitted with wet facilities. Affordability, ease of deployment and transportability are some of the main driving factors behind most top-down solutions. Whilst these are all important considerations especially in situation where a quick response is needed; a top-down approach generally means that lesser attention is given to the cultural, social and personal needs of the residents. Michael Agier suggests that in a post 9/11 context the world has distanced itself further from those considered undesirable, as a result he argues that the manner that governments treat refugees today has been de-socialised; that our aid solutions have become mass produced for handling the masses, not the individual [8]. This is visible in Top Down shelter initiatives where products come across as distanced from the cultural and social needs of refugee residents. Additionally, despite transportability and price being key drivers of top down temporary shelter initiatives; the resulting products are still not easy to move to areas with difficult access and still require heavy transport systems [4]. Often resulting in more expensive solutions than a similar bottom up system due to the associated costs of transport and production [9].

Figure 1: Right: U-dome by World Shelter (photo credit: World Shelters); Left: Exo stackable shelters (Photo credit: Michael McDaniel, 2016)

3 Bottom Up solutions

These types of shelters are usually built with locally available materials, for example, earth shelters, primarily timber shelters or shelters built of metal sheeting. In these cases, actors responsible for the management of the camps provide tool kits and training for the displaced population to build their own shelters or in some cases the camps could be built in advance of the arrival of refugees. This approach can help overcome the high cost of transport of prefabricated shelters. In addition, community participation can create a strong identity relationship between the occupants and their new dwellings, creating ownership and a greater sense of responsibility that one relates to home. However, such solutions are not always feasible in refugee settings due to political sensitivities. In addition, vulnerable families (for example elderly or disabled) might be at a further disadvantage if they were unable to get enough support to construct their shelters. Furthermore, unlike top-down solutions, shelters built on site might suffer from poor built quality and workmanship, such as gaps in the structures. This could result in a poor thermal performance, draughts and rain leakage. Also there might be negative implications on the local environment, if the sourcing of materials is not sustainable and well managed. The construction time might take longer, and they are sometimes seen as diverting efforts from post-disaster recovery and permanent housing reconstruction especially in the cases of internally displaced populations.

Figure 2: Right: Superadobe construction technique, (Photo credit: Calearth.org, 2017); Left: Philippine temporary bamboo and timber shelter (photo credit: Jenelle Eli, IFRC).

Figure 3: Self-built temporary shelter using metal sheeting in Nepal, Photo credit: D.Albadra

Despite the aforementioned issues associated with bottom up solutions; it is often argued in the literature that these solutions are more suited to local context and culture. To shed more light on the positive impacts of bottom-up solutions; some of the benefits associated with them are discussed below:

3.1 User participation impact on quality of life and psychological well-being

In a case study by IBC (International Blue Crescent) and CRS (Catholic Relief Service) in which beneficiaries were engaged in the construction and decoration of their accommodation; it was found that involvement in the process gave residents an increased sense of belonging, reinforced the sense of identity and recognition of home. Those involved also benefited from learning construction techniques [10]. While mass production of a single design can provide the basic temporary shelter requirements of privacy and shelter, the quality of life that comes with individuality, culture and a sense of home requires a more localized architectural approach. Beyond the initial need for basic shelter refugee housing is the starting point for rehabilitation following the traumatic experiences they left behind. In order to begin to recover the displaced need to re-establish a sense of ownership and belonging in their new accommodation; to apply the cultural context of home.

In 2009 Christine Walsh published a paper, Characteristics of home: Perspectives of Women who are homeless, exhibiting findings from 20 interviews with homeless women in Calgary providing insight into how best to design for the displaced. Walsh suggests that a sense of home is vital in recovery from the hardships experienced by these women. Both homeless and internationally displaced persons go through the trauma of being without a home, as a result the concept is of heightened importance to both groups [11]. Despite the understanding of its importance, it is hard to correlate a universal definition of what home is. Coming from such different backgrounds the women interviewed give stark contrasts in the values they perceive as home, exaggerating the individual nature of the thing. A study at the University of Padova, Italy on the psychological effects of living in a Dacha, traditional home, or metal container on earthquake victims suggested that a home attachment could improve on post-traumatic stress reactions. The findings build on Walsh's suggestions of the importance of culture to the concept of home; that shelter shape and material are important in matching a cultural prototype of home. The study shows a correlation between shelter type and psychological

stress, concluding that cultural attachment to their accommodation benefits residents psychological well-being [12]. It is therefore important that refugees feel a cultural connection to their accommodation. The comfort that comes with a sense of home would further enable refugees to return to normality.

"victims assigned to dachas were more satisfied with and more attached to their temporary homes and reported greater psychological wellbeing (fewer psychological stress symptoms, less discomfort and a lesser feeling of being dominated by the situation)."

(C. Giovanna, F. Ventimiglia, A. Maass (2010): 1)

3.2 Utilising refugee innovation and skill sets

Independence within a camp context is another important sign of normality. Governments might discourage this as self-sufficiency can indirectly imply permanence. While host governments and many aid organisations seem to consider refugees as passive dependents [13], the reality is that the majority of refugees have had comfortable lives, where they might have been a professional or run a successful business. Despite their skill sets refugee communities are consistently under-estimated and under-utilised in the construction of their own shelters. In 2015 Alexander Betts, Louise Bloom, and Nina Weaver published a paper on refugee innovation. The paper pays homage primarily to the skills, motivation, creativity and drive of refugees. Looking at examples from around the world the paper demonstrates refugee adaptations to the aid they are provided with in order to meet cultural and individual needs, often making the materials work harder and go further than the original designer had intended [14]. Lionel Beehner's essay '*Are Syria's Do it yourself Refugees Outliers or Examples of a new Norm?'* looks at refugee adaptations to provided shelters, observing the case study of Za'atari Camp in Jordan. The paper argues that the more common than not adaptations to shelters in the camp were inevitable; that despite standardised aid distribution refugees will rebel against the uniformity [15]. When residents' demands of their housing change and they are no longer grateful for temporary shelter but in need of a temporary house or home, they will adapt their environment to suit. If a unit fails to meet users' cultural and individual needs they will make changes and additions to meet their personal standards.

4 Discussion: The case for customisable and adaptable solutions

Albounour suggests that temporary houses are not discrete products for mass production but cultural artifacts of special meaning to the communities that use them [10]. While he admits the need for construction to be as quick and affordable as possible it should do its utmost to encourage local participation. Evan Elise Easton-Calabria looks at the issue in a historical context, proposing that aid distribution to refugees before the second World War the United Nations took a Bottom Up approach. That the system was beneficial for both the refugees who learnt self-sufficiency and the host nations who gained from the trade and boost to the workforce [16].

[T]hrown almost naked on the shores of Greece, [refugees] have displayed such an industrious and active spirit that they are nearly all able today to earn their own livelihood without any help from the Greek Government or any other source. Refugees' 'morale and their scale of living rise visibly month by month, and their asset value to Greece increases in proportion to the decrease of their miseries'

(E. E. Easton-Calabria(2015):412)

To get around the high cost of transport a number of shelter designs have moved to a kit system, allowing for elements of the shelters to be more easily packaged and transported. The advantage of a kit system is that, although partially prefabricated, it is constructed on site, which allows for community participation. Which in turn helps create a strong identity relationship between the occupants and their new dwellings, a sense of ownership and a responsibility that one relates to home.

As such, combining the two common approaches of top-down and bottom-up solutions can be beneficial to both the stakeholders and the beneficiaries alike. Solutions that are partially prefabricated, but designed to allow self-assembly, flexibility and a range of configurations; can combine robustness and enhanced performance, with individuality and user participation. Such approach can also allow for the displaced people to be involved in the decision making and giving them a choice over the shape or feel of their new home. Yet offer a better built quality shelter in terms of its thermal performance, durability and built quality. Below we present the case of Zaatari refugee camp in order to demonstrate the likely benefits of such approach.

5 Case study: Zaatari refugee camp, Jordan

Al Za'atari refugee camp, 12km south of the Jordan-Syria border [17], hosts around 80,000 Syrian refugees making it the 4th largest city in Jordan and the largest Syrian Refugee camp [18]. In 2017 the camp has just passed its 5th anniversary; since opening on 29th July 2012 [19], Za'atari Refugee Camp has evolved from a handful of tents in the desert to a high functioning urban settlement. The camp's evolution, from tent camp into an urban settlement of some 80,000 persons reflects both the needs and aspirations of the camp's residents and a transition to a more predictable, cost effective and participatory platform for the delivery of assistance [19].

"In the Middle East, we were building camps: storage facilities for people. But the refugees were building a city."

Kilian Kleinschmidt [20]

Despite efforts to initiate self-sufficiency within other aid sectors the housing distribution is still based on a Top Down System of design and construction. The majority of structures in Zaatari camp are mass produced caravans. However, the majority of residents has made some form of adaptation or alteration to the caravans they were provided with (see figures 4, 5, and 6).

We surveyed 54 households in several districts in Zaatari camp and found that 92% of the families had adapted their buildings in one form or the other. These included building a side extension to the caravan (70%), enclosing between two caravan units creating a shaded courtyard (43%), creating an additional window (3%), and replacing the timber floor of the caravan with cement on gravel. These results are in line with UNHCR findings in 2014 [21] in which, 1000 of the 16000 surveyed shelters had structural modifications to the caravan itself however over 3,500 had new cemented courtyards between the caravans. These number are likely to have increased as UNHCR data shows that the oldest districts in Zaatari camp also showed the highest percentage of structural modifications to the caravans [22]. As such it is safe to assume that being in the camp longer gives residents a stronger motivation or means

to adapt their living conditions. Many of families interviewed stressed that what we were seeing was the result of several years of savings and step by step modifications.

The high number of adaptation demonstrates a camp-wide dissatisfaction with the provided shelter in its un-altered form. Adaptations to existing shelters could be seen as a signpost for inadequacies in the provided accommodations ability to meet cultural and individual needs. Adaptations simultaneously provide evidence of the skill sets and motivation of resident refugees to improve their living conditions. There is evidence in Zaatari camp that refugees did not only adapt their shelters out of necessity but also in the pursuit of creating a 'home'. Many of the adaptations made were aesthetic or decorative. This has transformed the camp from grid-like standardised caravan camp into an organic camp with each shelter having its own character and individuality. Such expressions innovation and independence should be encouraged. There is evidence that refugees would welcome an opportunity to work and are willing to take part in the construction of their homes. In November 2017, following an announcement the previous February that Syrian refugees living in camps could obtain permits to work anywhere in the country [23], UNHCR commissioned a survey to determine the skills sets of Refugees living in Za'atari camp. The survey determined that over 20% of male residents had experience in the construction industry. The survey also showed the value of training and willingness to work:

"When offered training 54% of female and 75% of male respondents would be willing to take up a job outside of the camp, and are also willing and interested in gaining any new skills that may open up avenues for employment." [23]

The survey strengthens observations that refugees already have the skill, innovation and drive to make them keen learners, eager to take on the opportunity to learn new skills. A combined system of Bottom-Up and Top-Down approaches to construction of shelters would make use of the refugees drive and skills, offer them training opportunities, allow them to express their individuality and improve their well-being. In addition, it will better guarantee that the shelters are hazard-free, robust and comply with local rules and guidance.

Figure 4: One man dismantled one of his caravans to build a new roof between the other two caravans, creating a living space with a ventilated roof to overcome the summer heat.

Figure 5: Improvised shading solutions and extensions. Notice sharp edges could be dangerous for children

Figure 6: Decorative elements helps create a feeling of a home.

6 Conclusions

Shelter solutions come in two main brands; top-down and bottom up. This paper discussed the pros and cons of each solution and demonstrated through the case study of Zaatari camp that a hybrid approach may be more appropriate. The case of Zaatari camp is proof that refugee camps are in need of more long term and readily adaptable shelter solutions. Zaatari's caravan shelters are not designed with adaptations in mind, as a result the architecture of adaptations and extensions to the shelters is hap-hazard and inefficient. The evidence suggests that despite a lack of framework for adaptation in the prefabricated shelters, the drive of residents to customise the place where they live is strong enough to overcome the rigidity of the shelter design. In order to achieve a higher standard of living and improve on the quality of the *provided* shelter. Refugees would no longer need to resort to expensive and inefficient methods to adapt their shelters if given the opportunity to be involved in the decision making and design their own shelters to meet their individual expectations. Thus, shelter construction might become more coherent and cost effective in the long term. With improved shelter solutions, adhering to cultural and individual needs, would come a return to relative normality and as such an improved psychological wellbeing amongst residents.

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A REVIEW OF COURTYARD ITEMS IN TRADITIONAL ANTAKYA HOUSES IN THE CONTEXT OF FUNCTIONAL FLEXIBILITY

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Abstract

In terms; flexibility is ability to adapt various conditions. Flexibility of housing is a concept that allows the users to make changes to response the different needs in time. At this point, traditional houses which has open-ended structure and unspecified spaces, are a successful example of flexible housing.

In this study; Traditional Antakya Houses which reflect principle of flexibility of spaces allow different functions and architectural elements that permit free use (courtyard/ havuş, sofas, etc.) are discussed.

The intention of this study is to reveal the expressions of flexibility in the traditional houses. So the courtyard which is one of the main architectural elements of traditional Antakya houses, is analyzed in the scope of functional flexibility. Functional flexibility express the structure which can adapt to different functions.

Four different plan types of courtyard houses that are selected from Antakya have been researched in this context. In addition to this, personal interviews were made with the users of the house about functions and demands of the courtyard.

As a result of the study, the changing functions, spatial usages and understanding the user's perspective about the flexibility of the courtyard Antakya houses are determined.

Keywords

Flexibility, Functional Flexibility, Flexibility Housing, Courtyard, Antakya Houses

1 Introduction

The house is a place where people spend the most time from their birth to their death. Also, housing is the place where people meet their basic needs. Flexible house is a sustainable house where people can respond to their changing needs and demands over time. At this point, traditional houses constitute an example of a flexible housing with multifunctional courtyards and functionally compatible rooms. The courtyard, which is the free space of

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human beings, meets the residents with its versatile and transformable features. Courtyard in housing contains different functions like sleeping, eating, socializing, making food, planting flowers in the garden, growing vegetables and fruits, having fun. Some houses with courtyards that have been restored in Antakya have been converted from housing units to hotels, restaurants, cafes, exhibition houses, museums, institutional units, religious buildings.

In this study, various functions of courtyard houses are investigated in general of Antakya and evaluated with versatility and convertibility parameters in terms of functional flexibility.

In the study, firstly, information is given about Antakya, then, explanations are made about Traditional Antakya Housing, Courtyard, Turkish Housing, Flexibility and Flexibility of the Courtyard and ultimately, the results of readings and observations, the existing and changing functions of courtyards are determined. The main aim of the study is to demonstrate the sustainable identity of traditional Antakya housing with the different functions provided by the courtyard.

2 Antakya and Study Area

Antakya is county located at the center of Hatay region which is at south of Turkey and east of Mediterranean with 12 districts. Antakya, covering 689 km², constitutes 13% of the province's surface area [1].

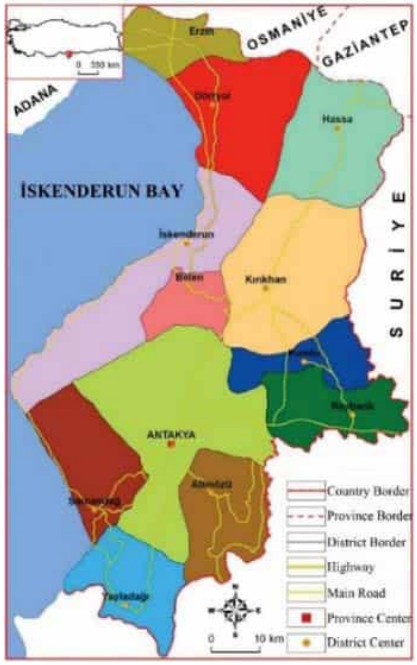

Figure 1. Location of Antakya [2]

Antakya is located at the beginning of the Lower Asi Valley between Mount Amanos in the north and Kel Mountain in the South. Also, city is located on the skirts of Habib-i Neccar Mountain at 440 meters height [3]. A border element in Antakya that divides the city into two parts is the Asi[3] River, the Orontes of the Ancient Age. On one side of the Asi River there are

[3] The Asi River passes through Antakya and is turned into a canal, about 2 km. length and 30-35 m. [3].

new building structures and on the other side there is the area where traditional Antakya dwellings are located, which is the urban-historical site area.

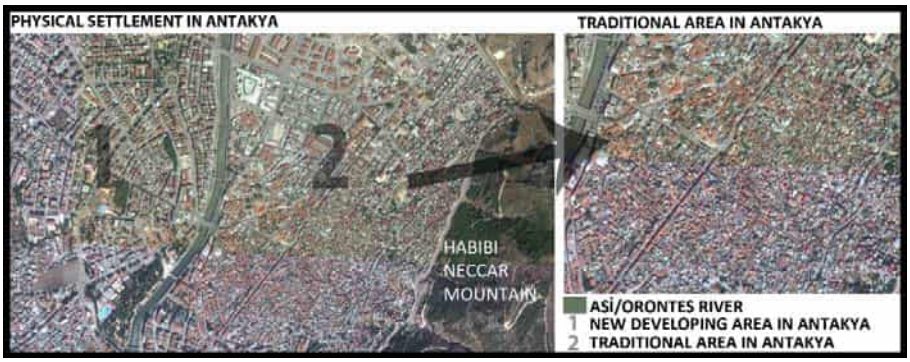

Figure 2. The physical settlement of Antakya [4]

In Antakya, which is under the influence of the Mediterranean climate, winters are warm and rainy and summers are hot and dry. In addition, one of the typical climatic characteristics of the Hatay Province is the dominant wind blowing in the South-West direction [1]. In Antakya, which is affected by the Mediterranean climate, the houses are built with courtyard and in a way that will take a dominant wind.

Antakya was founded around 300 B.C. [3]. Antakya has hosted many civilizations since its foundation. Antakya has been home to Hellenistic, Roman, Byzantine, Arab, Seljuk, Crusaders, Mamluks, Ottomans, French and Turkish cultures throughout history. Housing units in Antakya are blended with these different cultures. Hellenistic-Roman period's courtyard houses and the city walls are covered with non-open walls, narrow streets in the Ottoman period are examples of this situation.

3 Housing Concept in Antakya, Turkish Housing and Courtyard

The traditional Antakya dwellings examined in this study bear traces of Greek - Roman and predominantly Ottoman residential architecture. In addition, the items in the Turkish residential architecture resemble the Antakya dwellings. There are a number of rooms which open courtyards in the Greek residential architecture [5]. Then there is a type of house in Rome which has two interior courtyards, peristyle and atrium [6]. According to Schoenauer and Seeman, 1962, when entering the Roman house, a short corridor is reached from the outer door and courtyard is accessed from the corridor [6]. In Antakya dwellings, similar to this, the distance between the street and the courtyard is 1.5-2 m. covered and 2-3 m wide. There is a corridor in its length. So the courtyard is passed with a second door. 'Aralık' is designed to cut the direct relationship between the street and the courtyard [7].

Figure 3. Aralık and Antakya courtyard [8]

Ottoman and Turkish culture also influences the formation of traditional Antakya dwellings. According to Eldem, who worked on the plans of the Turkish house, the main elements of the Turkish house; sofa, rooms around the sofa and stairs [9]. According to Eldem, the most important feature that separates the Turkish house from the Western houses is that the rooms are opened individually to the sofas and the sofa creates the moving paths in the house [9].

Küçükerman describes the sofa in the Turkish house as an important space that collects the families together forming the new spaces by associating the rooms with each other and defines the room as a structure that consists of versatile functions like an independent house, but is shaped as a single space [10].

Eldem (1954) [9] divides the Turkish house into four divisions: outer sofa-inner sofa-middle sofa and without sofa. According to Erdoğan, Antakya dwellings have developed in the type of without sofa plan [6]. In two-storey houses, which are mostly single storeys, the development of the plan is based on courtyards [6]. According to Demir, the courtyard connecting the volumes in the traditional Antakya houses; [3] as the place of gathering and distribution. The courtyard, which connects the rooms together, is also a theme that needs to be focused on. According to Hasol, the courtyard is defined as a open top, closed area and is located the middle of a building or building group [11]. Factors shaping the courtyard design are climate, geomorphological structure and topography, socio-cultural structure, local material [6]. Due to the warm and humid climate of the Mediterranean as well as the cultural structure of the community and the need for security, the high courtyard walls in the houses reflect a life style in Antakya.

4 Traditional Houses of Antakya

In Antakya housing patterns, structure-courtyard-street association is adjacent. It is seen that the formation of this pattern is influenced by climate, safety need and cultural reasons. There are narrow and curved streets (some of them cul de sac) in the pattern and to houses are entered from these streets. Generally, the courtyard, which is located in the middle of the buildings, creates gaps in the city after passing through narrow streets.

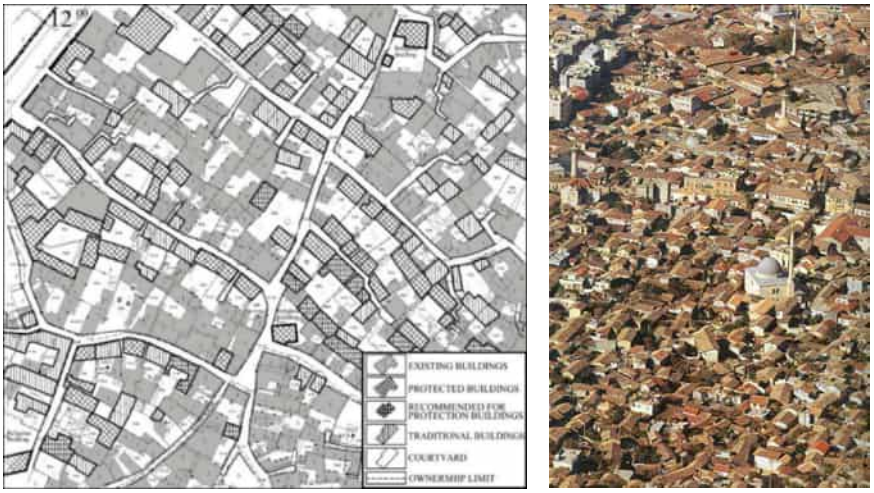

Figure 4. From left to right, the first picture is a Traditional Antakya pattern analyses example (The maps which are taken from Protection Implementation and Control Office in Hatay [12] and Metropolitan Municipality of Hatay [13] were processed for analyses by the author) the second picture from urban pattern in Antakya [3]

According to Temiz who has worked on about Antakya, the oldest houses in Antakya today are from the XIX. century [1]. The traditional, protected Antakya dwellings built in the 19th century developed in the form of a room and courtyard. In some houses only garden or courtyard-gardens can be found. The courtyard walls are generally windowless and functions in the housing or courtyard are not perceived from the outside. The courtyard, enclosed by the rooms, provides to take light and air to the rooms [3]. Usually rooms are located on one side of the courtyard, on the other side, service volumes such as kitchens, toilets and baths are settled [3]. The doors and windows of the rooms which are arranged around the courtyard, are opened separately [7].

Figure 5. Traditional housing and courtyard in Antakya [8]

The Antakya courtyards are called ‘‘Havuş’’ in local language. The havuş’s floor is sometimes covered with marble, tile mosaics or poured mosaics and generally with rectangular cut stones [3]. There are fruit trees such as orange, mandarin, grapefruit, lemon, citrus, pomegranate, loquat tree, banana, olive, mulberry [3]. The most important figurative element of the houses on the courtyard of the houses are the geometric or herbal stone carving arrangements that is making on ‘‘fanus and kuş takası’’ [1]. Demir [3] defines 'fanus takası' like cavities within the stone wall and usually put the lamp glass in order to brighten the courtyard. And Demir [3] indicates the sections that allow light to enter the front of the courtyard-facing rooms are also defined as 'kuş takası'. Apart from that there is a stairway leading to the upper floor spaces at

a suitable place in the courtyard [3]. The rooms on the upper floor are used as bedrooms, cellars, warehouses for crowded families [3].

Erdoğan, who had worked on the courtyard; Parcel-housing-courtyard relation in Antakya dwellings divided into two groups [6]:

- **Central courtyard settlement:** The courtyard is located in the middle of the building mass, the most commonly used settlement is surrounded by different volumes of houses from two or three sides
- **Interior courtyard settlement:** This settlement, which is located in the center of the courtyard and surrounded by buildings from four directions, is not very common.

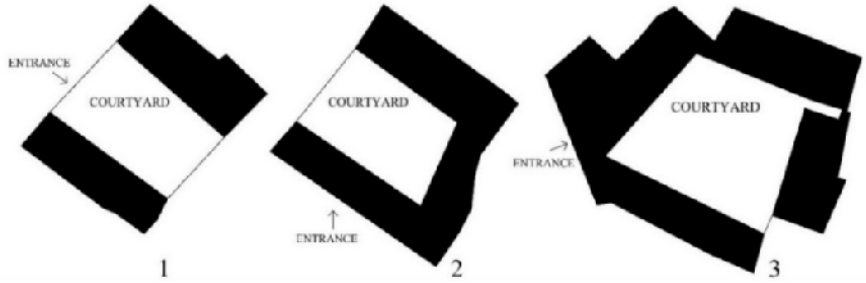

Figure 6. Examples of Central Courtyard (1-2) and Inner Courtyard (3) housing plan schemes in Antakya (Housing plan schemes were processed by the author on the basis of maps which are taken from Protection Implementation and Control Office in Hatay [12] and Metropolitan Municipality of Hatay [13])

Different functions can be made in the courtyards of Antakya dwellings. In the use of the courtyard for different functions, the items of courtyard play an important role. These items in Antakya houses are **well-bürke-seki-livan**.

The well located near the service volumes such as kitchen and toilet is one of the fixed elements in the courtyard [3]. Water is taken from the well and water is used in various works. The other fixed element in the yard is the fountain pools called local *bürke.* In accordance with the size of the courtyard, there is a *seki* on the corner [3]. Seki which is made of stone and sometimes covered, sometimes open on top, is a resting place and has a 45-50 cm high from the ground [7]. Seki, which is closed on top and is open to courtyard in front of, called the '*livan*' in Antakya [3]. Seki, which has multipurpose function is used as a living and dining corner in the daily life of the family, is the place where bride and groom sit at wedding [3]. These items in the house's courtyard is helping to occur different functions.

Figure 7. From left to right, respectively, well, seki, pool, soku stone [8]

According to Rifaioğlu who has worked on Antakya, while courtyards in Antakya dwellings are mostly used as storage areas in winter, the area where agricultural production is made by drying vegetables and fruits in summer [14]. Many red peppers grown in Antakya, dried in the courtyard of the house and then from these peppers are made powdered pepper or pepper paste. In addition, many olives grown in the region are collected and picked in courtyard. Also wheat and pepper are beaten in courtyard with '*soku*' stone [15]. This means that food production is made in courtyard and the courtyard supports agricultural production.

5 Flexibility in the House and Courtyard

Flexibility is defined as the ability to change easily according to the situation [16]. Flexible housing is a housing that can adapt to changing needs and models both socially and technologically. These changing needs can be personal (extended family), practical (age progression), or technological (retrofitting old services). The changing models can be demographic (single-person housing), economic (the creation of the tenants) and environmental (houses responding to climatic changes) [17]. Flexibility is an attitude towards rigid functionalism [18]. Therefore flexible housing should allow for the selection and personalization of individuals for multifunctional use of space [18].

The courtyard, which is a multipurpose space inside the building, is a slack place and gives flexibility to the house because of its potential to accommodate different functions. According to Jeremy and Till [17] slack spaces, (empty-stagnant space) are typically located outside the housing unit and are customizable by users. The courtyard allows different functions with its static and empty structure and provides functional flexibility in buildings.

6 Classification of Flexibility, Functional Flexibility and Method

The main topic of this study is the evaluation of the courtyard item on the basis of functional flexibility in Antakya therefore functional flexibility is explained in more detail. The concept of flexibility is classified according to different authors. According to Hofland & Lans (2005), [19] Dittert (1982) distinguishes flexibility in two groups: functional flexibility and structural flexibility. Then, Van Eldonk & Fassbinder, add to Ditteret's class, the concept of "character flexibility" which points to possible changes at architectural quality, facade or residential identity [19]. So according to Van Eldonk & Fassbinder, flexibility is divided into three groups: [20]

- **Spatial (Structural) Flexibility:** This flexibility not only relates to structural changes, but also to physical changes that occur indoors. Residents can change their homes according to their own preferences based on professional intervention.
- **Functional Flexibility:** The ability to change the current situation without professional intervention. It is based on to assign new functions to excess rooms and provides to change room functions and relationship between rooms.
- **Character Flexibility:** It allows to change the facade or identity of housing. It refers to the direction of the architectural quality.

In 2007, flexibility was classified by Al-Dakheel as functional, structural and cultural [21]. According to Dakheel, functional flexibility is the ability to exchange or interchange space function and the ability to separate the unit [21]. Functional flexibility is explained by the following components: [21]

- **Versatility:** Layout should allow spatial multiple use with minor structural changes.
- **Convertibility:** It is the ability to interchange spaces without making any structural changes.
- Ability to separate into two units and rejoin in the second stage.
- Pre-design service and utility areas for plumbing and electrical systems.

In addition to the findings of Al Dakheel and other researchers, Gilani [20] has addressed components such as flexible furniture, multifunctionality (the different function is in the same place at the same time) and adaptability to disabilities within functional flexibility.

These classifications and functional flexibility components are valid for both inside and outside of the space. The courtyard is an external space and functional flexibility are examined under two main title in this study. These are **versatility / multifunctionality** and **convertibility.** Evaluation of the courtyard in terms of these parameters, thanks to made the determination of today's function, interviews with users and photographic documentation techniques.

7 Examination of the Courtyard of Traditional Antakya Houses in Terms of Functional Flexibility and Findings

In this study, four types of traditional courtyards selected from Antakya were examined to understand the functional flexibility of the courtyard. Other houses which has different functions were also photographed. The four Antakya dwellings examined are examples of the middle courtyard type. These housings's courtyards can be accessed from both narrow and wide streets. In figure 8, number 1-2-3, there are no direct transportation to courtyard in buildings. From the corridor is reached to courtyard. In the case of the conventional housing used in figure 8, number 4, the courtyard is accessed through the courtyard door. In the courtyards there are usually items like seki, pools, trees, flowers, wells. In Figure 8, areas of the courtyards have 171 m2, 147 m2, 134 m2 and 84 m2 respectively. There are one and two storey room/rooms and wet spaces around the courtyard. The large empty spaces provided by the courtyard give functional flexibility. These buildings, which were used as houses in the past, are now being used as public buildings and residential buildings. These buildings are protected and mostly restored.

Figure 8. The examined Antakya houses (Housing plan schemes were processed by the author on the basis of maps which are taken from Protection Implementation and Control Office in Hatay [12] and Metropolitan Municipality of Hatay [13])

Apart from this, there are examples of houses used as restaurant-cafe-hotel-exhibition area-museum-religious buildings-public places in Antakya. In these buildings, the courtyard has many functions such as waiting, eating, seating, gathering area and entertainment area (Figure 9). This means that the flexible structure of the courtyard provides the sustainability of the building by undertaking different functions.

Figure 9. Functional flexibility of courtyard in Antakya. The eating area in Figure 1-2 [8], the gathering area in Figure 3 [8], the entertainment area in Figure 4 [8], the exhibition area in Figure 5 [8], the waiting-seating area in Figure 6 [22], the praying area in Figure 7 [23].

These traditional residences, examined by photographic and plan-based, have been evaluated as a result of observation and interviews (with users of courtyard in Antakya houses) in terms of functional flexibility. According to this:

A look at versatility / multifunctionality of courtyards samples examined: The courtyard in the Antakya housing is a place where people meet daily necessities (eating and sleeping), sitting and speaking with guests. From this point of view, the courtyard is the social environment of people. In addition, the courtyard is a place where family members come together in entertaining moments such as weddings, promises, and happy moments. Also, at the funerals, people gather again to share their sadness. In its most basic sense the courtyard, connects the rooms in Antakya dwellings and a transition element that is accessible to the top of the staircase. The courtyard, an area where people are cooling off under fruit trees, is also a place where people work. The courtyard is a place where vegetables and fruit are washed and dried. From this point of view, the courtyard boost trade by supporting agricultural production.

A look into the convertibility of the courtyards samples examined: Traditional courtyards that function as dwellings in the 19th century, today function as hotel-restaurant-cafe-exhibition house-museum-resting places-public institutions-religious places. To summarize briefly, there are different functions of courtyards in buildings that have been transformed into functions other than housing. These:

- The courtyard function in public and institutional buildings host important meetings, symposium.

- The courtyard has functions like reception-waiting area-dining area in the buildings which have turned into hotels or guesthouse.
- In the buildings converted to restaurant, the courtyard is open spaces where people eat.
- In the buildings converted to cafe, the courtyard has become a social venue where people sit and speak, listen to music and have coffee.
- Some dwellings have been converted into religious buildings and have included functions for prayers in courtyard.

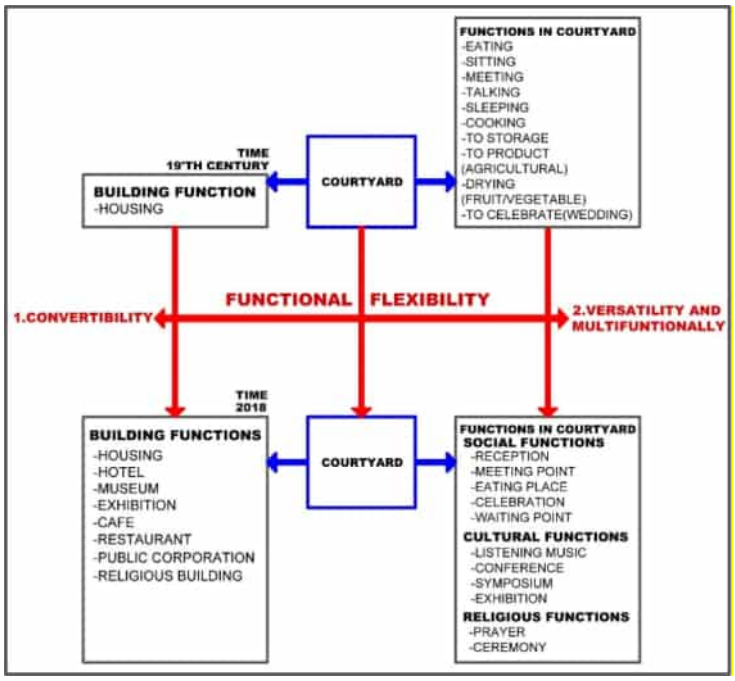

Figure 10. Analysis of Antakya Houses and Courtyards for Functional Flexibility

8 Suggestions and Conclusion

In traditional Antakya houses, the courtyard; is a unit that reflects local identity which has different functions and gives flexibility to the structure. The courtyard is suitable for versatile planning as it is located on the central area around the rooms. If assessed throughout Antakya, the courtyard item with a social or cultural function can be interpreted as an input of flexibility that allows the use and sustainability of the home. Thanks to this social and cultural function that the courtyard undertakes, today, apart from housing, other types of buildings, which have public and social functions within it, allow courtyard space to be used with different functions. The courtyard, which is identified with the sofa of the Turkish house and provides socialization, can be a reference to new building designs and can take different forms in housing designs. But at first, courtyard should protected with its original form. The municipality, architects, restorers, art historians, archaeologists and most importantly the public, should work together to restore unused houses to life with different social-cultural functions.

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PROJECTIONS AS MECHANISMS OF MEDIATION

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Abstract

Architecture is about the construction of in-habitable space. The aim is its physical presence, but *how* and *what* we build depend on *when* we build. In other words, the generation of space has a *History*, which is an extension of how we see ourselves in different times. It is a projection of our most inner desires and necessities. The history of space, as analyzed by Foucault, is the history of technology *[technologies of the self]* in which the practice of social relationships and the spatial organization that is produced is clearly identified over time. As we can see in the conception of formal characteristics of the house, for instance, an integral part of the social and political structure of the family. It is produced as specific responses to social phenomena, and they are exposed to other independent phenomena, defining future conditions to come. In this sense, we can argue that the problem of space in Architecture lies on the notion of *inhabiting* a time.

My explorations are based upon two particular notions. First, they are an attempt to investigate the interaction between Art and Architecture through representation of space in which different approaches carefully develop such relationship as a *symbiosis*. Drawing, painting, collage, assemblage, become *mechanisms of mediation* between architectural notions of space and their representation. They constitute different elements of interpreting the duality of *object and space*. The second notion is framed by an exploration of the relationship between architectural concepts such as light, shadow, projection, transformation, sublimation among others, developed on psychological perspectives, particularly Carl Jung's theories, in which both coexist in a series of dichotomies such as *order / chaos, individual / collective; subject / object; rational /irrational, conscious / un-conscious.*

Art and Architecture operate on common foundations. Architecture first exists as representation**.** Its ultimate purpose is to exist in the physical world where it can be experienced as a manifestation of certain social conditions. There is an interesting intersection of multiple aspects that are considered part of both Art and Architecture. We must understand how the creative process generates a certain attitude that defines a particular thinking approach to be able to frame it within our specific context. In the creative process we must recognize two aspects: what is produced by an Architect / Artist as a consequence of an awakening of ideas and the impact on their conscience, and the particular visions and concepts derived from his / her direct interpretation. These ideas are the motivator principle that underlies in all created forms. Every form is a symbol and every symbol is thus the external-visible expression of an internal and spiritual reality. The present paper is part of an ongoing investigation which is

developed in my first-year architectural design studios.

1. Notions on Architecture, Art, and Academia.

Contemporary cultural congestion defines the individual experience, at the beginning of the 21st century, as a result of coexisting with a series of dichotomies such as: global / individuality; subjectivity / inter-subjectivity; rationality / irrationality; end of history / genealogy of history, individual / particular ethics, etc.
Fundamental works of Architecture and Art, those which still have a place in historic memory despite the time elapsed since its construction, are those who managed to integrate the spirit of its time with tradition and cultural specificity, those who managed to merge established tectonic and spatial values with individual creativity, and created a dialogue of coincidence of local and foreign aspects, new and existing conditions, merging the present and the past at a particular moment.
Architecture is generated from a series of interlocking events from different social levels, and being an Architect involves a global awareness of the movement of these events. Making Architecture means, among other things, to articulate the different dimensions of society at a particular time.
Octavio Paz says …" *To be truly modern, we must first encounter our tradition* …" [1]
It operates at different levels, it is a discipline that combines experience, image, concept and use, and by definition merges the outside projection of image with interior, psychological space and the notion of collective.
One of the conditions inherent in being an Architect is the search for innovation. It is there where much of its spirit exists within the condition of a globalized world. The Architect must be an enhancer of ideas at all levels and a visionary, that projects into the future meaningful concepts that become concrete realities, not only as visual constructs, but also as social fabrications.

2. Architectural space / social space

Teaching Architecture / Art in general terms, should be guided by ideas that reflect different aspects of contemporary cultural, social and technological phenomena, in which links between academia and society can be established. From the global nature of contemporary practice and the increase of the necessity on sustainability, to integrating digital design and fabrication to the tradition of design thinking. These new conditions represent a singular point of view regarding the relationship between Architecture with other disciplines, as an interwoven three dimensional fabric of vertical and horizontal elements, which generate the process of transformation of space, - *the social*. Exposure to visions that allow questioning aspects regarding an approach of teaching Architecture / Art and consequently the production of space, is one of the premises proposed in my experiences in design and art studios and theory, which aim to be a place of exploration and invention, as a kind of *theatre* where the Creative process and culture are put on *scene*, in which the role of Architecture and Art and their learning process is questioned in terms of the elements and strategies that generate them.
This on-going research project is an investigation on how they define individual and collective

space. Such questioning is based on the idea that architectural education is not an autonomous discipline which is only concerned with the plastic and artistic issues contained within the process of generation of space, but rather, as a result of understanding it as a consequence of historical, social, economical, political and technological conditions and their manifestations through the specific and autonomous process of design. That is to say, from the essence of architectural process and its singularities, to what is considered in many cases, the periphery. This research explores what occurs on the periphery with the idea of questioning and testing what is assumed at the center of the discipline. Heidegger talks about the limit as the place where something begins to be present, rather than the place where it ends. It is also the place in which juxtapositions with other disciplines occur. This inter-textuality has the potential to reaching a kind of self-criticism or self-reflection relative to our profession. A self-look to the process of generating space and to its basic underlying suppositions is not possible through the self-gratifying tendency of pure formal exercise, but, on the contrary, it is made possible through the discovery of the conflicts and contradictions between the autonomous requirements of the discipline and concrete demands of society.

Architecture is about the construction of in-habitable space. The aim is its physical presence, but *how* and *what* we build depend on *when* we build. In other words, the generation of space has a *History*, which is an extension of how we see ourselves in different times. It is a projection of our most inner desires and necessities. The history of space, as analyzed by Foucault [2], is the history of technology *[technologies of the self]* in which the practice of social relationships and the spatial organization that is produced is clearly identified over time. As we can see in the conception of formal characteristics of the house, for instance, an integral part of the social and political structure of the family. It is produced as specific responses to social phenomena, and they are exposed to other independent phenomena, defining future conditions to come. In this sense, we can argue that the problem of space in architecture lies on the notion of *inhabiting* a time.

Our times are characterized by a series of occurrences that signify new ways of *thinking, communicating, being, making;* which can't be classified using traditional notions of existence. Foucault refers to these unclassified occurrences as *Heterotopy* [3] and J.L.Borges makes a reference to them in his "Chinese encyclopedia". [4] So then, architectural space, the space in which social occurrences take place, is intimately linked to what kind of elements for classification are available on a particular time for our use and characterization.

Architecture in its broader sense is embedded in a very particular situation since it is the only discipline that by definition combines concept and experience, image and use. It is a *hybrid art* which its heterogeneous definition [inhabited space-social phenomena] makes it a singular discipline, an event *par excellence* **.** It is capable of containing a place for the *Shock [as referred by Walter Benjamin]* a place for the invention of ourselves, to be separated from reality, and at the same time, to encounter it, the place in which differences that characterize us are combined *here and now.*

Architectural visual culture of our time exists bounded by a fixation with appearances, surfaces, and instant visual impact. David Levin calls it a "frontal ontology" which describes the prevailing frontal and focused vision. It defines a kind of *retinal Architecture* as Juhani Pallasmaa conceptualizes our time as controlled by an *ocular bias.* He develops the subject as *"…the ocular bias has never been more apparent in the art of Architecture than in the past 30 years*

as a type of architecture aimed at a striking and memorable visual image, has predominated. Instead of an existentially grounded plastic and spatial experience, Architecture has adopted the psychological strategy of advertising and instant persuasion. Buildings have turned into image products detached from existential depth and sincerity…" [5]

Architecture is being conceptualized through what mass-media is determining as culture. Mass-Media, based on S. Chase's definition, consists in the group of technological inventions which amplify a message generated on a determined individual or group, allowing it to be perceived by millions of people "*more rapidly and noisy*".[6] The contemporary tendency of architect's and architecture is to be part of the world of architecture as mass-media in which *Instagram*, *Face Book* and *the web* is the ultimate goal. Renato de Fusco in his book "*Architecture as Mass Media*" put forward the idea that architecture is part of the systems of communications that define culture not only from its functional aspects, but also as a container of image/meaning. Prof. Mark Jarzombek analyzes how modern society is determined by what he calls *data exhaust* - an invisible anthropocentric ether of ones and zeros - as a consequence of " *our digitally monitored age*".[7]

3. on Visual Perception of Space

The perception of space, in its general conception, in which all the senses operate to establish a connection with the person, defines an essential part of the way social interactions happen. It is the higher-order of a process of integrating, recognizing, and interpreting complete patterns of sensations defined as *Exteroceptive* in which all the senses participate in recognizing stimuli generated outside the body. Visual perception constitutes a fragment of the process of perception.

Architectural space is the frame for social activities, hence the importance of understanding the connections between the singularities of perceiving space and the kind of programmatic consequences of these singularities. *Visual perception of s*pace consists on the continuity of different fragmented experiences [*to address the cubist and Futurist approach]* which determines a partial understanding of the object/space perceived. In other words, the perception of architectural space is conformed by a collision of interpreted three dimensional images on one single mental construct as a consequence of a dynamic interior / exterior *promenade.* In a similar way, the concept of "*Situationist space*" suggests that the perception of urban / architectural space depends exclusively on movement through space and time. Guy Debord defined such experiences as "*Spatializing actions*" or *Derives.* In his publication "The naked city", [8] Debord and the situationist apostates criticized the traditional and utopic way of analyzing the space of the city through what they considered as "pure structure" [langue] without individualization [parole] represented by the map [plan]. In other words, the process of perception of space is not incorporated into the two-dimensional representation [seen from nowhere]. The observer perceives reality through vision and the other senses. Visual experience consists on a series of potentially chaotic input of information from the outside. Ideas of objects and events in the world are not copies of external reality, but rather, are the consequence of an interactive process that occur within the subject where they suffer operations of juxtaposition, inhibition and merge with other simultaneous ideas. "…*the mind does not reflect truth, but rather it extracts it from a continuos process of collision and perceptions, which generate a re-formulation of the experience*"… *an individual reality.* [9]

4. Projections and the creative process

Art and Architecture operate on common foundations. *Architecture first exists as representation***.** Its ultimate purpose is to exist in the physical world where it can be experienced as a manifestation of certain social conditions. There is an interesting intersection of multiple aspects that are considered part of both art and architecture. We must understand how the creative process generates a certain attitude that defines a particular thinking approach to be able to frame it within our specific context. The notion of Art can be interpreted in two ways. First, it is an idea that everything that is developed with dignity in the making can be considered Art. When we talk about the devotion and high quality of any work, then it can be defined as an artful piece. In Architecture, we can talk about "*a work of Art* " when certain aspects of a particular building are above and beyond our expectations. I am particularly interested in a second interpretation, which constitutes the classical understanding of architecture as part of the École des Beaux-Arts, based on greek tradition, in which architecture stands along with Drawing, Painting and Sculpture further developed by the BauHaus in Germany. One of the most interesting aspects of the school after it moved to Dessau in 1919, and separating ourselves of the political implications, is the notion of creating a new kind of artist capable of reaching a higher balance between the beaux-arts and the skilled exercise in making. Gropius wanted to remove the distinction between the *pure* and the *applied* through new methods of teaching.

Art is a concept that encloses all creations in which a sensible vision, either internal or external of the world have been developed. It is a vehicle that allows ideas, perceptions and emotions to be re-presented through plastic [visual or not] resources. Architecture is the interaction between reason and emotion. Everything that is part of the architectural process is a consequence of these two forces. *Reason and emotion* create a discipline that is the result of both right and left parts of the brain acting together in a singular motion. Pop artist Roy Lichtenstein defined art as "*organized perception is what art is all about*…"

In the creative process we must recognize two aspects: what is produced by an Architect / Artist as a consequence of an awakening of ideas and the impact on their conscience, and the particular visions and concepts derived from his / her direct interpretation. These ideas are the motivator principle that underlies in all created forms. Every form is a symbol and every symbol is thus the external-visible expression of an internal and spiritual reality.

C.Jung talks about it in his "Modern man in search of his soul" …"*nothing influence more in our conduct as intellectual ideas. But when an idea is the expression of a psyche that has manifested itself in different regions of the globe separated and with no historic relation, such as East and West, then we must deepen the subject. Said ideas represent forces that are beyond logical justification and moral sanction, being always much stronger that the man and his brain. He thinks that he molds those ideas, but in reality, they are responsible of molding him and make him its unconscious interpreter.*."[10]

The un-conscious is formed by a series of individual and collective aspects that interact simultaneously. In the un-conscious operates an inherited cultural component, a mental matrix that gives form to our way of perceiving and interpreting the experiences that define us as individuals. The collective pre-existing information that lies in all of us are the Archetypes. Jung proposed that Archetypes are nature's vehicle to ensure continuity in social terms. We don't develop as isolated entities, but rather, we exist in a cultural context in which information and thought schemes are transmitted or inherited from generation to generation.

From the individual point of view, *the Mother, the Hero or the shadow*, for instance, are Archetypes as emotional patterns of conduct which define and mold our responses, perceptions and interpretations of reality. Based on Jung's ideas, they represent a kind of container in which they exist as collective un-conscious information to give meaning to our experiences.
Symbols and myths that appear to be in every culture are a signal that all human societies think and operate from a pre-existing cognitive and emotional basis that does not depend upon individuals particular differences and experiences from birth. Archetypes are recurrent patterns of images and symbols that emerge under different forms throughout cultures.
Architectural thinking is defined by Archetypes as any other human behavior. Architecture is a projection of our most inner desires in a juxtaposed process that involves the overlapping of the collective unconscious and the individual interpretations of reality. The representation of space in painting, sculpture or architecture is defined not only by the interaction between specific internal factors present in the author, but also by particular social processes as consequence of the historical reality in which they are submerged. Drawing and representation have the potential of signifying a mechanism of mediation between the notion of space as a visual construct and as a multi sensorial artifact and its interpretation in the observer which can generate a different kind of communication in a more absolute link according to the level of complexity involved in such relationship.
The concept of projection in western culture has been present for centuries. The first form of physical projection is the Shadow and it was an object of interest in greek mythology developing the *shadow theatre* to project sacred visions of the world in what is known as the Eleusinian cult. The shadow was also a sacred object in asian culture and hindu generating different manifestations as meditation tools.[11] In Eleusis mysteries shadows were projected on the walls as part of the religious rituals. Plato was inspired by these visions who practice the greek religion and the western iconic development was born from this cultural origin. In Platonic theory, the projection is the bases of human thinking. Our experience, what is real and imagined, all is projective. We live inside our own individual and collective projections. Getting out of them or recognize them is the key to reach a higher level of conscience. Gestalt theories also recognized the projective nature of perception and the subjective essence of our perception as well which determines our reality. The Platonic concept of projection is embedded in early christian philosophy. Form is also a projection. The iconic-approach in our world was developed during the Renaissance. The iconism during this period originated a cultural hypertrophy with the proliferation of mimesis and the reproduction of images which also is related to the development of mechanical reproductions of images such the *camera oscura* and optical illusions to be later transformed into photography, cinema and television.

5. Architectural drawing as a mechanism of mediation

Contemporary culture of immediacy and control, of simultaneity and displacement produces inevitably an architecture of vision, of instantaneous impact. There is an understandable fascination with digital technology and visualization of the architectural object. It possesses an infinite number of benefits concerning the development of the architectural project. However, computer imaging tends to generate a simplification of our extraordinary, multi sensorial

and simultaneous possibility of imagination by transforming our creative process into a passive manipulation of visual experience. Digital technologies tend to base the understanding of space through perspectival manipulation. This happens today especially in our schools. Architecture students tend to understand the design process as the learning of particular programs and applications, and as the immediate experience of self-gratifying visual objectives, rather than focusing on a more haptic sense of design thinking and cultural specificity.
Pérez-Gómez has said that the distance between architectural drawing and building has always been opaque and ambiguous. He analyzes how Vitruvius,for instance, understood the drawing as a minor part of the practice and how during the renaissance, architect's drawings signified a symbolic intention to be fulfilled in the built space while remaining an autonomous object of representation. [12]
In Art and Architecture, there is an exchange of emotions and associations between the work and the observer that depend on specific experiences and particular interpretations. A work of architecture is not perceived as an isolated collection of images, but rather, as an integrated haptic series of perceptions and emotions. Architectural space is the place in which physical structures, tectonic elements and external perceptions are overlapped with internal images and symbols, conscious and un-conscious mental sensations that, together, create a coherent experience with specific meaning. Rather than producing objects of visual seduction.

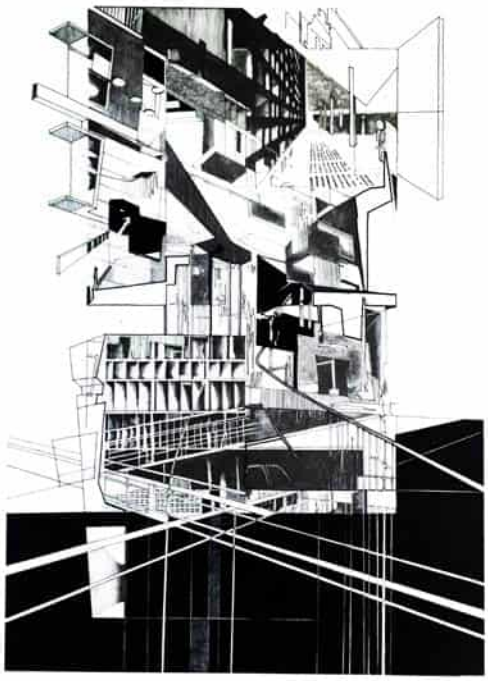
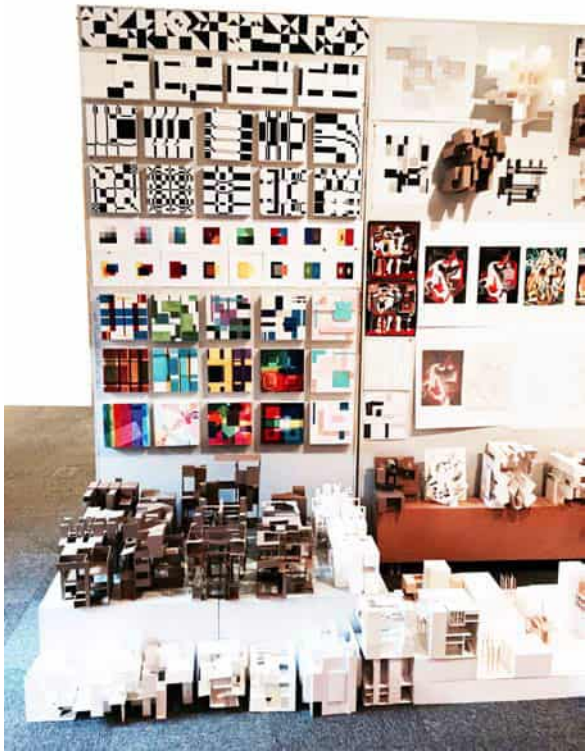


Figure 1.**Work by the Author.** Title: *Sublimation Series #25. 2015***.** Hand Drawing / Pencil + Ink on mylar. 24"x36". It is part of my investigation on the interaction between Art and Architecture through the representation of architectural space. Drawing, painting, collage, assemblage, become *mechanisms of mediation* between architectural notions of space and their representation. It is an exploration on the duality of *object and space*. Furthermore, it is also an exploration of the relationship between architectural concepts such as *light, shadow, projection, transformation*, etc., developed on psychological perspectives, particularly on C. Jung's theories, as a series of dichotomies such as *order / chaos, individual / collective; subject / object; rational /irrational, conscious / un-conscious.*

Architecture with capital A confronts and mediates space and meaning. spatial frame of reference and human experience.
The *haptic* [13] promote a sense of intimate perception, a proximity of sensations in the body. Pallasmaa defines the haptic as "*the touch of the eye*". In his appreciations, the historic development of the different techniques of representation of space are intimately linked to the generation of architectural thinking. They reveal and limit our understanding of the essence of space and its implications by framing the spatial operations. Digital visualizations tend to operate as existing in mathematical space rather than an existential and human cultural space. The development of perspective during the renaissance generated a perspectival tradition and an understanding of an exclusive visual space and a fixed singular perception. We build what we are able to understand and conceptualize as a visual construct.



The superficial forms, the aesthetic use of symbols, archetypes imbedded in marketing or the cult of the self on social media are mechanisms of projections. In this case, the archetypes represent the shadow. Jung tells us about the existence of projective activity in creativity, imagination and fiction. Art and Architecture are human activities and they need to be analyzed from a psychological perspective to understand the essence of the discipline. The artistic experience is not a rational experience nor is a totally conscious process. From a phenomenological point of view, art [and architecture] captures the beholder and the artist who creates it. Drawing can represent a mechanism of projection between the unconscious and reality. The unconscious and the archetypes constitute the origin of the artistic [architectural] experience. Art is generated from the soul and this soul embodies the universal, all cultures in all times have the same experience in relation to the artistic phenomena. The artist [architect] represents the instrument that produces the symbol and its interpretation in a particular reality constitutes the artistic projection.[14]. It is the focal point of this investigation developed in my first-year design studios and it needs to be approached from within our academia in which the design studio becomes the place for exploring and reconciling the self.

Figure 2. 3- First semester Design studio. Phenomenal transparency, the perception of space, color and emotional responses in the interpretation of representation.

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ARCHITECTURAL DESIGN AND / OR SUSTAINABLE BUILDING: A QUESTION OF LANGUAGE?

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Abstract

Achieving peer acknowledged excellence in architectural design is widely considered to be the pinnacle of achievement for any practicing Architect. Indeed, at the heart of the learning outcomes of any architectural education is an emerging notion of what Architectural excellence is and indeed, notably, this includes knowing how to speak about it. Thus, conveying the professional skill of understanding and knowledge of architectural design language. Living alongside this is the widely acknowledged need for the built environment broadly - and buildings specifically - to respond to the environmental, economic and social requirements of sustainability. This apparent dichotomy of approach has brought about a schism in design practices, whereby sustainable buildings are largely perceived as worthy, pragmatic; but perhaps soulless, while outstanding architecture remains something 'other'.

This paper aims to explore the languages involved in describing and discussing excellence in these two diverging fields, with an aim to find a nexus between them, resulting in a refinement in architectural practice that might enable Sustainable Design Excellence to become the norm rather than an exception.

Keywords

Design process, Sustainability, Language, aesthetic, design excellence

1 Introduction

Sustainability has become a key motivation in most forms of policy (local [1], national [2] international [3] levels) and many forms of development; providing as it does a lens by which to consider what is meant by appropriate human advancement for the 21st century and beyond. When carefully considered it provides a framework by which to consider the equity of current and future actions across its three pillars: social, environmental and economics. It has long been seen that the role of architects and architecture, in designing and enabling the delivery of quality in the built environment, from building through to urban scale, aligns directly with the ambitions of sustainable development. Indeed the Royal Institute of British Architects (RIBA) strategy 2016-20 defines their purpose *'To serve members and society in order to deliver better buildings and places, stronger communities and a sustainable*

environment' [4]. In this context it can be seen that, at least theoretically, excellence in both architectural design and sustainable practices are central themes in the language of the profession. However, through the recent formation of the 'RIBA Commission on Ethics and Sustainable Development', which is tasked with considering how *"the architectural profession can best reflect its core values of public interest, social purpose and sustainability"* [5], it can be seen that the institute acknowledges that despite its integrated vision for design, the reality is somewhat different. Indeed, it will be argued here that the challenge to produce a synthesis between the two fields of architectural design and sustainable performance will require fundamental changes in education, practice and most importantly in the language that we use to evaluate and describe excellence. Confidence in a distinct language is core to Architectural education, and as is the case for all professions; it is one that enables practitioners to identify with each other, but also ensures that students are equipped to discuss and debate design, not least to enable its betterment over time. Here at its heart lies the need for a fluency in the language of space, concepts and qualities; language that, alongside drawing and imagery, is at the heart of communication during the design process, is indeed itself a design tool. Meanwhile, the theory and practice of sustainability has evolved its own lexicon, that speaks of environmental impacts and wider sustainable performance of buildings. It is argued here that these two languages have, as yet, not successfully merged, indeed that the language of sustainable buildings, and its evaluation, is to some extent mutually exclusive to that of architectural excellence and its associated evaluation.

Whichever design paradigm an Architect is focused upon, the pursuit of excellence is, for each the ultimate goal. However, as will be shown, the language of excellence currently applies two different lenses. This paper argues that a synthesis of language is required in order to enable pursuit of an effective nexus – Sustainable Design Excellence. Therefore, this paper aims to explore the extent to which there is an absence of reference to each other's language within the alternative lexicon of excellence. Thus leading to lack of capacity to effectively engage with either sustainability or design excellence. Indicators which characterise the two fields of Architectural Design Excellence (ADE) and Sustainable Practice Excellence (SPE) will first be defined and then this paper seeks to explore the potential for producing a synthesis of design language, such that, Sustainable Design Excellence might become a common goal.

2 Methodology

In order to undertake this work it was first necessary to establish definitions of excellence currently applicable within each field, in the context of the design process. Although three phases were initially studied: 'Pre-Design', 'Design & Construction' and 'Post Occupancy Evaluation', this paper focuses on the first two phases; that address six of the seven stages of the RIBA plan of work, a framework applied in most built environment development projects [6]; as well as to assessment tools applicable in each of the fields, including BREEAM, LEED and Open House for SPE and the Design Quality Indicator for ADE. Additionally, while the Post Occupancy Evaluation phase, is acknowledged as vital to the delivery of sustainable performance, the potential offered through synthesis discussed in this paper has begun to be successfully addressed elsewhere (Soft Landings [7] and Green overlay to RIBA's plan of work

[8]). The literature relevant to each of the fields was then synthesised in order to establish evaluation frameworks, requiring the identification and definition of themes and indicators.

2.1 Defining Architectural Design Excellence (ADE)

ADE is a *"tricky issue"* which is very difficult to define, yet it's achievement is the goal of the industry [9]. Compounding this difficulty is the fact that many of the aspects are of a qualitative and ethereal nature; and ideas of architectural quality, excellence and style can be interchanged and conflated. This research used as its starting point the most developed definition of design excellence in the UK context, the "Design Quality Indicator" – a questionnaire which is used to rate quality [10]. In order to broaden the scope of the definition to also include architectural education and review through competition, descriptors of quality from Centre For Architecture in the Built Environment (CABE) and the design council, (including design review criteria [11], and the value handbook [12]) the QAA subject benchmark standards for architecture [13], RAIA award core criteria [14] and RIBA good design definitions [15] were added.

These sources were assimilated and repetitious elements were deleted to arrive at a list of 178 indicators, divided into Pre-Design and Process (19 indicators), Design and Construction (122 indicators) and Post-Occupancy Evaluation (60 indicators: including 23 from the Design and Construction phase which need to be re-evaluated at POE stage).

2.2 Defining Sustainable Performance Excellence (SPE)

The SPE evaluation framework was largely derived from a sustainability assessment tool that was developed as a part of an EU project "Open House". The aim of this project was to *'to develop and to implement a common European transparent building assessment methodology, to develop and to implement a common European transparent building assessment methodology'* [16]. Unlike many sustainability assessment tools, such as BREEAM and LEED, that focus on environmental factors, almost exclusively, the project strived to establish a holistic tool, that considered sustainability in terms of environmental, economic and social factors as well as to consider the sustainable performance throughout the development process, including the processes for their delivery.

During the process it was decided to remove those factors that would be likely to be beyond the control of the architectural designer. This included factors related to the site itself, as typically the design team is not able to influence the selection of a site for a new development. Further, factors relating to the supply of water and its disinfection were also excluded, as all buildings in the UK are required to have adequate connection to potable water. In order to consider the extent to which this theoretically derived framework (Provided by Open house) addresses those factors that are broadly acknowledged to be representative of holistic sustainable practice excellence in existing developments, the thematic framework provided by the well respected publication by Dr Paola Sassi (2006) Strategies for Sustainable Architecture [17], was used as a sense

check to realised case studies. This comparison resulted in the addition of an indicator related to design for climate change adaptation.

Following the synthesis of these sources, including deletion of repetitious indicators, a final list of 81 indicators were arrived at for the SPE evaluation framework. As with the ADE definitions, these are divided into Pre-Design (9 indicators), Design and Construction (41 indicators) and Post-Occupancy Evaluation (31 indicators).

2.3 The nexus analysis methodology

Table 1: ADE and SPE Numbers of Indicators per Phase

	ADE	**SPE**
Pre-Design	19	9
Design and Construction	122	41
Post Occupancy Evaluation	60*	31
TOTAL	**178**	**81**

It can be seen that there are many more ADE that SPE indicators. This is likely due to two main factors: firstly, that they come from more numerous sources which have each attempted to define the same issues, though often in subtly different ways; secondly, it can be argued that many of the factors tackled in relation to ADE are more difficult to define, qualitative factors such as those relating to quality and delight; rather than quantities as is the case for many of the SPE indicators. The variation of the distribution of these indicators within the development process is also of interest, with the preponderance of each lying with the Design and Construction phase; while higher proportions being within the pre-design and POE phases for the SPE framework.

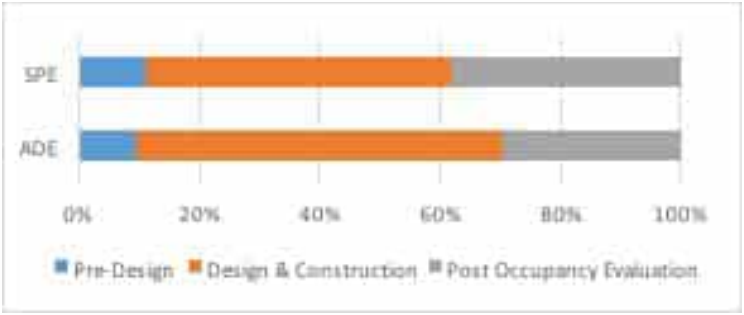

Figure 1. Proportions of indicators per development phase

This distribution of SPE indicators could be described as enabling the honing of a complex system, while those associated with ADE support the delivery of a broad contextual approach to building design.

As an approach to maintain objectivity in this qualitative analysis process, one author focussed upon the definition of ADE and its themes and indicators, while, the other's emphasis was on SPE. Then, comparative analysis of the two resulting evaluation frameworks were undertaken by each author and finally, these were cross-checked in combination to arrive at a robust 'nexus' of their meaning and language. In this way each

author became the 'champion' of a field; ensuring the minimisation of bias, assumptions or preconceptions in both the creation of the frameworks and the nexus analysis.

3 Outcomes

The outcomes of the analysis phase discussed below present both the similarities and differences in the content and language used in the ADE and SPE in the two stages of Pre-Design and Design & Construction. Thus, in this section, the authors aim to explore:

- the relationship between SPE and ADE themes and indicators,
- those SPE indicators that have no equivalence in ADE and
- those ADE indicators that have no equivalence in SPE.

As a result of this analysis we aim to understand the role of language and frameworks for excellence in understanding why 1. architecturally excellent buildings are not also sustainable and 2. why sustainable buildings are rarely considered architecturally excellent.

3.1 Pre Design

The SPE evaluation framework identified just 9 broad indicators in this phase, while the ADE suggests 19. The relationship between the themes for these indicators is summarised in the table below. This suggests unique and valuable aspects of excellence at this phase within both the ADE and SPE as well as considerable overlap in their contents.

Table 2: Relationship between SPE and ADE themes in the Pre-Design Phase

	Process of Team Selection	Site Selection	Stakeholder Consultation & Engagement	Design Quality & Excellence	Appropriate Procurement Route	Emerging Concept & Design Philosophy	Client Needs, Budget & Viability	Promote opportunities for innovation
SPE	X	X	X					X
ADE	X			X	X	X	X	X

For SPE, the integration of relevant indicators into the process of team selection is vital within this Predesign phase; whether this be through traditional routes, including within the client brief or within competition documentation. This need is also reflected in this phase for ADE where design quality indicators call for the selection of an appropriate interdisciplinary team, chosen through appropriate methods and that results in: '*a team with a genuine understanding of sustainability issues, and a commitment to a project which is sustainable when taken in the round*' and *'a client committed to sustainable development, both in the long and short term'.* Importantly, the ADE adds to this phase, the need for consideration of broader team credentials: *'a professional team with the appropriate range and level of skills for the demands of the project'.*

In SPE, the second group of indicators relates to the process and factors by which the site for development is selected. With access to public transport, services, the reuse of buildings or land and avoidance of geological, contamination flood or others risks such as radon are avoided or their impact minimised. While the third theme is associated with consultation and engagement with stakeholders from an early phase. Neither of these sets of factors are addressed at this phase for ADE, where the remainder of the factors

are associated with the following design quality and excellence factors: *'have adequate amount and quality of thought applied for the demands of the project'* and *'have evidence of and measures in place to ensure a commitment to excellence'.*

The ADE also raises the need for the consideration and selection of an appropriate procurement route, which is perhaps a surprising oversight in the SPE given the known strengths and support that certain procurement routes offer to sustainability as a factor of quality [18]: '*be grounded in a clear set of ideas about how the project will be procured & delivered', 'have a clear procurement process route, with competitive process where appropriate'* and *'have a procurement process which ensures that the design intentions are carried through to the finished project'*

Of great significance to the difference between ADE and SPE at this phase is that the ADE indicators call for the design team to already: *'have evident underlying principles, values, core ideas and philosophy'*; to have defined the architectural concept and philosophy and thus ensuring that this is evident at this early stage. Interestingly ADE also includes a range of indicators associated with client needs and the need to set a clear programme of work early on as well as a feasible budget and ensuring that the project is viable. Further, that taking advantage of opportunities for innovation should be a part of the design process, even at this early stage. Although absent at this phase for SPE, this latter factor might be seen to be associated with two indicators that were placed within the design process phase for SPE within the sub section: Integrated design and planning: *'multidisciplinary & early formation of teams'* and *'design charrette processes'*. Whereby, the early formation of the design team and the use of design charrette processes core to the interdisciplinary design process are known to promote the uptake of design innovation [19].

Within the pre-design phase, the ADE framework also included the following indicators that can clearly be associated with sustainable thinking, but that are not made explicit within the formal sustainability evaluation process at this phase: *'has a client/brief in which it is recognised that good design can contribute to efficiency for the building's users'.* Which is widely acknowledged as a key business case for social sustainability thinking in the built environment [20]. While the following ADE indicator: '*has a client committed to value rather than lowest cost and to the importance of whole-life costs'* can also be considered core to sustainable economic principles, [21], but is again absent at this phase for SPE.

Generally, it can be seen that while the ADE includes reference to sustainability, albeit using different language and perhaps therefore measures of success, its focus is on instilling design concept, budget and procurement issues, whereas the focus of SPE is on site issues and the sustainability credentials of the design team. This perhaps can be argued to infer adherence to the explicit factors raised within the ADE which map directly to sustainability thinking. Although, it is equally arguable that their absence in the SPE framework, may lead to their absence during this phase of the design process.

3.2 Design and Construction

In relation to the design and construction phases, it appears likely that the following relationships are explicit at the level of themes for the Sustainable Practice Excellence (SPE) and Architectural Design Excellence (ADE) Frameworks:

Table 3: Relationship between SPE and ADE themes in the Design & Construction Phase

			Architectural Design Excellence Themes:							
			Brief: function / use / programme:	Health & wellbeing:	Transport: Movement & Access:	Context & Site:	Materials	Performance in design & use	Cost / Value / Budget	Culture / Image / character
Sustainable Practice Excellence Themes:	Environmental	Energy:		X				X		
		Lighting:		X				X		
		Materials					X	X		
		Water						X		
		Site Design			X	X				
		Waste					X			
		Consider climate Change Adaptation						X?		
	Social	Accessibility			X					
		Education								
		Community		X		X				
		Health & Comfort		X				X		
	Economic	Building costs							X	
		Building Performance management						X	X	
		Opportunities for Employment								

At the level of themes, it can be seen from this comparative overview, that the ADE themes of Brief and Culture appear to have no direct mapping against the SPE themes. While the SPE theme of "Opportunities for Employment" and "Education" also appear not to be found within the ADE. This comparison will now be undertaken at the level of Indicators, firstly from the perspective of the SPE's Environmental, Social and Economic sub-themes; followed by discussion of those indicators for which there is no synergy found in each framework.

It can be seen from table 4, that the relationship between the SPE **Environment** and ADE indicators in terms of a broad distribution is similar to that anticipated at a theme level. However, this more detailed level of analysis has revealed a more intricate and complex distribution of this relationship than the themes alone would suggest. Whereby, the ADE Energy theme has the most equivalence of indicators, followed by Site Design, Waste, Materials and Lighting.

Table 4: SPE Environmental Indicators & Number of ADE Indicators per Theme

SPE: Environmental		ADE Themes								
		BRIEF: function / use / programme:	Health & wellbeing:	Transport: Movement & Access:	Context & Site:	Materials:	Performance in design & use;	Cost / Value / Budget:	Culture / Image / character:	Total
Energy:	1. Energy Efficiency Strategies - Thermal - Fabric including air tightness		2				6			8
	2. Energy Efficiency Strategies - thermal - Passive design		2		2		7			11
	3. Energy Efficiency Strategies - Systems		2				7			9
	4. Renewable Energy Sources						2			2
Lighting:	1. Daylighting strategies		1				4			5
	2. Light Pollution						3			3
	3. Efficient artificial lighting systems		1				3			4
Materials	1. Minimise need – Consider materials dimensions / build small	1				1	1			3
	2. Renewable / certified					1	1			2
	3. Local					1	1			2
	4. Low Impact (eg: Air / water pollution in source / manufacturing)					2	1			3
	5. Design for Delight - desirability					2			1	3
Water	1. Minimise Use – systems and education						3			3
	1. Efficient Use – systems and education						3			3
	2. Alternative source – grey or rainwater						1			1
	3. Waste water treatment									0
Site Deisgn	1. Sustainable Transport: Access to public transport / Minimise car dependency / Enable Pedestrians and Cycling		1	8	1		2			12
	2. Ecological Value of Site: Previously developed & / or low ecological value & protect & enhance value				1					1
	3. Develop at appropriate high density	1			1					2
	4. Sustainable drainage									0
Waste	1. Reuse of buildings / materials					1	3			4
	2. Minimisation in construction					1	3			4
	3. Design for deconstruction					3	3			6
Adaptation	1. Design to consider climate change adaptation				2		1			3

In relation to SPE ***energy*** indicators that relate to fabric design, air tightness, passive design strategies and renewable energy sources: these were found to relate to ADE

themes of Health, Context and Performance and indicators in terms of: health, for the design to consider occupant's thermal comfort; performance, for the minimisation of heating, ventilation and cooling, with coordination of systems and the achievement of energy efficiency, reduction of CO2 and emissions as well as to achieve a positive impact on the environment and to deliver a layout which takes account of solar orientation so that internal and external spaces benefit; context, to have appropriate orientation, prospect and aspect and to consider the local microclimate. Largely these factors compliment the pragmatic, high level SPE indicators, operationalising their meaning for designers. However, the indicator seeking minimisation of ventilation may simplify this aspect to the detriment of effective health comfort, while the implicit nature of references to renewable energy design in the ADE indicators, may result in reduced attempts for their integration into the fabric whether at construction or in the future.

In relation to SPE ***Lighting*** indicators that relate to daylighting strategies, light pollution and Efficient artificial lighting strategies: these were found to relate to ADE themes of Heath and Performance and indicators in terms of: health, to provide sufficient and quality daylight and artificial light; and performance, has a layout which takes account of solar orientation so that internal and external spaces benefit, is energy efficient, reduces CO2 use and emissions, uses as little energy as possible. Here, daylighting and artificial lighting considerations are reasonably similarly considered, with the important addition of the word "quality" within the ADE framework which is absent within SPE. While, although implicit in the ADE discussion of efficiency, light pollution, and its important impacts on local flora and fauna are not explicit here.

In relation to SPE ***materials*** indicators that relate to the minimisation of need for their use as well as the sourcing of local, low impact, renewable, certified and finally their role in the aim to 'design for delight': these were found to relate to ADE themes of Brief, Materials, Performance and Culture and indicators in terms of: brief, where there is a call for the building to be of appropriate size, with consideration of net to gross sizes; materials, considering the use of materials wisely and responsibly, the consideration of the composition of materials, the use of good quality materials, that have a pleasing material form; performance, that reduces CO2 use and emissions; and culture, that calls for a building that has a pleasing form / is beautiful / gives delight. Here, the consideration in the brief only addresses part of the issue, where the sizing of building elements can be related to material sizing, also to reduce waste. In relation to ADE materials indicators, again, material quality and composition here provides a complementary commentary against the expanded environmental impact agenda addressed more thoroughly by the SPE indicators. Finally, both ADE and SPE, despite slightly differing language, consider the key role that materials play in the resulting design quality 'delight' of the building.

In relation to SPE ***water*** indicators that relate to minimal and efficient use in terms of systems and education as well as alternative sources and waste water treatment: these were found to relate to ADE theme of Performance in terms of being energy efficient, reducing CO2 and emissions, using as little water as possible and having a positive impact on the environment. For this theme, it can be seen that, apart from the indicator relating directly to quantities of water, the other indicators relate only implicitly to water and its impacts and design implications in the built environment. Further, for waste water treatment, there are no equivalent indicators in the ADE. This theme, therefore

represents a significant weakness in the ADE in relation to sustainable water design. It could be suggested that water strategies have little potential to impact on building design, although the Phillip Merrill Environmental Centre (2001), Annapolis, USA, by the Smith Group suggests otherwise.

Figure 2. Phillip Merril Environment Centre: Designed Integration of Water Systems

In relation to SPE ***site design*** indicators that relate to access to sustainable transport, the protection or improvement of ecological value, appropriateness of density and sustainable drainage: these were found to relate to ADE themes of Brief, Health, Transport, Context and Performance indicators in terms of: delivering a realistic brief in relation to the site; Health, that the development promotes health communities; Transport, that the development opens up options for moving through the wider area, makes a positive contribution to the way people move around a place, has good access to public transport, can contribute to improving public transport links, has adequate and appropriate car parking, has good wayfinding and signposting, promotes sustainable transport and provides for cyclists; context, it is informed by analysis and understanding of the investigation of the nature of the site's context including patterns of movement as well as physical characteristics, has a landscape design which makes sense as a response to the nature of the site and its context and does not propose more development than the site can reasonably take; and for Performance, reduces CO2 use and emissions and uses as little energy and water as possible. It can be seen again that there is reasonable synergy in the discussion of sustainable transport and the appropriateness of density, whereby the full synthesis of these indicators would result in a stronger and greater specificity in understanding of these themes for designers in terms of design excellence. However, in relation to ecology, despite implicit consideration in ADE of the landscape design context, the importance of ecology is not explicit. While for site scale sustainable drainage, this factor is not addressed at all in ADE. Although there is some likelihood that this would be encouraged through the legislative planning process, where necessary, this may not result in its appropriate and design quality led integration into the development.

In relation to SPE ***waste*** indicators that relate to the reuse of buildings and or materials, the minimisation of construction and the concept of design for deconstruction: these were found to relate to ADE themes of Materials and Performance and indicators in terms of: materials, considering demolition/recyclability, encouraging their use wisely

and responsibly and calling for the consideration of the composition of materials; and for Performance, the reduction of CO2 use and emissions and the use of as little energy and water as possible. It can be seen that ADE indicators lack explicit mention of design for deconstruction or the reuse of materials or buildings, both incredibly impactful on waste from construction. While, ADE does consider future recyclability of materials in the context of demolition and design focused qualities, consideration of composition of materials and their responsible use. Again, there are considerable benefits in the definition of Sustainable design excellence to be achieved through the synthesis of these two frameworks.

Finally, in relation to the SPE theme of ***adaptation,*** *its* indicator calls for Design to consider climate change adaptation: this was found to relate to ADE themes of Context and Performance and indicators in terms of: Context, has appropriate orientation, prospect and aspect and considers the local microclimate; and performance, responds to climate change. Here, again the SPE indicators in relation to this more quantifiable issue, are perhaps arguably more explicit, as ADE's performance that responds to climate change may be interpreted in terms of mitigation rather than a design response that speaks of responsiveness to future climates. Again synthesis of the two frameworks is likely to improve the holistic nature of design responses to these challenges.

Following this discussion of the relationships between ADE and Environmentally theme of SPE at an indicator level it is now necessary to consider those environmentally associated ADE indicators for which the SPE offers no equivalent indicators:

In relation to ***Transport Movement and Access***, 2 ADE indicators must be considered: firstly 'has adequate and appropriate car parking'. Although this was found to be related to SPE: Site Design, Site transport above, it should be noted that it is likely that its interpretation in the two contexts of design excellence and sustainable practice will likely differ. An ideal Sustainable Design Excellence (SDE) framework would therefore require a more explicit call for reduced reliance on motorized transport. Secondly, 'safe for goods': this is not considered in SPE and could be incorporated into any future SDE.

In relation to ***Materials***, 8 ADE indicators must be considered further: the use of appropriate materials; the consideration of the construction of materials; the promotion of safe construction; the consideration of: the coordination of fittings, orientation of materials and colour and textures; that the building and its materiality is well resolved and that it as a whole contributes to innovation/develops new knowledge. While it can be argued that the promotion of safe construction is explicit in the CDM regulations and as such does not require explicit mention in a framework for design excellence. Many of these other indicators speak of other factors: coordination, orientation, colour, texture, relationships, holistic resolution; that are not explicitly addressed within the SPE. Indeed, such material qualities are often central to the language of architecturally excellent buildings and their absence in the SPE is to the potential detriment of the overall design quality of sustainable practice. Further, it is easily argued that quality and resulting longevity and user 'love' for a building is central to long-term sustainability.

In relation to ***Performance*** in design and use, a further 5 ADE indicators must be considered: has a design which matches up to the brief; is physically sound and works as intended; has an efficient structure; is well detailed (structurally); and is fire safe. Of these, the need for fire safety has, unfortunately, been strongly highlighted by the recent

Grenfell tower disaster. While the importance of the other factors highlighted here, can again be interpreted as factors relating to design quality; in terms of both functionality and detailed design, which although not directly related to sustainable performance, certainly hold relevant in terms of an ideal Sustainable Design Excellence.

A comparative analysis at the level of themes for the **Social** SPE theme again suggests a similar distribution within the ADE framework, as illustrated in table 3, with (SPE to ADE): accessibility mapping to transport; Community mapping to Health and Context; and Health and Comfort mapping to Health and Performance; and education finding no comparable theme. While, undertaking the comparative analysis at the level of indicators, as presented in table 5 below, again reveals a more complicated, multifaceted relationship; interestingly, at this detailed level there are some ADE indicators which can be related to Education, despite the absence of an overarching ADE Education theme.

Table 5: SPE Social Indicators & Number of ADE Indicators per Theme

SPE: Social		ADE Themes								
		BRIEF: function / use / programme:	Health & wellbeing:	Transport: Movement & Access:	Context & Site:	Materials:	Performance in design & use;	Cost / Value / Budget:	Culture / Image / character:	Total
Accessibility	Inclusive barrier free access			1						1
Education	Promotion of sustainable lifestyles: Including ease of operation		1				5			6
Community	Participation: identify and engage with stakeholders / encourage ownership / enhance			3	2				7	12
	Enhance Quality of Life		3	1	4			1	3	12
	Provision of & accessiblity to facilities	1			2			1	1	5
Health & Comfort	Occupant Health - Minimise internal air pollution		4							4
	Noise Pollution		2							2
	Restorative environment		3							3

In relation to the SPE ***Accessibility*** indicator: inclusive barrier free access; this was found to have direct equivalency in meaning and in language to ADE indicator: to provide inclusive and accessible access to all.

In relation to the SPE ***Education*** indicator: promotion of sustainable lifestyles, including ease of operation; there are 6 ADE indicators which correlate with this concept in terms of the themes: health, providing healthy communities; and performance, ensuring that the building has good coordination of operable, reliable, systems with minimal controls and a plausible cleaning and maintenance routine. The ADE indicators are vague in terms of what a healthy community might look like, but, perhaps unexpectedly, have many technical descriptors for the usability of the system. Whilst these ADE indicators are numerous, they are of a technical building systems nature and not explicitly related to building users or their lifestyles, nor do they relate to an overall educational theme; this may be because architects consider the promotion of certain lifestyles so intrinsic to their role as designers that this issue is not overtly referenced.

Comparison of the SPE ***Community*** Indicators, relating to Participation: identify and engage with stakeholders /encourage ownership / enhance identity, enhancing the quality of life and Provision of & accessibility to facilities; revealed a complex relationship across 6 of the 8 ADE themes. This comparison, reveals that both ADE and SPE indicators have a strong emphasis on the importance of building identity and its relationship to the wider community, including accessibility and integration with site context and in making a positive contribution to community fabric and users. ADE indicators also talk of less easily quantifiable concepts; such as lifting the spirits of users. Here, relevant ADE indicators are *'outward looking'* (in terms of the building) and, unlike

the SPE indicators, provide some means as to *how* these aspects might be achieved, for example, being liked by visitors, safe for people, enabling participation in the life of the surroundings, having a relationship with the character of the context, encouraging investment in the surrounding community and improving the environmental quality of the context. The ADE indicators apply a richness of language in describing these qualitative concepts, that is perhaps unsurprising given the focus that architectural training gives to conceptual work. So, in synthesis the quality and richness of ADE's Indicators can provide qualitative depth to the more pragmatic SPE indicators.

In relation to the SPE ***Health and Comfort*** Indicators, relating to Occupant Health, Noise Pollution and Restorative Environment, the equivalencies in the ADE are all within the Health and Wellbeing theme. While there are pragmatic ADE equivalents relating to appropriate acoustics, air quality and hazardous environments, the language of the ADE indicators again makes reference to more quality based concepts such as improving the quality of life, reducing stress, providing better and healthier places to live and use.

There are a number of ADE indicators which have no direct equivalence in the SPE, one within the Health theme: providing appropriate spatial quality and the others within the Context and Site theme; site masterplanning, future development, historical context of the site, urban design analysis, views and landscape design. These again relate to questions of quality and design concepts, which provide parameters that inform design excellence.

This comparative analysis of the Social indicators has found that both the ADE and SPE indicators broadly evaluate the same issues, though some with more explicit emphasis (Education theme in SPE) and others in greater detail (e.g. the numerous ADE Community indicators). As was the case for the Environmental theme, the language of the ADE provides a richness and depth to the SPE, as well as indications on how to achieve design excellence. Both evaluation frameworks are concerned with both building and community social issues, while, ADE indicators do so through a different lens and stronger focus on the wider site issues and SPE on education and user issues: ADE looks out to the site; SPE looks in, to the users: Both are important.

Finally, a comparative analysis at the level of themes for the **Economic** SPE theme suggested a similar distribution within the ADE framework, as illustrated in table 3, with (SPE: ADE): Building costs to Value; Building Performance Management to Performance and Value; and Opportunities for employment finding no a comparable theme. As was the case for Environmental and Social SPE themes undertaking this comparative analysis at the level of indicators, as presented in table 6 below, reveals a more complicated, multifaceted relationship, than was suggested through the theme level analysis.

Table 6: SPE Economic Indicators & Number of ADE Indicators per Theme

SPE: Economic		ADE Themes								
		BRIEF: function / use / programme:	**Health** & wellbeing:	**Transport**: Movement & Access:	**Context** & Site:	**Materials**:	**Performance** in design & use;	Cost / **Value** / Budget:	**Culture** / Image / character:	**Total**
Building costs	Life cycle costs vs capital cost				1	1				2
	Design for Maintenance					1	4			5
	Design for Longevity and flexibility	1				1	5			7
Building Performance management	Effective building handover	1								1
	Set building performance targets	1								1
Opportunities for Employment	Consider mixed use development	1								1
	Promote opportunities for local employment	1						1	1	3

In relation to the SPE ***Building Costs*** indicators: Life cycle costs, Design for Maintenance and Longevity and flexibility, these have equivalencies in the Brief, Context, Materials and Performance ADE themes. The Brief and Context ADE indicators make reference to: the plausibility of site planting schemes; the cost issue of building value; and to the adaptability of the building for future use. The Material ADE indicators call for: the use of good quality materials, but does not specify their maintenance, longevity or flexibility value. While the Performance ADE indicators refer to the building in a general way in terms of: low levels of maintenance, durability, weathering well and having plausible maintenance and component replacement regimes. The ADE indicators therefore deal with costs through reference to the building as a whole, rather than its constituent material components.

In relation to the SPE ***Building Performance Management*** indicators: Effective building handover and the setting of building performance targets; find some equivalence in the ADE indicators, though the relationship is incomplete; located with eth ADE Brief theme: the building being fit for purpose and working well; and having a clear, coherent and realistic set of aspirations and intentions. However, these fail to require the specification of building performance or to make reference to the building handover process, and as such they may be subject to wider interpretation than the equivalent SPE indicators.

In relation to the SPE ***Opportunities for Employment*** indicators: Considering mixed use development and Promoting opportunities for local employment; the equivalencies for the former are again vague, calling for a realistic brief in relation to the site; while the ADE indicators for local employment opportunities are more clearly stated, calling for the project to help to maintain the value of surrounding properties, and encourage investment, regeneration and new jobs and to participate in the life of the city/surroundings.

There is only one Value ADE indicator which has no direct equivalence in the SPE which relates to the project maintaining or adding to [building] value. The status of the client and their budget within the ADE was highlighted in the Predesign phase, and this emphasis is maintained here, with a focus on return on client investment. In general, the SPE indicators, therefore, define the economic indicators more specifically, with the focus of the ADE on general building performance and value for money for the client.

4 Conclusion

This paper has presented the creation and comparative analysis of two evaluation frameworks for two built environment paradigms: Architectural Design Excellence (ADE) and Sustainable Practice Excellence (SPE). This was undertaken in order to begin to understand the barriers that exist in terms of language, to the delivery of a synthesised architectural paradigm of Sustainable Design Excellence. Generally, it can be concluded that both ADE and SPE have strengths and weaknesses; and that both paradigms largely seek to address the same broad themes, especially addressing themes and specific indicators that each paradigm might not expect. For example, for practitioners within the SPE paradigm, it may be unexpected that user needs and building performance are reasonably well addressed within ADE; while for those working within the ADE paradigm, that the focus of SPE is not solely on energy and performance may be equally surprising. However, the focus/lens of the language for each is however fundamentally different and thus complementary. For example, for both paradigms,

site is key to excellence, but in very different ways; where the SPE unique lens, focuses on participatory practices for stakeholders, while the ADE relates more to character, culture and identity. Although identity is mentioned in SPE, it plays a minimal role in comparison to ADE where culture is the focus. What exists instead is a different and complimentary foci and an elegance, depth and proliferation of language, within the ADE framework, such as 27 ways to evaluate culture, image and character, that can only enrich a combined paradigm for architectural excellence.

A language of Sustainable Design Excellence (SDE) should therefore draw from both paradigms and create the nexus of a new language to deliver delightful, responsible and quality within a new framework for sustainable architectural design. However, in order to achieve this synthesis in practice, this new language and framework will need to be further defined, accepted and integrated into all aspects of professional including: education, media and importantly explicitly integrated into the pinnacle of architectural excellence, the criteria for national and international awards, such as the Stirling Prize.

5 Next steps/Future work

The next phase of work aims to apply the same analysis to the POE phase. Additionally, the authors will present at the upcoming PLEA conference in December 2018 on the evaluation of SPE in the context of the 21 winners of the RIBA Stirling Prize; as a proxy for ADE in current and recent practice. The ultimate goal in the authors work is to work towards an evaluation and understanding of the design processes associated within both ADE and SPE paradigms, as well as the processes of those practitioners already successfully delivering SDE; in order to promote and enhance the prevalence of Sustainable Design Excellence within architectural practice and the wider construction industry.

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THE METAMORPHOSIS OF THE LANDSCAPE: THE ADAPTIVE REUSE OF MARBLE WASTE

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Abstract

Every year, millions-of-tons of marble are generated from the extractive industries present in the quarries' area of the "Estremoz-Anticlinal", Portugal. However, only 9% of extracted marble is used because only this percentage is considered of "quality". This huge-gap, shelved in stone accumulations, designated by "*Escombreiras*" (quarry waste), creates a strong impact on the landscape and it cannot be disposed due to economic reasons. The developed research based on the concept of giving a new meaning to what is ordinary and of working with the waste rather than exclude it, *a-priori*, to preserve the historical and industrial memory of the place, not removing marble-waste from the context where it belongs. There will be a rethinking of the area through the reuse of the "*Escombreiras"* for the promotion of a new kind of ephemeron buildings inside. These interventions will be integrated within the surrounding landscape, ecology, geology and art, using interdisciplinarity as a key driver for innovation. The proposal allows to re-use the marble-waste in site and promotes the improvement of landscape in the area of Estremoz quarries.

Keywords

Mounds of rest; Quarries; Ephemeron; Reuse; Marble-waste.

1 Introduction

The largest marble explorations of Portugal are located in the Estremoz-Anticlinal, roughly 50 kilometers northeast of the city of Évora, in the central interior of the country. This geological structure, which has 40 km length by 7 km width, extends in a northwest-southeast direction, intersecting the municipalities of Sousel, Estremoz, Borba, Vila Viçosa and Alandroal (Fig. 1). The quarries only exist in the three central municipalities of the Anticlin: Estremoz, Borba, and especially, in Vila Viçosa where resides the highest concentration of material; this is the reason why this is know as the "marble triangle". The mentioned municipalities belong to the region of the Alentejo, which is well known to be a

region with extensive and hot summers, where the control of the water normally has been always crucial in the habits of their populations. Although the use of the water has been continuously rationed over the years, the areas close to the Estremoz-Anticlinal has always exhibited a great abundance of it because it is located inside a large aquifer named "Estremoz-Cano System". That characteristic favors a broad land use and the formation of farms, orchards, and gardens giving rise to a particular type of landscape, much greener, contrasting with its surroundings instead dominated by forestry and rainfed agriculture. Thus, the richness of the soil and the abundance of groundwater caused a specific agricultural activity, with an occupation of the territory that can be considered atypical in the Alentejo. [1]

At the same time, the core of the anticlinale is characterized by the presence of an enormous quantity of marble, which represented an advantage not only in relation to the extraction activity, but also to the concentration of the transforming industry (the "oficinas") in those three municipalities, which contribute to the economic development at a local, regional and also country level. Some examples are the "oficinas de canteiro", which are industries based on the production of pavement blocks, and the main "oficinas" that transform the larger blocks with better quality into ornamental stones for direct exportation. However most of the quarries export the extracted blocks directly to foreign countries or to the region of Sintra, near Lisbon, to be transformed into ornamental stone and after go to the international market. In this case the most significante add value go to other areas, outside the Alentejo region.
The well known extraction activity of the Alentejo marbles has started in the Antiquity. Certainly, it has not been developed regularly, over the years, but it has been intensified since the second half of the last century, with the introduction of new technologies that allow improving the efficiency, speed of extraction and amount of production. There has been a gradual substitution of natural energies (water, wind, and muscular strength) by new steam, diesel and electrical energies. In this way, it was created a real modern industry, mainly concentrated in the Municipality of Vila Viçosa, as well as the majority of the "oficinas" previously described, becoming medium-sized enterprises that export their products also abroad [2].

The continuous opening of many quarries gave rise to a landscape of high industrial concentration that has partially overlapped the agricultural landscape (initially unique) full of vineyards, olive groves, cork trees and cereals. On the one hand, industrial activity brought improvements to the economy of the area in a first long period; on the other hand, it has also contributed to the degradation of the site since, after stopping the extraction work, the disabled quarries were neither properly closed, as claimed by the legislation, nor adding any value from the patrimonial point-of-view; also, some quarries were disabled before any legislation was produced and now deal with property issues with the Portuguese regulator.
This artificial landscape is a witness of an intense work of extraction during centuries, although only a small portion (about 9% as said before) was sold by commertial reasons; they are related to the small medium dimension of the blocks due to the intense fracturing the rock related to a long and intense geologic/tectonic history of the region. The karstification of the marble, mainly in the most superficial levels is also an important and random feature that can affect the previsibility, quality and management of the exploration, largely increasing the quantity of waste material. Moreover, aesthetic aspects such as the

presence of spots drastically reduce the commertial value the stone making it almost unusable. In short, everything is reduced to the use of the stone simply for ornamental purposes, since this Has been the only profitable use of these marbles. The extraction is very intensive and the size of each permit for exploration is very small in area due to ancient family distribution of land; the consequence is that innumerous quarries are characterized by extremely deep depressions (up to 150m, in depth, in some cases), with vertical walls of white, pink and green marble, flanked by huge piles of residual stones and waste that take the name of "*Escombreiras*" containing a large quantity of material which is durable and can be used for several centuries (Fig. 2-3a-3b-3c). Although the existing legislation, by obvious technical reasons related to the vertical and deep walls, as well as to the small area of each quarry hole this almost prevent any gradual environmental recovery either during or after the end of the exploitation.

Fig. 1. Territorial classification
Source: PROZOM

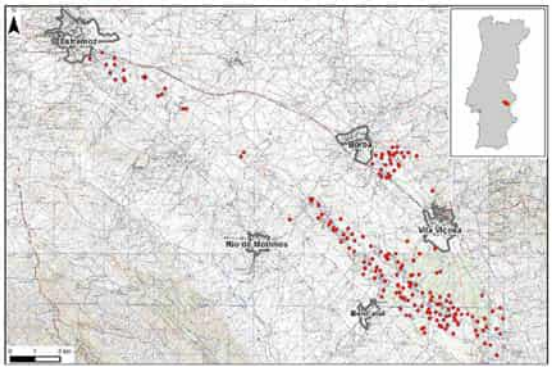
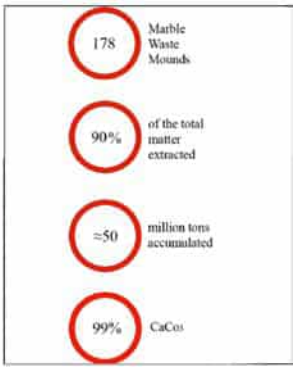


Fig. 2. Individualization of the location of the "*Escombreiras*"
Source: Carta Militar de Portugal folhas 425, 426, 427, 439, 440, 441



The main problem is that this marble is used only in small amounts as by-product (e.g. for building use, road paving materials, production of artificial aggregates, soil pH correction) and, the rest of it, still remains there to "deface" the landscape, since it cannot be disposed, elsewhere because it is not economically fisiable. In fact, the costs that can be added either in relation to the transport of this residual material to landfills, nearby or far away, or in relation to the work of the individual manufacturing operators, are considerable, since in the region there are very few and small industrial facilities related to the use of the marble waste as by-product.

Given the depth of the excavations and their strategic position ("Estremoz-Cano System" Aquifer), the water, in the abandoned quarries, is always present inside them, creating artificial lakes, spontaneously colonized by endogenous plant and animal species that nidify in those places (Fig. 4a-4b-4c). These are factors that, in general, despite the apparent industrial appearance, contribute to give a pretty aesthetics to the area. However, at the same time, also cause environmental problems. In fact, beyond the water pollution, one finds that, in the dry season, the stone dust, produced in active quarries, floats through the air, depositing on the vegetation, nearby crops, causing low soil fertility due to the excess of the alkalinity, destroying the vegetation cover and, consequently, the landscape. Finally, in a brief reference to the health of the people, marble waste can create dangerous working

conditions if the waste mounds are stacked in a caotic way, since the associated dust may cause respiratory, ocular problems and skin irritations. [1]

Fig. 3 (a) Mounds of rest (b)
Autor: (a; b) Paulo Caetano

(c) Fig. 4 (a) Quarry (b) (c)

Autor: Katia Talento

2 Literature review

Despite the disadvantages caused by the consequences of the mineral activity, the landscape of the Estremoz-Anticlin is considered as a testimony of an industrial activity with a considerable significance and as a dynamic cultural heritage, created and feeded by the hard work of many generations of men.

Intending to have a wider and more creative vision, we can claim that these abandoned installations of the marble industry have left us, not only hardship, but a huge potential as well for their reuse and their refunctionalization. There are many publications concerned with this problematic which propose ideas for the reuse of the residual material. Its applications are so many, spanning from the glass, chemical, pharmaceutical, environmental, agricultural, plastic, steel, metal, textile construction industry to public works [3]; [4]; [5]. The few applications that can lead to a large (big) consumption of this waste material are those oriented to civil construction industries, for the production of lime and cement, for calcining acid soils in the agriculture sector, for the composition of bituminous mixtures useful to road constructions and aerodromes in the civil engineering sector [6]; [7]; [8]; [9].

Furthermore, it is also possible to find the concept of reusing the marble waste in the architectural field. In this, it was claimed that it is possible the use of residual stone for different products, at different scales and in different sectors, such as, the architecture for

the production of structural walling and laminated modules for bioclimatic construction, and the urban design for the construction of furniture items as found (o verified, noticed) through the design and the construction of a kiosk-lantern located in the municipality of Villa Viçosa, and through the conceptual project, not materialized, of the Marble Foundation and of the CECHAP (Study Centre for Culture, History, Art and Heritage) headquarters located in the same municipality [10]. In fact, it exists a very big interdependence between the marble production and the wastes accumulated in the escombreiras.

Another idea is to take advantage of these wastes during the work period when the quarry is active in order to avoid having artificial marble mountains, unused, which cause a strong impact in the landscape. This idea recomends to use, reuse or discard the marble leftovers for the creation of a new construction material denominated “Marcrete” (a fusion of marble and concrete) for applications in the architecture’s domains [11].
One of the problems derived from the marble extraction activity is either the quarries’ abandonment at the end of the extraction or, at the moment in which the operators realize that, the quarry itself, is not able to offer enough quantity of marble for continuous production. In this way, huge empty areas remain, in the “mutilated” landscape, without any use, to which a new utility must be given, to ensure that they fully integrate with the surrounding landscape, not simply being a place of abandonment. In the context of this topic, there are many publications and projects that show the redevelopment and the reconversion of abandoned quarries in working, relaxation and leisure places [12], but also in locations able to be restored as eventual controlled landfills [13].
In summary all prior art, with the exception of the quarries that obviously remain on site, treat the marble-wastes in the way that they are partially removed from the place and used elsewhere, outside the Anticlinal. So the problem required a different approach more linked trought the reuse of the stone landscape in the way to be possible creats a new landscape with mounds of rest.

3 Research questions

On the basis of the above-mentioned references, it is possible to observe that the theme of the redevelopment of the industrial area of the Estremoz-Anticlinal, has been repeatedly discussed, according to two different approaches. The first consists in working in the location (in the case of the redevelopment of marble quarries) and, the second, consists in working off-site, exporting the material of which the “*Escombreiras”* are composed (in the case of the reuse of marble wastes for their transformation in products with other utilities). On the contrary, the solution proposed in this paper, is innovative since, in both cases, it suggests to act exclusively *in situ*, therefore, not exporting any kind of material. It aims to leave everything as it is, but looking at it with different eyes, and seeing the “*Escombreiras”* not as imperfections to be suppressed or hidden, but having good potential for the development of the industrial area, which have their own entity and utility. They are "*traces deriving from the action of man that are transformed into signals and overlap with the genesis of the territory. To re-evaluate a site it is necessary to consider these signals, understanding the characteristics of the site and making the new system compatible with the existing one*” [14].
The developed research based on the concept of giving a new meaning to what is ordinary and of working with the waste rather than exclude it, *a-priori*, to preserve the historical and industrial memory of the place, not removing marble-waste from the context it belongs [15],

[16], [17], [18]. In this way, the "*Escombreiras"* not represent disturbing factors of the landscape but iconic elements of the stone territory because they provide a dynamic and changeable image coherent with the context and with the concept of the landscape itself [19], [20].

Therefore, the research questions associated with this work can be summarized as follows:

1) Will it be possible to redevelop the "stone landscape", previously mentioned, throught the use of existing forms and elements (marble materials and *Escombreiras*) to preserve the historical and the industrial memory of the place by means of a policy of the reuse, with interest in the waste in an interior economically unfavoured region?

2) Will it be possible, throught innovative strategies, to demonstrate the effectiveness of transforming a disused industrial landscape into an active and visited place having also an aesthetic value?

4 Proposal

This paper describes some of the embryonic issues of the ongoing research which propose, as a first approach and using the theories described up to now, to redevelop the territory under evaluation throught the construction of cost-controlled buildings inside the "*Escombreiras"* to provide additional economic resources to a country with strong financial limitations (Fig. 5). The plan is to have "ephemeral buildings" inside some of the existing "*Escombreiras"*, possibly equipped with connections to the adjacent abandonated quarries, which will change, dynamically, their appearance based on the arrival of new marble wastes. Therefore, they will be ephemeral because ephemeral are the "*Escombreiras"*, since they do not always have the same configuration and, on the other hand, they are directly proportional to the amount of excavation and waste. The more marble is accumulated, the more material is used in their construction and in their transformation into public utility buildings. The ephemeral theme has been examineted, in this case, according to a different point of view:

Will it be possible to speak about this concept having available a rigid and strong material such as the marble?

About that, the basic idea is not destroying the waste stacks to build everything from scratch, since the material for obvious reasons does not consent it. Instead, the idea is to reinterpret the variable spaces. As stated before, the constructions will be ephemeral both, in the landscape and in other types possible uses in the context of the inactive industrial areas, regardless of the construction material, which can vary in both, shape and appearance, either by addind or subtracting marble pieces to the outer casing and the plant (for example by changing the internal paths). The ephemeral concept also persists in consideration of the interconnections between "*Escombreiras"*, quarries and the external space. The creation of these interconnections will be influenced by the existence of the water factor, present in the marble quarries that, through its variable level, will impact,

continuously, on the variation (in time) of the buildings. In this way, they will become constructions with different uses and aspects in relation to the different seasons of the year.

Fig. 5 Rethinking drawings
Autor: Katia Talento

The ideia is to convert mounds of waste in real buildings having self-utility and self-identity. This concept leads us to think mainly in the construction methods of the referred buildings. How will it be possible to obtain empties inside an ephemeral mass formed by wastes piled in a caotic way?

To preserve the exactly existent position and shape of the mound of waste, a first approach could be "to aggregate" the marble waste, through an appropriate material (for example cement or concrete) creating blocks, with controlled dimensions, that may be disposed according to a given form. These will mark the external perimeter of the "*Escombreira*" under evaluation. The same stone blocks will be anchored to each other and,

simultaneously, to an underlying steel grid that will provide a greater resistance to the accumulation of residues. The construction process proceeds with the excavation operation (starting from the bottom) inside the "*Escombreira"*, gradually expelling the residual material for the creation of open and empty volumes. The excavated material will be positioned on top of the perimeter steel grid with an increased resistance, which, at the same time, will be contributed to stiffen further the created structure. This operation of "pull and put" will involve different configurations in the outer casing of the "*Escombreira"* (Fig.6). In this way, it will reinforce the ephemeral concept, previously mencioned, and it will savor the thematic of "not finished" already examinated by Leonardo and Michelangelo in ancient times, and by Frank Gehry in the contemporary age.

The ideia to build inside the mounds of waste, represent certainly, an innovative vision in the architecture sector. It is also true that, having an available area of 600 km^2, it is possible to start implementing this concept, to further develop it, and to continue spreading it into different directions, thinking to reuse the huge amount of marble waste also for different uses. It worth also keeping in mind the strategic position where the Anticlinal is situated, which benefits from some water abundance, due to the presence of the Estremoz-Cano aquifer System. Taking advantage of this richness, the second approach of the present research proposal, still in an embryonic way, the construction of useful elements for complementing the stone buildings. For example canals that favor the passage of water among different areas of the anticlinale and contribute to the development of the landscape system related with the "*Escombreiras"*.
The proposal answers to the two research questions, since the promotion and the construction of mutant buildings in an industrial and abandoned area, consents to redevelop the "stone landscape" throught the use of existing forms and elements (marble materials and mounds of rest), and to transform, at the same time, the landscape into an active and visit place having also an aesthetic value.

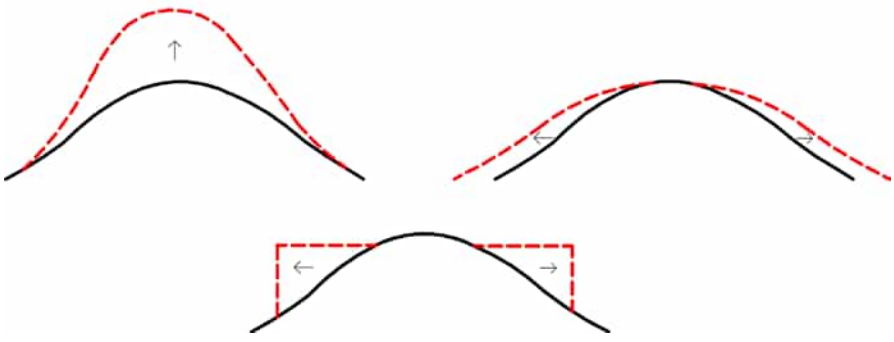


Fig. 6 Different configurations in the outer casing of the "*Escombreira*"
Autor: Katia Talento

5 Conclusions

This paper promotes the visibility to a environmental and landscape problem. The present research providing a new meaning to what is ordinary and working with the marble-waste

rather than exclude it *a-priori*. The proposed ideas rely on preserving the historical and industrial memory of the place, and it's historical landscape, by not removing marble-waste from the context it belongs. It was proposed and described a way of re-thinking the area through the reuse of some "*Escombreiras"* for the promotion of "ephemeron buildings" in their interior space. In this context, the situation that motivates us to investigate, is based on the conception that all the environment has been connected to a "project" that corresponds to the work to be developed in order to understand where efficiently place the marble wastes. In this way, one was faced not only with a simple industrial disposal but, in alternative, with a real architecture having functionality and aesthetic content in a industrial and natural landscape.

This landscape will continue to be industrial because, using the policy of the reuse in situ, it will preserve the traces, the signals in the territory and the memory of the place. It will be also natural because the area will acquire aesthetic quality through the reconversion of the mounds of rests in the dynamic buildings, but also through the rethinking of the total landscape in which the Mounds of rest and the quarries are located. In this way, it will be considered cohesion methods between the natural and the artificial that will merge together. In fact, some "*Escombreiras"* actually are colonized by a lot of vegetation, showing their intentions to adapt to the continuos mutations of the territory and to seek a contact with nature. Anticipating the future work, all the landscape will be revalued seeing the quarries and the "*Escombreiras"* as new topologies of habitats to prevent the loss of biodiversity, in a place subject to ongoing excavations.

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BRIDGES OF MEDIEVAL AZERBAIJAN

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Abstract

In the article the question is about the architecture of bridges in the architecture of medieval Azerbaijan. The construction and dislocation of bridges on water ways was directly connected with social-political and trade-economic condition of the country in either historical period. As a complicated sphere of engineering art the bridges demanded the participation of masters – muhandises of high qualification.

Keywords

bridge, bridge-bed, key-stone, profiled archivolt, vaulted spans

The values of cultural and natural heritage are of exceptional interest – as a part of the world heritage of the mankind, remarkable universal value from the point of view of history of architecture, science and art.

The diversity of typological spectrum of buildings and structures of medieval Azerbaijan answered all sides of the people's way of life. Picturesque multi-structure mosaics of the architecture characteristic of community of tendencies and integrity of the style is based on the unity of territorial, social-economic and historical development, massive layers of material and spiritual culture of the people on the bosom of which there evolved mighty architectural schools founded on the diversity of historical prerequisites which determined the specific character of the complex of means, principles, elements accepting stable architectural forms.

The system of water-supply, complicated hydrotechnical constructions – kahrizes (drainage), bands (weirs), ovdans (piping), sebils (springs) made up the vital basis of town functioning. Irrigation canals really "blood-supplying" arteries promoting the rise of cultivation of lands turning them up to emerald oases, fruit – bearing and decorative gardens in the depth of which there were built monumental structures – palaces, mosques, imamzades and etc., as well as folk dwelling. [1, p.117, 118]

The bridge construction in medieval Azerbaijan is distinguished with richness and diversity of compositional solutions. The architectural solution of bridges based on the unity of the form and functions was in accordance with local building materials as well as local natural situation with maximum regard of the convenience for crossing.

The elaboration of the “language” of architectural form is built on the accent of expedient form of the lancet of semicircular vault the significance of which becomes leading and paramount. It corresponds the opposition of vaulted spans and mighty pillars-semiciracular “bulls” based on “shoes” with a sharp form of graphically efficient breakwaters. The whole constructive system of one and multi-span bridges is built on monolithic vaults of wide span.

The aesthetics of the organization of bridge form consists in general lar ge plasticity with expressively outlined arches with quoin-shaped or profiled wide archivolts, high attics uniting the whole composition, clearly outlined “pyramids” – buttresses used as unloading apertures emphasizing the range of the construction.

The combined masonry of harmonized building materials in the bridges reaches a special virtuosity – in the combination of the trimmed stone (archivolts of arches, piers, vaults), the brick (tympanums, the upper part of piers), rubble (roughly trimmed stone) and cobble in a special, constructive, at the same time picturesque masonry “fishbone”, of cobble-stone and boulders “in herring-bone” preventing from making up inclined and vertical cracks, even of polychromic ceramics (the bridge in Gazhvin) [4, p.37, 188]. The brickwork in the combination with stones of various tones with hardly noticeable junctions makes an impression of constructive firmness, monolithic character.

The epigraphy is laconic, it quite often contains the architect’s name, thus in epigraphic ligature of 4–span bridge on Pirsaat–chai there is indicated the name of ustad Yagub [4, p.188]. The bridge (Maragha-Tabriz) where there was used twice on the key-stone of marble panel and on the pylon’s cartouche [4, p. 285].

Numerous one-span bridges having mainly circular contours are evidence of high building habits and skills of masters. The architectural forms of “Gozbel kyorpu” near the village “Kazanchi” of 20 m long, 3,12 m wide, laid out of cobble on the background of which especially efficient is elastic curve of the lancet arch of 10,2 m span. The protruded archivolt is of trimmed stone and is raised on the level of the arch’s top marking as a point of a steep slope along both sides of bridge-bed.

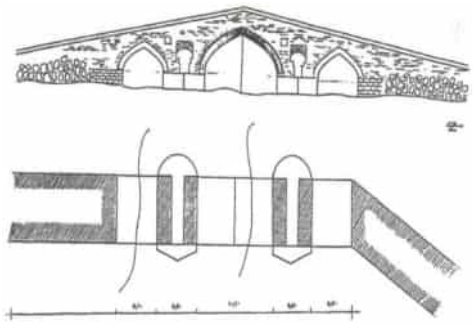
Unlike the refined form of the bridge in the villige Kazanchi, the bridge in Hamadan (South Azerbaijan) organically included in the picturesque town ensemble, with its majestic monumental forms as if repeat proudly rising mountain range Elvenda.

Multi-span bridges, the spans of which are: a) different (“Synyg-kyorpu” on Khram-chai, spans 8.2-16.1 – 8.0 – 26.1 m); identical (the bridge Kumlavar; the bridge near Salyan, XVI c.; 4-span bridge in Ardabil;) c) they grow on one of banks with high relief which is observed in non-symmetric, with one-sided slope of 6-8 degrees, the bridge near the village Azy (Nakhchyvan AR on the slope of 8-10 degrees [4, p. 180, 188]; d) dynamically grow on the centre where the last arches are smaller than the arches in the middle (11-span bridge in Khudafarin with spans 4+4,5+6,5+6,5+10+8+8+5,5+4,5+4+3,5 m) [2, p. 95] (P.1,2).

P. 1. Bridge. Khudaferin

P. 2. Bridge in the Aza, Nakhchivan

"Broken" plan of multi-span bridges with natural way out of rocky "rapids", as well as with the purpose of rational fastening of bridge-bed to riverside piers of the relief. Bridge-bed may be: a) horizontal ("Ajy-chai kyorpu", Tabriz, South Azerbaijan; "Pol-e Shekhr"; "Nir", Ardabil, South Azerbaijan); b) with a small slope in the middle part (the bridge "Giz-kyorpu", Miane, South Azerbaijan); with a steep slope on both sides of brikdge-bed ("Sardar-kyorpu", Zanjan, South Azerbaijan) (P.3).



P. 3 Bridge. Zenjan, S.Azerbaijan

P. 3. Qiz-kyorpu in Miane, S.Azerbaijan

The development of divisions in multi-span bridges acquires a special energy owing to sharp change from slow rhythm to flashing, as a result the length of the bridge is keenly appreciable. In the bridges with a small number of spans in striving to attach the steadiness to the whole composition they often used the method of architectural symmetry where the middle part – usually too high one – is marked off with the ledge of the archivolt.

On the bank piers of strategically important bridges there were large premises intended for caravans, for guard duty, guardsmen and officials raising fare what can be shown on the example of "Synyg-kyorpu" on Khram-chai (XIIc.) with the space of premises on the left-side of the bridge 166 m2, on the right-side-116m2 [3, p.107]. The same is on the bank piers of the bridge near Juga (Nakhchyvan AR) which reached 100m long, where there were large premises with original planning.

The bridge in Tabriz is architecturally expressive, the bridge-bed is compactly filled up with shops with their domes wavily continueing its direction which considerably strengthens the plasticity of the whole construction. I'd like to add that there are such examples in Venice (Rialto), Florence (Ponte Vekkio), Paris (Pont au Change), England (Old bridge, lost).

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REFLECTION ON CONSTRUCTION BOOM OF CULTURAL FACILITIES IN CONTEMPORARY CHINA : FROM THE PERSPECTIVE OF 'GRAND THEATRE UPSURGE'

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Abstract

In the contemporary massive upsurge of urban construction in China, excessive input of cultural facilities in recent 30 years is the most striking architectural phenomenon. Cities have invested heavily in a variety of large-scale cultural flagship projects in succession, with location concentrated in the city centre and adjacent to the Government, or in the form of large group on the axis of the new district, so as to manifest its city brand image and cultural strength. Especially, construction of grand theatre has drawn the most attention with the highest cost, the most unique shape and the most complicated construction techniques. However, no surge of crowds has appeared in some completed grand theatres. On the contrary, some have even been ignored by the public, gradually became white elephants.

Appropriately, this paper reviews and summarizes construction boom of cultural facilities with phenomenon of "grand theatre upsurge" as specific case, analyses the diversified historical background of the integration of grand theatre as a cultural resource in public policy and development plan, and expounds what extra urban functions and social functions it has; Difference between the actual use of the grand theatres and the expectations of the designer; Causes for passive performance of grand theatre in public life and being labelled as "gentrification space"; Under the context of globalization, whether the newly created cultural space respects local people's living habits and adapts to local climate and blends into regional culture or not. In this way, the relationship between cultural buildings and political rights, urban structural readjustment, civic life, economic development and value of cultural space are explored, with supplement to the construction of cultural buildings in history and theory. Meanwhile, China is now in the accelerated period of urbanization, along with the reform of China's administrative system of culture, grand theatre design will also change with the social demand, the research results can provide a timely practical information for administrative decision makers, designers and other stake-holders in charge of future construction of new theatres and old theatre upgrading.

Keywords

Rapid Urbanization; Cultural flagship projects; Grand theatre upsurge; Civic life; Public space; Theatre Design Strategy.

1 Introduction: Rapid Urbanization and Construction Boom of Cultural Facilities

The real start of urbanization in China dates from the 1980s. With the further deepening of reform and opening up, the urbanization rate got rid of the long-term stagnant impasse and saw a sustained rise. Data released by the National Bureau of Statistics of China has shown that, the urbanization rate rose from 19.39% to 29.04% between 1980 and 1995, with an average annual increase of 0.64%; between 1996 and 2016, China's urbanization rate increased at an accelerated pace from 30.48% to 57.35%, with an average annual growth rate of 1.34%, which amounts to around 2.1 times of the former period (Figure 1). [1] The development of urban infrastructure can hardly keep up with the explosively rapid expansion of urban population, thereby spurring cities to expand outwards around the old quarter and resulting in a mass city-construction movement.

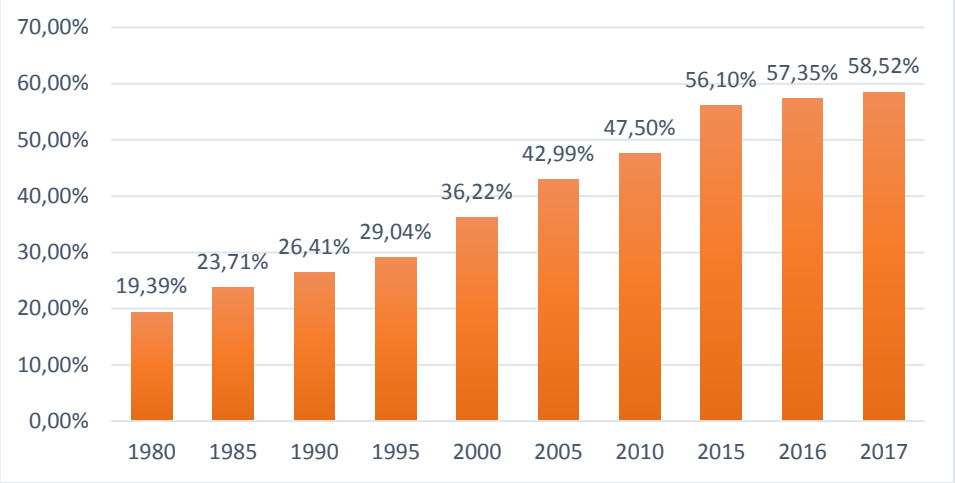

Figure 1: China's urbanization rate (from 1980 to 2017)

Drawn by Author

In 1997, Guggenheim Museum in Bilbao set a miracle by changing the future of a city, so almost all cities hope to replicate the effect of Bilbao. With the intensification of competition between cities under globalization, the urban design oriented by cultural strategy has become a dominant force in urban renewal in developed countries. Decision-makers make it clear that construction of cultural buildings can not only improve city's image but also boost economic development. With the rapid growth of GDP, investment in cultural facilities from all levels of government also continued to grow. During China's massive urbanization process, building cultural mega-projects to boost new town development has become widely-adopted planning, resulting in emergence of huge, expansive and strange buildings. Years of practice has gradually formed China's new town planning ideas: cultural buildings will be built adjacent to the administration center, trying to shape a political and cultural center under the control of the axis, so the design of cultural buildings is often the first to obey the political aesthetic needs. Against the background of massive new town movement, the decision-makers have built many buildings in suburbs and conduct large-scale renovations on city structure. The government takes the new urban area as their symbol. Then power reflected in every city space there. These are embodied in the close integration of political symbols and spatial. The city has become a place of power.

In 2017, per capita annual disposable income of China's urban residents was US$5,800, with an Engel coefficient of 28.6%, which declines by 0.5% from 2016 and first time approached the 20%~30% standard of affluence specified by the United Nations. [2] With a rise in income and decline in the Engel coefficient, residents' consumption of services will keep growing, while their demand for cultural facilities is also on the rise and witnesses a tendency of diversity. However, in terms of actual circumstances, the potential cultural demand of people nowadays fails to be converted into real cultural consumption and activities. In March 2016, the General Office of the State Council issued *The 13th Five-Year Plan for Economic and Social Development of the People's Republic of China*.

Later in February 2017, the Ministry of Culture published *The National Plan for Cultural Development and Reform in the 13th Five-Year Planning Period*, which mentions that the "13th Five-Year Plan" period is the decisive stage in finishing building a moderately prosperous society, and actively promote the party committee and government of all levels to place cultural construction on an important position, improve the network of public cultural facilities, and enhance the efficiency of public cultural services…[3]The realization of the above objectives rests upon the reasonable spatial layout of cultural facilities and the diversified, human-oriented design of public space. Based on the construction of cultural mega projects in China over the recent two decades, it is easy to find that the variety becomes increasingly complete, and has relieved citizens' demand for the amount of cultural facilities but seems somewhat unsatisfactory in the spatial quality of cultural buildings, which is mainly reflected in the fact that in the context of a much lower amount of cultural buildings per capita than that of developed countries, all varieties of cultural buildings haven't been teemed with visitors as expected.

2 Grand Theatre Upsurge

In the context of rapid urbanization in China, Cities have invested heavily in a variety of large-scale cultural flagship projects in succession. Especially, construction of grand theatre has drawn the most attention with the highest cost, the most unique shape and the most complicated construction techniques. The cultural system's transition from the planned economy to the reform and opening up in mainland China can be traced back from the late 1970s to the early 1980s. As the pioneer of China, Shenzhen's reform and opening up have made Shenzhen Grand Theatre completed in 1989, establishing a symbolic relationship with reform and openness. Cultural buildings represented by the Grand Theatre began to be invested with other social functions except for their own functions. Shenzhen Grand Theatre marked the beginning of our modern theatre and ushered the coming of the "Grand Theatre era". [4] Its stage mechanical system was designed by the British company.

In the 1990 s, the completion of Shanghai Grand Theatre marked the beginning of our country with the international level modern theatre. In fact, Shanghai Grand theatre has been launched before the ministry of culture issued the "five-year plan", it began piling in September 1994 and completed in August 1998, which is the first large-scale cultural project through the international bidding in Mainland China. The architectural design using the scheme from French architect Arte Charpentier, which led the trend of looking for the overseas architect to do the theatre design. In February 1997, the Ministry of Culture issued the "9th Five-Year Plan" of cultural undertakings, which clearly stipulated the specific quantity of cultural facilities, [5] which promoted the upsurge of the construction of grand theatres.

Driven by the will of the government, the provinces and cities scrambled to spend the huge sums of money to build the Grand Theatres, in order to enhance the image of the region. According to incomplete statistics, 364 theatres have been newly built, rebuilt or expanded since 1998, with a total investment of above 100 billion yuan. Among them, 34 theatres were built from 1998 to 2000, 61 theatres were built during the period of "the Tenth Five-Year Plan" (2001-2005), 102 theatres were built during the period of "the Eleventh Five-Year Plan" (2006-2010) and 167 theatres were built during the period of "the Twelfth Five-Year Plan" (2011-2015) showing the construction speed has accelerated obviously. In terms of the scale of construction, theatres which account for 62% of the total, covers an area of between 10,000 and 50,000 square meters, with an area of less than 10,000 square meters and more than 50,000 square meters, respectively, of 24% and 14%. As for the investment of construction, the investment of 51% theatres is between 100 and 500 million yuan. 31% and 18% of the theatres obtain below 100 million yuan and over 500 million yuan for development respectively. [6] About the areal distribution, 58% theatres are centralized in eastern China. On the contrary, there are shortages in western and central China. For the planning, 70% of the newly-built theatres are in new towns (districts) or development zones. With respect to the auditorium capacity, most of them are large-scale theatres or extremely large-scale theatres. There are 112 theatres have seats between 1201 and 1600, and 70 theatres have more than 1600 seats. [7]

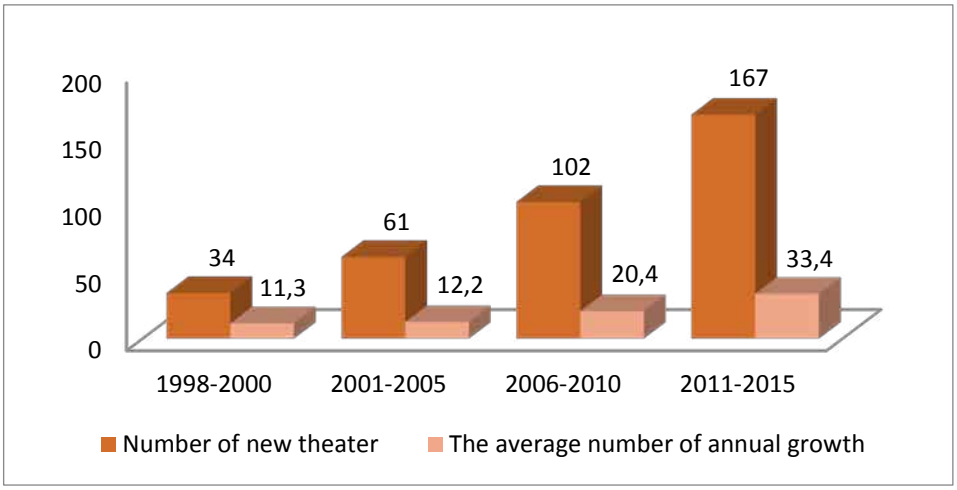

Figure 2: Number of Newly Built Grand Theatres from 1998 to 2015

Drawn by Author

These newly built theatres may outnumber the opera houses and concert halls built in the Western world since the end of World War II. No other country in the world has constructed so many grand theatres and other cultural buildings in such a short period. The theatres in China are mostly developed by local government, in addition to hosting the theatres' basic function, the characteristic of the political and cultural symbol is added. However, we cannot help asking that the construction of such large sculptures of the mega-projects, how much did they do to improve the lives of citizens? And can they really make China to become a high-level center of international cultural activities in Asia? So as to further establish the international status of China's cultural power as expected in the Prime Minister's report? However, the Cultural Development Statistics Bulletin in 2016 published by the Ministry of Culture of the People's Republic of China seems to give us an answer. 1,265 performing venues, run by cultural departments at all levels, held overall 68.1 thousand performances in

2016, in other words, each venue only offered 54 performances a year on average. [8] Compared with the normal performance level of around 200 a year, there are nearly 73% room for improvement. The boom in theatre construction didn't have a boom in entertainment to match. Besides, the homogenization problem among theatres is rather serious. Most of the grand theatres are based on an opera house with a large picture-frame stage, combining a concert hall and a small multi-function hall as their standard layout.

3 Investigating the Design Characteristics of the Newly Built Grand Theatres

Based on the investigation of the relevant data and onsite visiting, the author sorted out large-scale (with 1200 seats or above) grand theatres which cost more than 100 million yuan in prefecture-level cities of Mainland China after 1998* and make a list of their gross floor area, cost and composition of performing units, designer, completed year and location, etc. (due to limited space, complete table is omitted)

Table 1: The large-scale Grand Theatres (or performing center) with cost of more than 100 million yuan in China Prefecture-level cities after 1998 Drawn by Author

Province/ Municipality	Main Prefecture-level City	Name of the theatre	GFA (m^2)	Complete year	Designer	Total investment		Hall Composition	Total seating capacity	Location
						Hundred million Yuan	Hundred million USD			
Beijing	-	National Center for the Performing Arts	165000	2007	Paul Andreu, France	30.67	4.60	4	5850	City center
		Beijing Tianqiao Performing Arts Center	75000	2015	Guangzhou Pearl River Foreign Investment Architectural Designing Institute, China	undisclosed	undisclosed	4	3300	City center
Shanghai	-	Shanghai Grand Theatre	62803	1998	Arte Charpentier, France	12.00	1.80	3	2506	City center
		Shanghai Orienial Art Center	39964	2003	Paul Andreu, France	11.00	1.65	3	3301	New town
		Shanghai Symphony Hall	19950	2013	Arata Isozaki, Japan	undisclosed	undisclosed	2	1600	City center
		Shanghai Poly Grand Theatre	56000	2014	Tadao Ando, Japan	7	1.05	2	1866	New town
Tianjin	-	Tianjin Grand Theatre	101200	2012	GMP, Germany	15.33	2.30	4	3121	New town
Chongqing	-	Chongqing Grand Theatre	103307	2009	GMP, Germany	16	2.40	2	2770	New town
		Chongqing Guotai Art Center	30200	2013	Cui Kai, CAG, China	5	0.75	3	1500	City center
Guangdong	Guangzhou	Guangzhou Opera House	73000	2011	Zaha Hadid, Britain	13.8	2.07	2	2247	New town
	Shenzhen	Shenzhen Concert Hall	41423	2007	Arata Isozaki, Japan	7.76	1.16	2	2183	New town
	Zhuhai	Zhuhai Grand Theatre	46000	2017	Chen Keshi, China	10.8	1.62	2	2100	Island near city center
	Dongguan	Dongguan Yulan Theatre	40257	2005	Carlos Ott, Canada	6.18	0.93	2	2000	New town
	Shunde	Shunde Arts Center	32000	2005	P&T Group Hong Kong	3.5	0.53	2	1986	New town
...										

* In 1998, the completion of the Shanghai Grand Theatre marked the beginning of the international level of modern theatre in China, which led to the construction boom of high standard theatres. So we discussed the theatre was built after 1998.

Just 20 years, China has built many large-scale, high-grade Grand Theatres. Between 1998 and 2017, there are nearly 78 large-scale grand theatres planned or completed in prefecture-level cities, with total investment above 49,324 million yuan (this total investment data does not include the cost of the seven Grand theatres which are under construction and 10 completed Grand Theatres whose construction fee which have not been opened to the public). On average, there are almost five large-scale and high-standard grand theatres built every year. Construction efforts can be described as unprecedented. In addition to Hainan Province and the Tibet Autonomous Region, large-scale grand theatres have covered all the capital cities in mainland China and some economically developed prefecture-level city. Among them, 91 percent were in multi-hall typology, 42.3% of the theatres were designed by foreign designers (including Hong Kong, Macao and Taiwan).

4 Conclusive Discussion on Those Common Problems in the Construction Boom of Grand Theatres

Comprehensive thinking about the situations of various cities in Mainland China, the construction of Grand Theatres has begun to take shape, the depth and breadth of the construction is the side reflects China's regional economic development level and the level of opening, as well as mapping out the degree of spiritual civilization and people's living standards in different region. However, rapid construction without theoretical guidance has exposed a lot of problems.

4.1 Uneven Geographical Distribution and Unreasonable Location

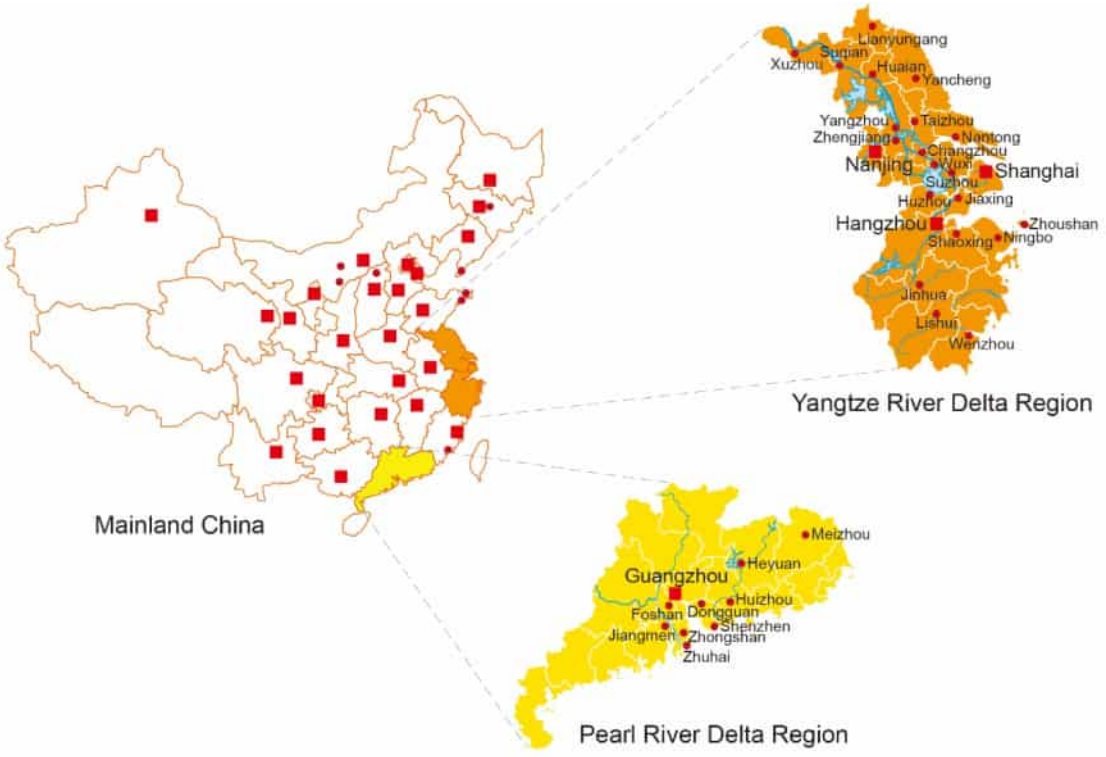

Figure 3: The Distribution Map of Newly Built Grand Theatres in Mainland China from 1998 to 2017 Drawn by Author

Geographically, the distribution of theatres appears on a diminishing scale from east to the west, and they are mostly concentrated in the southeast coastal areas while witness a shortage in central and western China. As shown in the Figure 3, the Grand Theatre is the most densely distributed in the economically developed Yangtze River Delta and the Pearl River Delta region. In particular, the Yangtze River Delta took the lead in forming the large-scale grand theatres full coverage in prefecture-level cities. From urban planning level, 22% of new built large-theatres are in the city center, the other 78% are in the form of large group on the axis or along the manmade river of new district(town), so the grand theatre is not only for the audience, but also has strong urban functions for the general public and passers-by.

The location of the Grand Theatre should meet the demand of the public as the starting point, but many decision-makers are more to consider how to build "achievement project" or "city name card" in site selection, especially the grand theatres or other cultural facilities placed far away from residential areas of poor accessibility, these kinds of megaprojects with huge investment and luxurious decorate become the public "suburban day tour" attractions. Taking Shanghai Poly Theatre as an example, the theatre is located in Jiading New Town (the northwest of Shanghai), built near the manmade lake, 28 km from the center of Shanghai, near the theatre are all the new high-end residential buildings by developers. The theatre is 2.2 km from the nearest subway station - Baiyin Road Station. It is about 4 km from the densely populated Jiading Old Town, and there are 5 bus routes available. 2.2 km and 4 km are not within walking distance. The ending time of the performance is at 10 pm in the evening generally while the bus service is over, the public can only leave by taxi or private car. In addition, the architectural design of huge scale, which too much emphasizes the ceremonial sense of iconic, always makes the public feel a sense of dignity.

4.2 Standard Homogenization & Low Utilization Rate of Grand Theatre in Medium and Small Cities

Besides, among the planned or completed 78 large-scale theatres with above 100 million of investment between 1998 and 2017, 68 of them have absorbed an investment of over 300 million yuan, accounting for 88% of the total. The function of the theatre is mostly a combination of a variety of performing units, among new grand theatres built after 1998, 52% of them have a large professional theatre supplemented by a multi-functional theatre; followed by three-hall type, accounting for 29%, mostly with a large professional theatre plus concert hall and supplemented by multi-functional theatre; four hall combination and single hall type are less, respectively, 9%. (See figure 4)

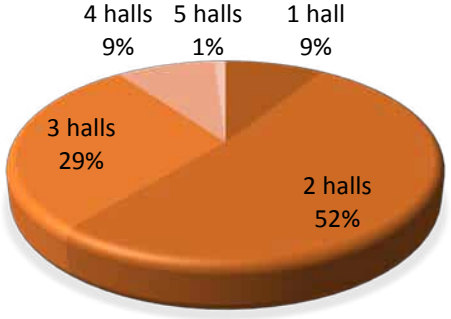

Figure 4: The Hall Composition of Newly Built Grand Theatres in Mainland China from 1998 to 2017 Drawn by Author

Besides, the homogenization problem among theatres is rather serious. The construction of the grand theatres is mostly inclined to professional, high cost, high-mechanized performing arts center. Most of them are based on an opera house with a large picture-frame stage, combining a concert hall and a small multi-function hall as their standard layout. However, the urbanization in China develops unevenly, and the size of cities also varies. Currently, constructing grand theatres according to an exorbitant standard will inevitably lead to a waste of construction resources.

There has been fierce competition among cities, not only in economy, capital and resources but also in achievements of government officials. As officials seek to build bigger and multi-functional facilities, some medium and small-sized cities have built grand theatres which are disproportionate to their cities.[9] Repeat the data mentioned in the previous page, the Cultural Development Statistics Bulletin in 2016 published by the Ministry of Culture of the People's Republic of China mentioned 1265 performing places, run by cultural departments at all levels, held overall 68.1 thousand performances in 2016, in other words, each venue only offered 54 performances a year on average. Compared with the normal performance level of around 200 a year, there are nearly 73% upgrade space. Unlike cities such as Shanghai, Beijing, Guangzhou and Shenzhen which saw high cultural spending and commercial application, some small cities are working to achieve their primary goal, that is, letting residents know it is worthwhile to enjoy a show in theatres, but theatres in these cities are vacant during most of the time, so many luxurious theatres have to be financed by local government. Even the ticket-free National Museum of China has always been a small part of the public's cultural activities. Although planning and design of cultural facilities should be farsighted, I believe that decision-makers should take time to think about whether they should make such huge investments.

4.3 Public Space Design Is Unsatisfactory & Service Facilities in Theatres Are Insufficient

Many of the grand theatres in China are simply equipped with a very large scale hard paving square, but landscape design, leisure facilities, commercial service facilities are not enough, thereby turning most external space into pedestrian space and taking inadequate account of the public's demands like small activities, exchanges and stopping. For architects, in addition to considering the requirements stipulated in the design brief, should pay attention to the expression of public, open, regional, human-oriented features in the cultural buildings design. We take Chongqing Grand Theatre as an example, the theatre is located at the cutting edge of the green axis of the landscape of Jiangbei City. Before the Grand Theatre's design came out, the government had been hoping to build a landmark building like the Sydney Opera House. The final implementation scheme is a "hard-hitting" building, a glass box that is directly landed, totally ignores the relationship between the theatre and the people. From the Figure 5, we can easily see that a piece of ground glass is much larger than an adult man, which directly reflects the imbalance relationship between the scale of the building and human behavior. Unfortunately, Chongqing do not have the climate characteristics as Sydney and lacked the enthusiasm and tradition of local people to participate in public outdoor activities. The utilization of the huge outdoor platform is extremely low, even no square-dance appears on this platform. Environmental behavior theory is generally accepted that the length of the duration of outdoor space is closely related to the quality of space, so we integrated the above

observation data, can see that the quality of public space of Chongqing Grand Theatre is not ideal. So, the public space need to consider the local climate characteristics and their cultural habits, take Chongqing for example, if just move the model of the Sydney opera house, but no Sydney's climate, and lack of the enthusiasm of the local people participate in public outdoor activities and tradition, then public space was destined to just a decoration.

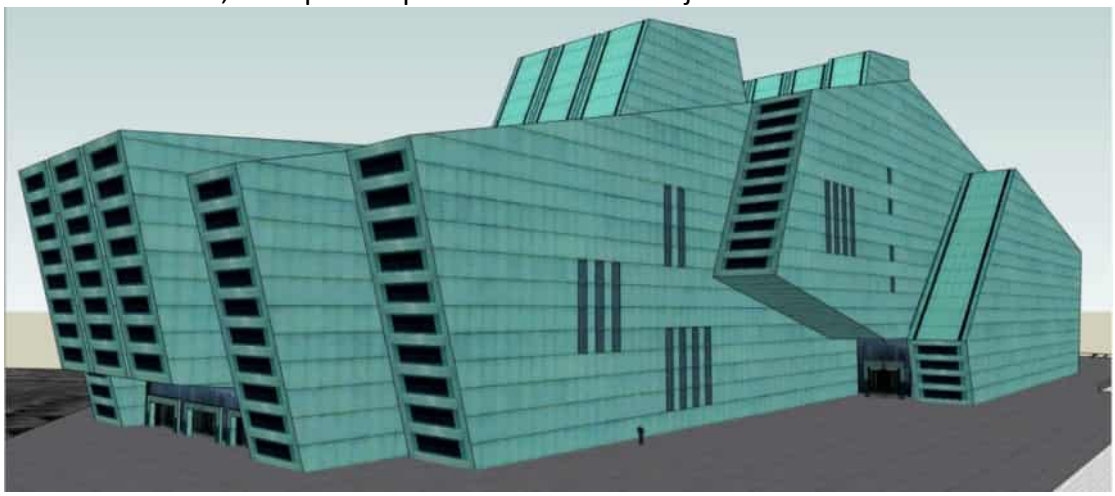

Figure 5: Chongqing Grand Theatres 3D Model

The service package of many theatres does not take the needs of the audience into account. For example, the space design of the waiting area is not ideal, the number of seats in the lounge hall is not enough, the catering service and other commercial service facilities are insufficient, and the washroom in the lobby has been set too little, etc. Most of the theatre is only set up a small cafe for simple meals and bookstores or souvenir shops. Most of the show was in the evening, food problem involves the audience, especially now, many of the new theatre set in a certain distance away from the downtown district, considering the peak hour traffic, collect the tickets and daddies scheduling problem, most of the audience is no meal to ahead of time. Most of the performances are carried out in the evening, involving the audience with dining problems, especially many new built theatres set in the new town which has a certain distance from the commercial area. So, most of the audience considering the rush hour traffic and time for tickets collection, would not have time to eat in advance. And usually the new theatres built near the administrative center in new district, the surrounding services are not complete, and the cafe inside theatre only provide high-price cold food which may not meet the Chinese people dining habits, resulting in a large number of audience enjoy the show with a hungry belly.

4.4 Low Level of Open and Inadequate Management

Local government consciously increased investment in cultural facilities but the administrators in some cities put these facilities under protection without thinking about the public's participation with non-consumption manner, thus replacing the public's demand with a hierarchical grade sequence, which will produce distance and isolation between the public and these grand cultural facilities. Taking the example of Shanghai Grand Theatre, the original public area and the staircase in front of the main entrance are usually enclosed with iron fence, when there is a performance, the security officer only opens a small opening in the middle, and audiences must to show their tickets to the security officers then can go up the stairs get into the theatre. What's more, Shanghai Poly Theatre makes the public more

disappointing, it only open two hours for public in the second Sunday of each month, and if there is a time confliction with commercial activities, the theatre can do the unconditional cancellation for visiting. Above phenomenon, to a certain extent, reflects the fact that the public space serving the masses is gradually being occupied by commercial activities. With the emergence of an overall commercialization of public facilities under consumerism, the equal public space has increasingly become the cultural consumption symbol of a certain class.

Figure 6: The 180-meters wide waterfall in front of the 6.6m high cultural square

In addition, the quality of public facilities must rely on a key issue, that is, the level of management and investment. Taking Shenzhen Cultural Center as an example, it includes Shenzhen Concert Hall and Shenzhen Library. See Figure 6, behind the 180 meters wide waterfall at east facade, there are two large staircases leading to the cultural square (outdoor theatre), which is 6.6m high above the ground. According to our interview with manager group of Shenzhen Concert Hall, they claimed that they had purchased some outdoor equipment and organized an event on the cultural square which is the platform sharing with the library. They have invited some street artists to have a show on Cultural Square in the past, but involved in the definition of dangerous responsibilities of the staircase and the urban management departments do not want the people too crowded, coupled with such activities need to declare in advance. Therefore, the street artists are not allowed to play in the red line of the concert hall, so as to maintain the elegance and order of the building. The original design of the outdoor theatre was cancelled by this way.

This is the typical case showing that architect's idea of the public space has not been implemented. The same case happened in Chongqing Guotai Art Center, which is located in the core area of Yuzhong District (Jiefangbei Central Business District). Architects and structural engineers spent a lot of effort to solve the technical problems for the small column network of Chongqing Art Museum stacked on the huge span theatre. The original urban design route is: from the Jiefangbei to the city square and then to the Chongqing Art Museum, the escalators and staircase system connect the museum and the theatre vertically, then cross the road and the ladder down to Hong Yadong. But the actual reality of the situation is: because the museum and the theatre is under two different company, they afraid of occurring dangers on the stairs will lead some definition of liability, which made the route to the public square in front of the theatre was broken. From the result we can see the architect's efforts and the support they have got was not matched.

4.5 The Missing of Public Voices in the Crazy Construction

Architects have tried to figure out what decision-makers want and attempted to stand out through unique design and attractive implications. The cultural organizations, as users or managers of the theatre, will only give opinions at the expert meeting, but it is difficult to

measure how many of them can be actually used. The citizens, are the main users of cultural buildings, but their right and participation are ignored.

4.6 Remarks

Meanwhile, China is now in the accelerated period of urbanization, along with the reform of China's administrative system of culture, grand theatre design and other cultural buildings design will also change with the social demand. The various non-ideal phenomena discussed above can provide a timely practical information for administrative decision makers, designers and other stake-holders in charge of future construction of new theatres and old theatre upgrading. Then, creating a more diverse, efficient, and equal entertainment venues serving the public, so that the taxpayer's hard -earned money is well used.

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TIME AND TEMPORALITY IN TRANSITIONAL POST-DISASTER ARCHITECTURE

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Abstract

There has been an increase in the propensity for natural disasters with significant consequences such as loss of homes, life, welfare and livelihood. The period of recovery for those affected can vary significantly depending on context; physical, political and economic. The architectural approach for providing shelter also varies especially when considering the issue of timeliness and temporality of emergency response to enable recovery and return to normality.

The current approach to delivering shelters post-natural disasters is influenced by factors of timeliness and temporality. Timeliness in the sense that urgent shelter is often required and the housing solutions are delivered to meet this need. Temporality is defined as the subjective or experiential passage of time. Most post-disaster shelters are designed to be temporary as in not-permanent, this notion in itself can be problematic as this objective then defines their design, function and purpose. However, it has been shown that most of the 'temporary' shelter solutions can exist well beyond the immediate to short term, some have been used for decades since the event took place. There is therefore the need to critique this approach and explore solutions that are capable to evolve and transition in time.

This presents a theoretical critique of these in the context of disaster shelters using examples of the disaster shelter design challenge recently completed by postgraduate students of our MSc in Modern Building Design. The students were given 4 elemental challenges: Air, Fire, Earth and Water; situated in real disaster contexts in 4 continents. They explored the physical, socio-cultural, economic and environmental issues to formulate architectural solutions that are both timely and temporal. Their outputs show that this approach is feasible and realistic for the delivery of immediate shelter solutions as well as long-term resilience to individuals and communities affected by natural disasters.

Keywords

Architecture, Natural Disaster, Resilience, Temporality, Transitional Shelter

1 Introduction

'Time has no being since the future is not yet, the past is no longer, and the present does not remain' [1].

Conceptualizations of time are embroiled in a long-standing debate between time as a physical, cosmological, objective experience and time as a psychological, phenomenological, subjective experience. According to Ricoeur [2], this is the 'aporetics'; an unresolved contradiction of temporality.

The essential difference between these posits can be illustrated by contrasting scientific with experiential conceptualizations [3]. And this exercise have also preoccupied philosophers such as Foucoult, Heidegger, Nietzsche, Deleuze, Merleau-Ponty and others in an effort to deconstruct and explain what [4] refers to as 'the time of our lives'. In using this phrase, Hoy attempts to resolve the contradictions of temporality as time as it manifests itself in human existence, rather than simply 'subjective' or 'experienced' time. But concedes that temporality must be *experienced* as real instances. Experiences that according to Augustine are embedded in past memory, present experiences and future expectations [5, 2]. And as the notion of a more dynamic temporality, in which past and future cling to the present, and time is experienced as a process of reflection or reflecting [6].

The timeliness of emergency response is crucial for those affected by disastrous events that is outside the reach of their influence or control. In spite of the unprecedented nature of these events, disasters and other emergency situations, do not often interrupt the temporality of human *being* for the survivors, as life and time continues to be experienced through memories of past lives (and loss), attention to present conditions and needs, and future expectations of normality and recovery.

Shelter and other ancillary architecture, delivered on time, can help to avoid further loss (including of life), maintain dignity, minimise the spread of diseases and deliver safety and security. In this sense, time is crucial. However, more than a timely approach is needed to transition to recovery. To this end, shelters become more than a physical container away from the elements, and transcends beyond the domain of response. The shelter embodies the container for self-efficacy and recovery, not simply the setting for marking time.

While significant efforts have been made to improve coordination between humanitarian organisations and to standardise responses, typically different shelter strategies are adopted in each situation with varying impacts on both the short-term recovery and long-term development of affected communities [7]. An emergency and/or temporary approach to shelter for displaced people, can potentially delay re-establishing housing which in turn delays other dimensions of recovery [8]. Further, a time continuum has been found to exist between emergency relief operations (as the first post-occurrence step), recovery initiatives, and development activities. Relief humanitarian organisations are set up for rapid entry and response, while development organisations are built on long-term response driven by locals need. Recovery initiatives are situated in the middle ground, looking at supporting local stakeholders to recover long-term capability, while often operating from a relief platform [9]. This well-recognized paradigm gap between relief and development activities is based on defining efforts along time-lines, in addition to other pragmatic reasons. It also constrains the development and refinement of the architecture of resilience as a realm of practice in itself. This study therefore focuses on the inherent limitations of the former and argues for a transitional approach which focusses on temporality, rather than time.

1.1 Why conceptualisations of time and temporality?

The gradual speed of catastrophic events not only affects the reality of the moment but causes anxiety and anguish for generations to come – Virilio [10].

Individual and collective experience of time differ according to experience, and extends beyond the simple human abstractions of distinguishing two end points and an interval [11]. For example, disaster response protocols will abstract between the time that the disaster occurs, to the time of full recovery and return to normality. Whereas, at any instance, the individual may be more concerned with the experience between these two points in time. A temporal approach therefore recognises that the experience of time can pass more quickly (slowly) when experiences are pleasant (unpleasant), are not urgent (urgent), are very busy (not busy), have a variety (no variety) of tasks, and engage a right-hemisphere (left-hemisphere) mode of thinking [12: 37–48]. And these experiences are mediated by context; geo-political, social, economic, environmental and the way we imagine, describe, and use time [12: 76]. This contradictions can be observed in the organisational discourse and practices governing disaster shelter provisions, compared to the individual and collective narratives that emerge from the same contexts.

Within the context of disaster shelter provision, contradictions exist between the objective and pragmatic notion of time (or timeliness) and experiential time (temporality). Here, Heideggar's notion of Da-sein – the revealing (or re-emergence) of *Being* and *temporality* can help to reimagine the architecture of disaster shelters both theoretically and pragmatically for the collective benefit of all concerned.

In *Being and Time*, Heideggar [13] in his own approach of hermeneutic phenomenology embodied the ontological aspects of human existence in the word - *Dasein*. However, Heideggar's dasein is not a static being, but is instead a being-in-the-world. Dasein has *potentiality* i.e. possibilities for the future. Dasein is always already in a situation and is constantly moving into a new one with its past experience going before it organizing what will next show up as relevant [14]. Dasein does not merely exist 'in time', but is rooted in temporality; movement through a world as a space of possibilities. This means that for the human *being* time is directional and relational; the past exists in the now as the "from whence" and the givenness of the present; the future exists in the now as the "to whence," its possibilities [15].

Similarly, emergency situations cannot be constrained to an Aristotle-ian objective notions of time alone, but needs to better embrace the transcendental nature of temporality as that which has: **context** (metaphysical and physical), **content** and **direction/movement**. These three factors should thus underpin the architecture of disaster shelters.

2 Architecture of disaster shelters

Shelter strategies in response to emergencies must be appropriate for their social and environmental context; but political, institutional and economic factors are also at play [7]. Post-disaster recovery processes and rebuilding outcomes take place within larger social and political contexts that constrain some actions, enable others, and can breed unforeseen negative consequences. In addition, post-disaster phases are not clearly ordered, and there are no discrete stages that communities move through on the road to recovery. Rather, the process of post-disaster recovery and rebuilding is marked by trial-and-error experimentation,

antagonistic group struggles, conflictual policies, contradictory institutional realignments, and crisis tendencies [17].

So the current approach to delivering emergency shelters are influenced by external factors as well as notions of time, timeliness and temporality. Time/ timelines and timeliness is often used to denote the point at which events occur and actions are taken relative to the time of occurrence. For instance, urgent action is often required in the aftermath of an event epidemiologically e.g. to prevent the spread of disease and physically e.g. to provide immediate shelter. However, as is often reported in the media, a 'timely' response defines thresholds in time that may be constrained by Santiago *et al.* [16]:

- the sheer magnitude of the number of people severely affected and displaced who needed assistance
- the inaccessibility of many areas due to the destruction of transport infrastructure
- the loss of power and communication lines, which hampered information gathering
- the loss of people who were part of the disaster response team; and
- lawlessness and insecurity.

This project focusses on the considerations of temporality in post-disaster architecture as an alternative to the temporary approach. The term 'temporary' means that dwellings are expected to be utilised for a fixed, short, amount of time. However experience indicates that housing interventions in the early stages after a disaster will affect long-term housing provision because temporary solutions tend to become permanent [18]. An example is reported in Wagemann [19] who found a combination of non-modified temporary house (after five years of use) as well as modified temporary housing. In contrast to a time-based approach, temporality is the subjective passage of time which in turn defines the intrinsic experience of those affected by the event; it takes into account the context, and provides the framework for a better human-centred approach. In considering temporality in phenomenological terms, the architecture of disaster shelters needs to respond to the context (metaphysical and physical), content and direction of those affected.

Without delving into the various factors that led to the prioritisation of time over temporality, this paper challenges this disparity because it often delivers an architectural solution that: (1) it fails to accurately reflect the reality of emergency oriented built environments - it has been shown that most of the 'temporary' shelter solutions can remain, together with occupants, in the same state for decades since the event took place. (2) It limits the *potentiality of being* of individuals and communities in these environments as previously discussed; and (3) it does not encourage practices that promote credible transcendental architecture to meet the current needs, as well as deliver effective transition towards new collective realities of recovery and future resilience. There is therefore the need to critique this approach and explore solutions that are capable to enable this evolution and transition in time.

2.1 Project scope

Temporary shelters or dwellings are defined as structures to incubate people living in communities which have been affected by a disaster (commonly referred to as disaster survivors). A temporary dwelling's settlement is the urban complex resulting from erecting temporary dwellings along with other services (educational, health, etc.) to serve the disaster affected community [20].

In literature, temporary and transitional shelter are used interchangeably. They both serve as post-disaster accommodation when no other alternative can be found, and when affected families are unable or unwilling to return to their pre-disaster homes or land [21: 244). The terms temporary and transitional have been used to refer to both the process and the building solution, but there are some conceptual differences. Most notably, 'temporary' refers to a building that will be used for a defined and short period of time, whereas 'transitional' refers to a process that bridges a gap [19]. The design challenge aimed to support the process of transition with the design 'product' that supports it.

3 The design challenge

Resilience is commonly defined as the ability to bounce back or recover from a shock. Resilience is improved by early warning, anticipatory actions and adaptive capacity. In this, architecture has a role to play. Resilient architecture is broadly defined as spatial and tectonic solutions that assure the efficacy of buildings to deliver both its primary, and temporality functions i.e. not just to provide shelter and protection against the elements and nature. Increasingly, questions are being asked as to why buildings and supporting infrastructure fail against the magnitude and frequency of global meteorological and hydrological natural events. Therefore, more needs to be done to increase the resilience of shelters; especially in the provision of emergency shelters after a disaster. In addition, the issue of transcendence of *being* also needs to be considered. Therefore, temporality should be included in the design brief of shelters such that they inherently support transition towards recovery and long-term resilience.

This premise underpins the challenge brief issued to the MSc in Modern Building Design students. The project brief asked the students to propose new transitional shelter designs for people displaced by real natural disasters that took place during 2016-17. The events were sited to align with the Avatar theme of air, earth, fire and water as follows:

- Group Air: Hurricane Matthew in southwestern Haiti near Les Anglais on October 4, 2016
- Group Fire: Wildfire in southwest of Fort McMurray, Alberta, Canada on May 1, 2016.
- Group Earth: Earthquake in the Kumamoto region of Kyushu Island, Japan on April 14, 2016
- Group Water: floods and mudslides near Sugar Load Mountain and Sierra Leone's capital city, Freetown in August 14, 2017

The location of the shelters were to be decided and justified by the students, based on a research and feasibility exercise (Figure 1). The tasks were undertaken by groups of 5-6 students, one day per week over a 4 week period. The brief highlighted the need to provide designs that avoid the previous controversies and problems of the transitional shelter approach as highlighted by [19]:

- Inappropriate and effective due to focus on quantity rather than quality
- Expensive and in some instances costing more in comparison to the price of a permanent house
- Poor quality housing due to the lack of technical skills, little or no technical support or supervision or lack of compliance to building codes.
- The lack of available land if there is displacement

- Unclear land ownership or rights. So mobility is a characteristic of transitional shelters because it provides a solution when land rights are unclear, so the building can be moved later to a permanent site. Yet, the best examples of the approach are to be found in areas with secured plots, where mobility is not necessary
- the cost of materials due to an increase in demand after a disaster, or use of poor quality materials
- limits of humanitarian responsibility and the handover of the process of transition from emergency to the return to sustainable livelihoods to a government, and the lack of attention to the transition
- Structures that deteriorate and turn into permanent poor quality housing, creating slum. This is because few human and economic resources remain after shelters are built, resulting in poor quality permanent housing that does not address long-term problems
- The absence of flexibility in the designs.

Pragmatically, the design solutions should consider: previous solutions and practices; existing environmental challenges; and the impact of the natural event, as well as providing immediate shelter solutions which supports long term transition towards resilience against future natural events. In addition, the shelter should: be adequately sized for a single family unit of 2 adults, and 2 children; provide basic amenities for cooking and cleaning; be easy to build and disassemble using low-skilled techniques; be easy to maintain and adapt; where feasible, use recyclable local materials, including materials reclaimed from disaster sites; be accessible and situated close to existing communities and cheap and affordable both in time, resources and cost.

4 The design solutions

Due to space constraints, projects hypothetically situated in Haiti and Japan are presented. They are discussed based on their response to the people, context, content (space and tectonics) and the extent to which the solution supports transition.

4.1 Groups Air: Haita

The students chose Les Cayes, a major city on the southern coast of Haiti as the location of their project. In 2016, this region was devastated by Hurricane Matthew, the category 4 storm which made landfall in Haiti in the early hours of Tuesday, October 4. The city also experienced flooding from continued rainfall after the Hurricane.

The students explored the urban development as well as the social and economic culture of the region. They also studied the history and impact of previous storm floods on the island. Then they studied the spatial layouts, tectonics and materiality of the existing houses. It was noted that majority of the buildings were made from unreinforced masonry which survived the storm. However, majority of the lighter weight roofing were lost in the storm.

From the feasibilities studies, the students' design approach focussed on a simple, modular self-build shelter that considers the environmental risks and available local materials. Therefore, the prevalent simple geometric raised form was retained, to include 2 bedrooms and a small integrated kitchen and bathroom. Depending on available funding, standardised kitchen and bathroom pods/assemblies can be provided and their location can be varied to

suit occupant preferences. Local materials like masonry, bamboo, rendered straw bale and recycled rubble were explored, and the final solution facilitates the use of all of these readily-available materials depending on immediate or subsequent availability. These materials are also already familiar to the residents, and support self-build and transitional improvements with little specialist training and input. The simple building and assembly techniques which include tied connections for bamboo elements also enables cheap and easy repair and maintenance to the shelter by occupants (Figure 2). Attention was paid to the tectonics and reinforcements were introduced to walls and roofs to facilitate future structural resilience. Internal spaces can be finished to user preference too, and communities can work together to build the shelters with options to cluster shelters also considered (Figure 3).

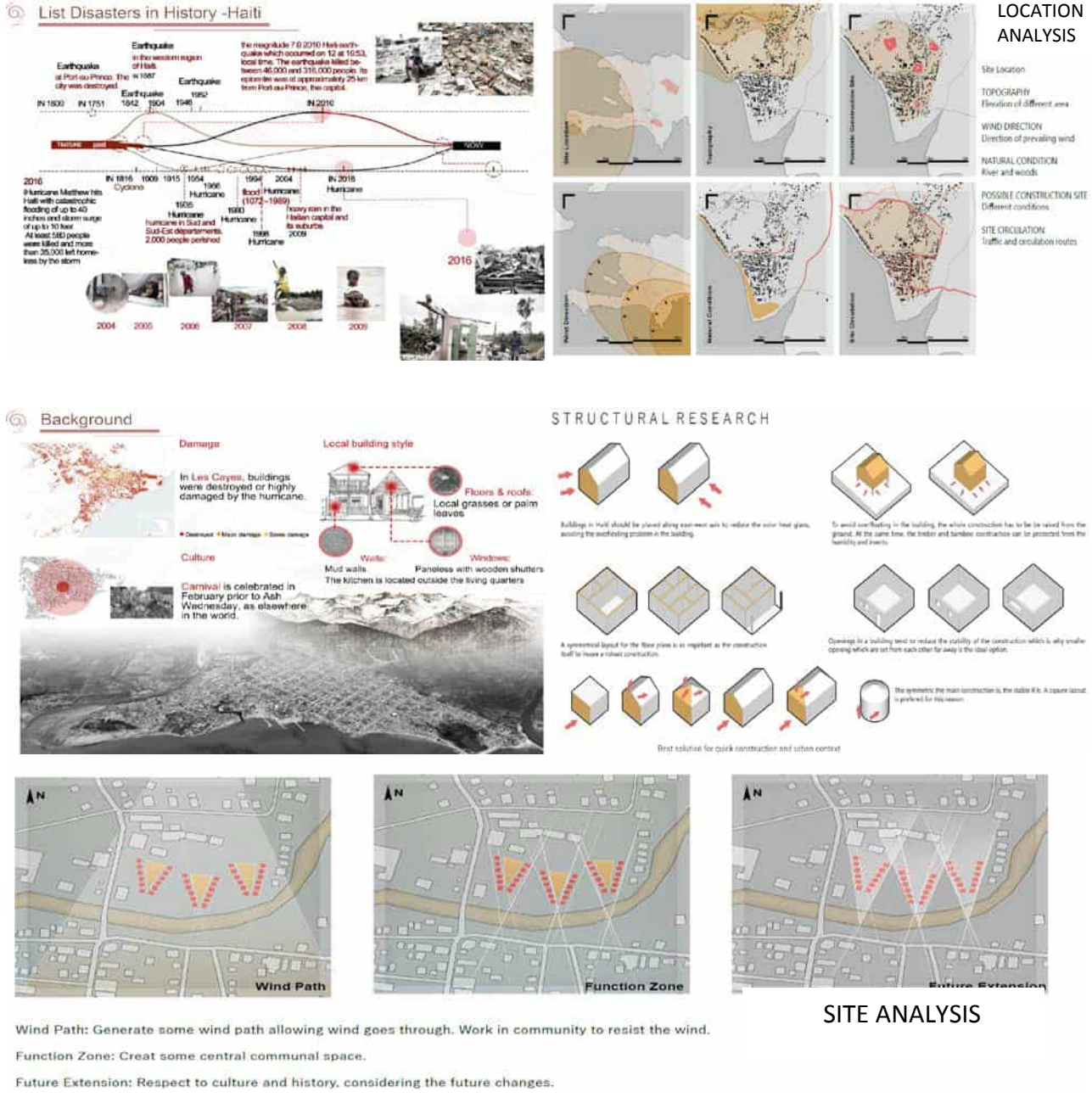

Figure 1. Background and feasibility to inform the site location and design approach

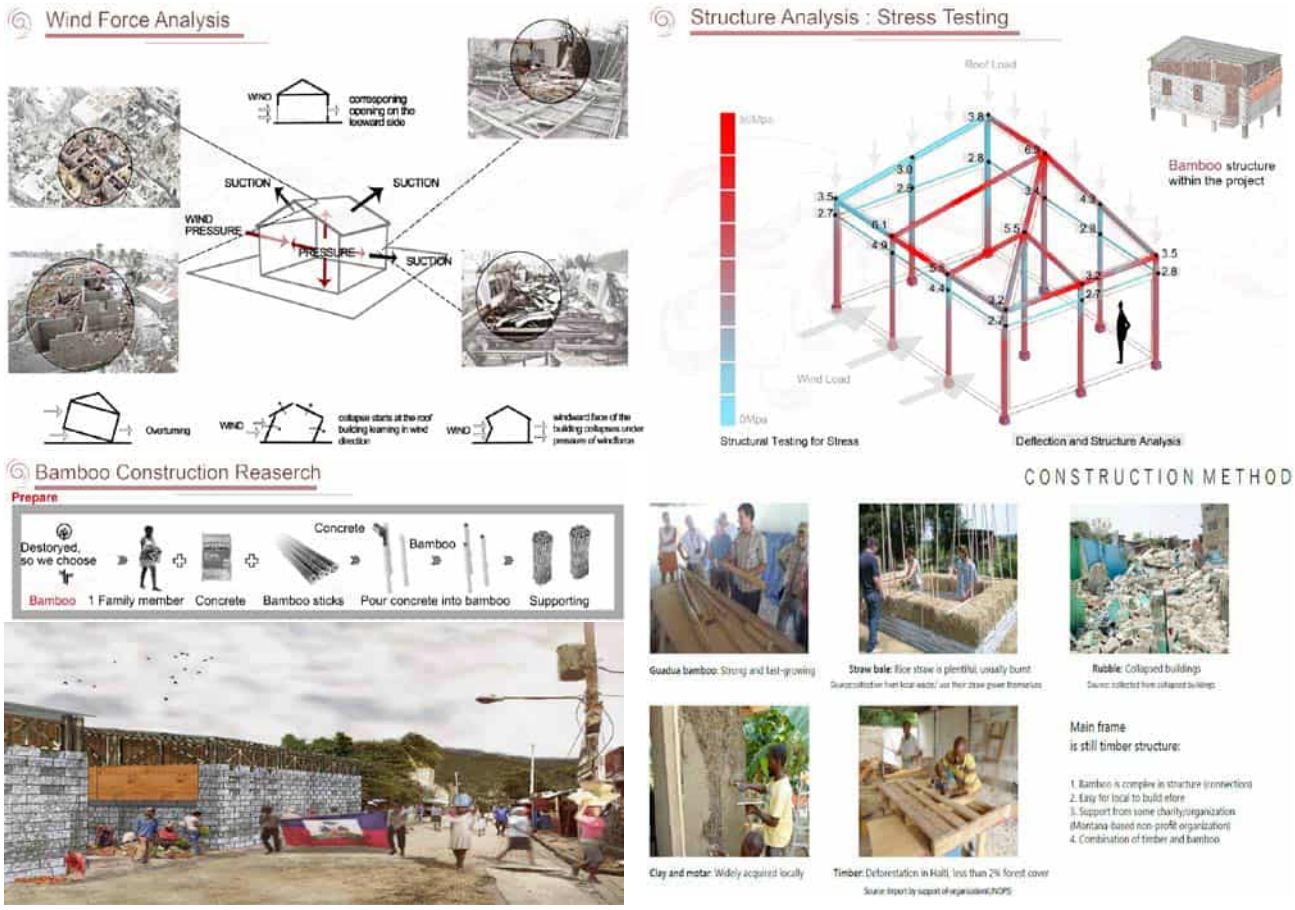

Figure 2. Structure and material analysis

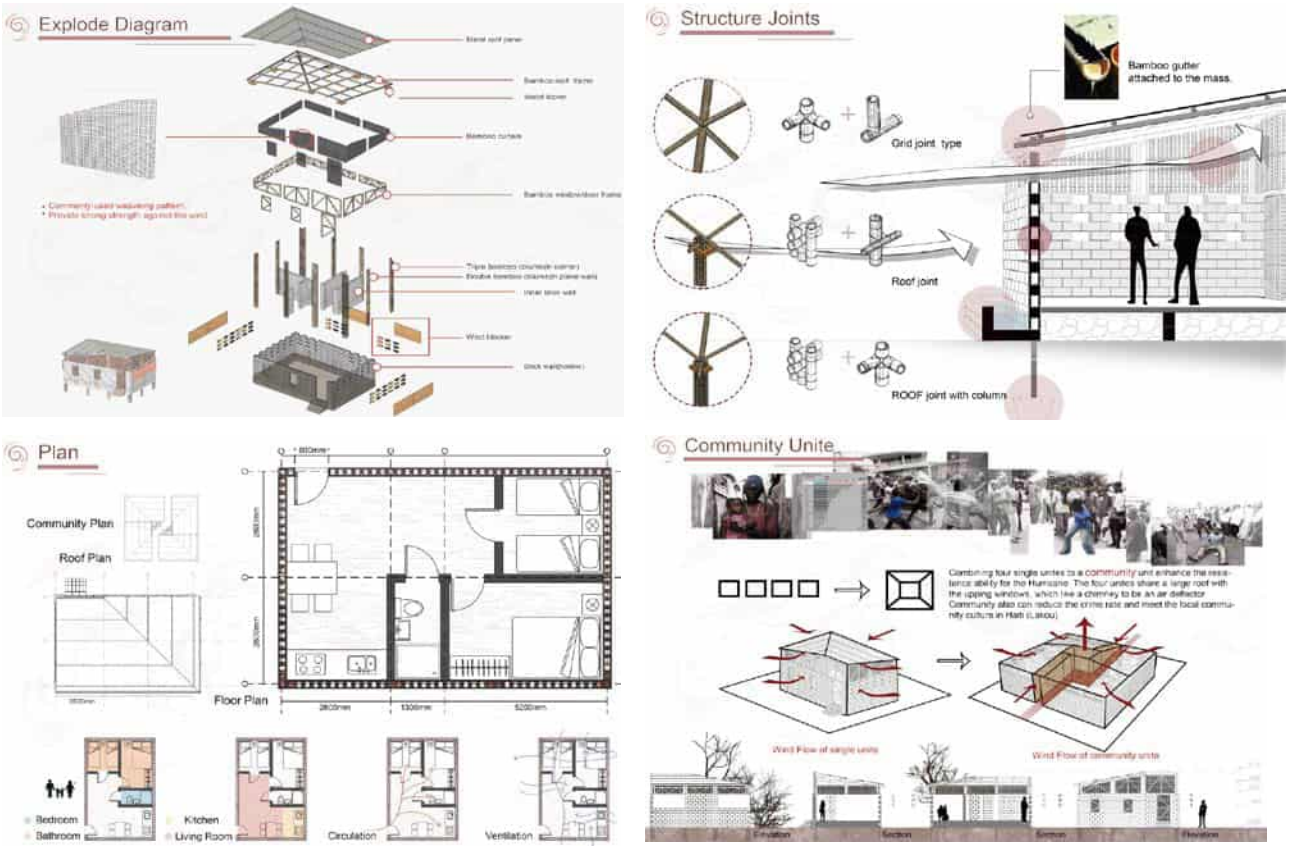

Figure 3. Proposed design, components and methods of construction

4.2 Groups Earth: Japan

A series of earthquakes occurred in the Kumamoto region in Japan starting on 14 April 2016. About 140,000 buildings were damaged, some severely and some 8,000 buildings collapsed. However, structural damages were mainly concentrated on buildings constructed prior to 1981, before the change in building codes in Japan. These were mostly wooden houses, with heavy roof structures.

Similar analytical approach was employed by the students proposing transitional shelters in this region. They considered the challenge of proposing new earthquake prone materials which reflects the architecture and culture of Japan and the use of local materials. Existing precedents were explored and simple solutions for seismically isolating the structure considered. A site in the centre of Kumamoto was selected to maintain close proximity to existing services and amenities, functioning roads for the supply of materials, and to maintain local connections for the affected residents (Figure 4). The objective being to support physical, social and emotional recovery. Concept development considered the urban and spatial arrangements in the existing communities. This led to the use of 'tatamis' as the basic spatial unit for the shelter.

The tatami consists of a base, omote and heri edges crafted in to a rectangle with standard size 1800 x 900mm. The spatial layouts and repeated structure (same size, easy to build and assemble) are configured based on this basic size (Figure 5). The traditional materiality of the tatami base consists of multi-layered rice straw, tightly fastened, and compressed. The cover (omote) is made from the rush plant (igusa). Modern materials are also used to produce the mats but the concept and tradition remains the same. This means that users can configure

internal spaces and size of shelter to suit. Multiple shelters can be combined to maintain family and community connections.

The tectonics of timber frame and panels are raised on short-bore wooden piles with available seismically isolated components such as laminated rubber, springs, ball bearings and other dampers (Figure 6) added. Joining details are also considered to support dynamic movements and avoid the collapse of the shelters during earthquakes.

5 Discussion and conclusion

The design and provision of emergency shelters are an important aspect of disaster response and recovery. However, this architecture of shelters remain ill-defined in theoretical, functional and pragmatic terms. This paper addresses one aspect of this issue – the use of timeliness, rather than temporality to consider, design and deliver shelter solutions. It argues that the latter better supports the need for transition from crisis to stability, or displacement to normality and recovery. Whilst the former supports the premise of temporary solutions that often results in inadequate shelters years after a natural disaster.

Examples of the disaster shelter design challenge recently completed by postgraduate students of the MSc in Modern Building Design at the University of Bath were then presented. The students were given 4 elemental challenges: Air, Fire, Earth and Water; situated in real disaster contexts in 4 continents. They explored the physical, socio-cultural, economic and environmental issues to formulate architectural solutions that are both timely and temporal. Their outputs show that this theoretical approach is feasible and realistic for the delivery of immediate, cost-effective shelter solutions as well as long-term resilience to individuals and communities affected by natural disasters.

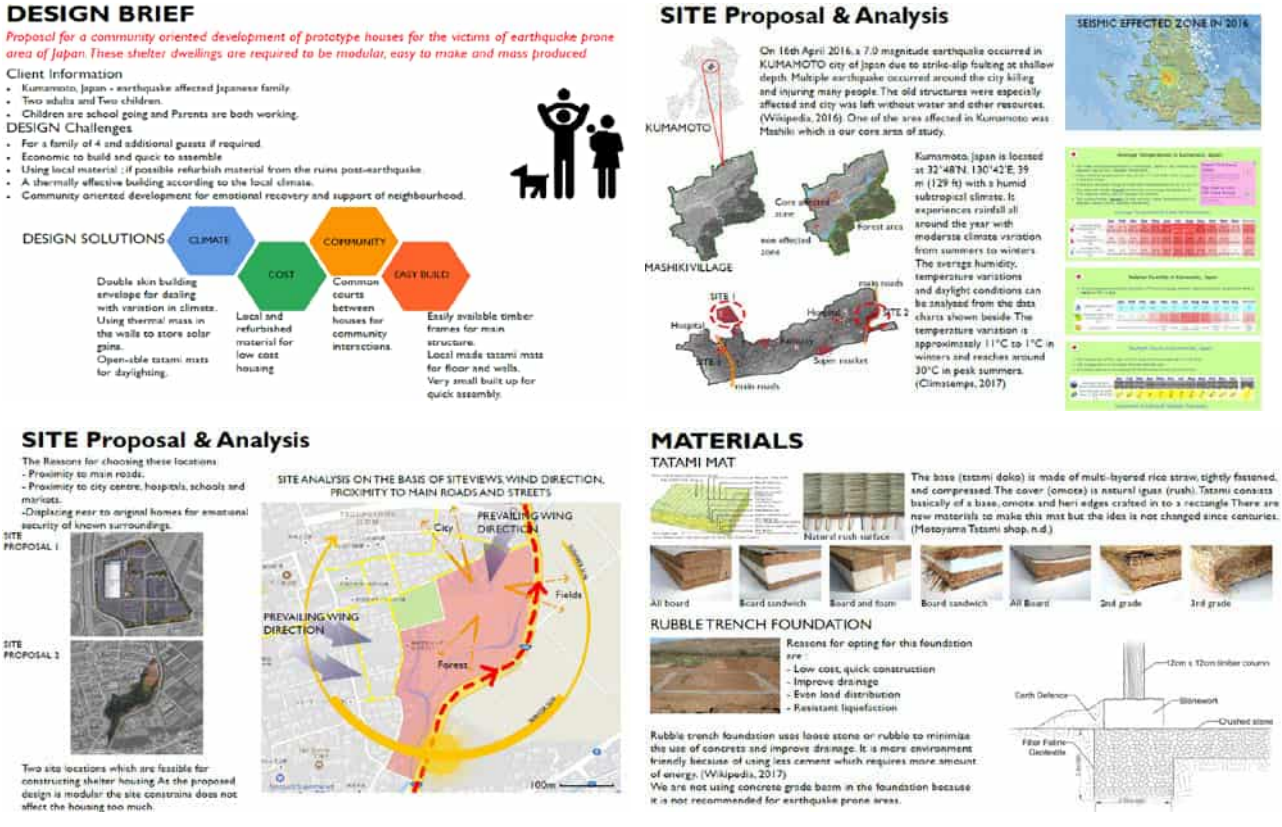

Figure 4. Understanding context, site and materials

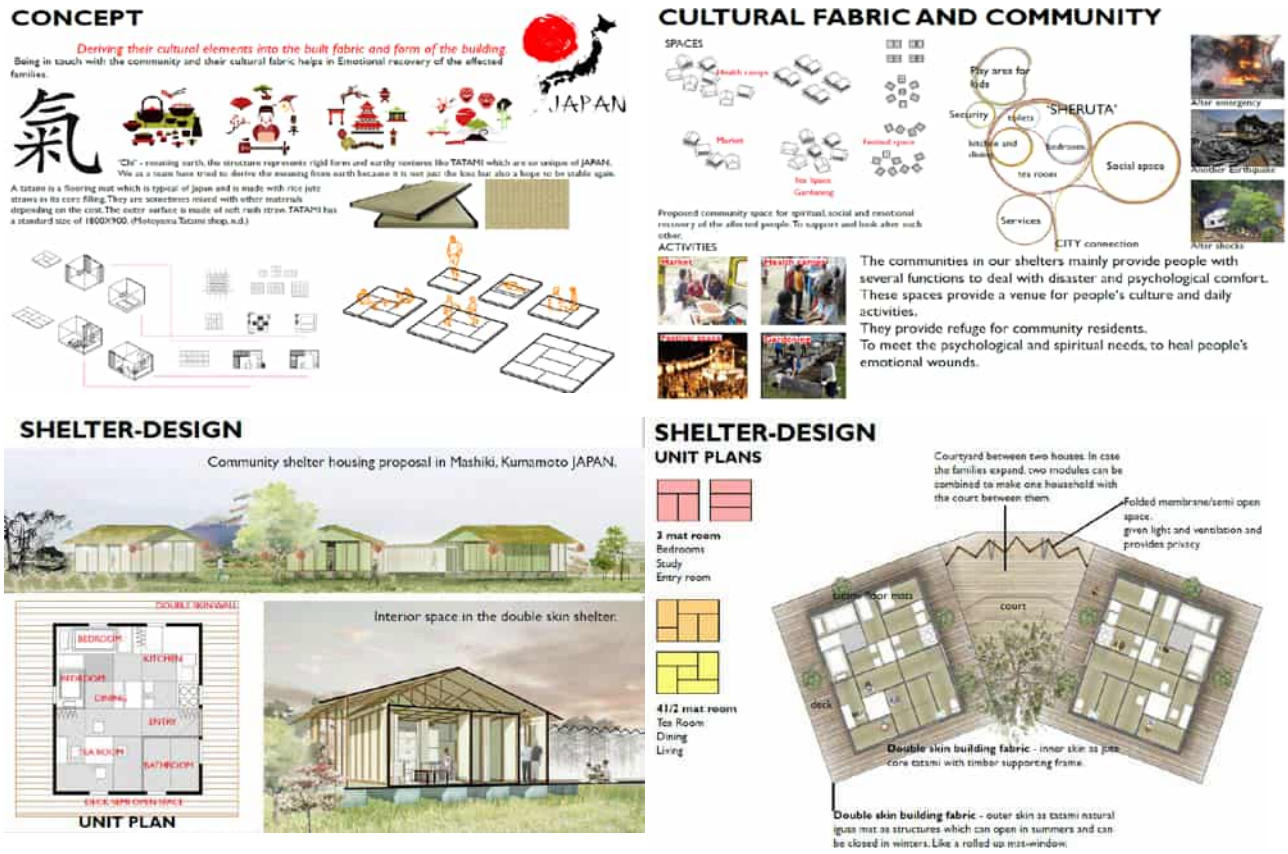

Figure 5. Concept and design development

Figure 6. Materials and tectonics

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READING GLOBAL ARCHITECTURE MEDIUM THROUGH ARCHITECTURAL BIENNIALS / TRIENNIALS

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Abstract

Through the history of architecture, several societies reflected various architectural insights to their architectural works from special perspectives in different geographies. This situation leads to the distinctions and diversifications of the architectural products in their raison d'être (reason for being), stylistic approaches and building types. This natural multiplicity in the architectural medium, over time, especially in the rapidly changing modern world of today, reduces the observability and discussability of the architectural medium. Therefore, it is regarded as the "architectural biennials/triennials" allow observing and discussing the changes and developments in the global architectural medium in proper ways. The architectural biennials/triennials represent the media in which the architecture phenomenon is presented, discussed, criticized and emphasized the direction and acceleration of architecture by producing discourses, based on the themes set by curators or organization committees.

From this point of view, the question of the research is; "do the themes, discourses and products revealed by "architectural biennials/triennials" respond to the current problems and needs of the global architectural medium?"

In this sense, the purpose of the research is to determine the ways in which the architectural medium handles architecture with different societies and perspectives in different geographies on a global scale by "architectural biennials/triennials", in addition, to reach a holistic approach of the global architectural medium in the light of "architectural biennials/triennials". In parallel with this purpose, Chicago Architecture Biennial (from America), Venice and Rotterdam Architecture Biennials and the Lisbon Architecture Triennial (from Europe), Hong Kong/Bi-City Biennial of Architecture and Urbanism (from Asia) will be examined. The research is limited to 20 biennials and triennials made in the last 10 years due to the architectural differences that may arise from periodical perspective. In the research process, firstly the mentioned biennials and triennials will be categorized within the scope of their themes and discussion topics, the findings will be obtained. Subsequently, descriptive analyzes of the discourses will be made through the obtained themes and topics based categorical findings. As the result of the research, the interpretations of the data obtained according to the framework created by the descriptive analysis method, the comparisons, evaluations and critics of the current global architectural problems within the biennials and triennials will be put forward.

Keywords

Architecture, Biennial, Triennial, Discourse, Product, Descriptive Analysis.

1 Introduction

The culture of architecture had been evolving continuously throughout the history. Starting its journey as a means to provide shelter to people, architecture, in time, came to cater for a multitude of needs and interests. The development of the works of architecture has been on a parallel course to that of the civilizational development of humanity. Geographical discoveries and the Industrial Revolution, in turn, accelerated this change and evolution embedded in the architectural culture. Such rapid developments in information and technologies also made it easier for people from different cultures to meet, and thus facilitated interaction between cultures. Elements of different modes of life could reach out to and get transplanted in different geographies. At this junction, the culture of architecture underwent formal, functional and semantic interactions. The world exhibitions acted as a major milestone in this context, furthering the development of architectural culture.

The first world exhibitions began in mid-19th century, providing a focal point to put on display any and all cultural, technical and technological developments and elements together. They provided the opportunity to get insights into and transfer knowledge from the wider world, from a single source. From the late 19th century on, the world exhibitions were followed by a string of biennales and triennials providing the medium of discussion and sharing about culture, arts and architecture, and effectively making a number of countries as the centres of attraction. The culture of architecture, in its turn, became an element of this sharing tradition; contributing for years either as the space to host the biennale/trienal, or as an object of mediation in the form of an element of culture. In this context, till 1980, the culture of architecture had been represented in the oldest biennale of the world; the Venice Biennale. From that year on, the biennale specialized as “The Biennale Architettura”. The Venice Biennale Architettura first focused on the architectural philosophy of the era and before, focusing on the main theme of “The Presence of the Past”. The main exhibition named “Strada Novissima” gave start to discussions on post-modernism [1]. Since day one, the Venice Biennale Architettura has been the most comprehensive and leading event where the architectural culture of the world is put on display. In addition to the Venice Biennale Architettura, there are a number of biennales and triennials which play a part in the culture of architecture with the discourses and products they present.

The article analyzed the Chicago Biennale of Architecture for the Americas, Venice and Rotterdam Biennales of Architecture and Lisbon Triennial of Architecture for Europe, and Hong Kong/Bi-City Biennale of Urbanism/Architecture, with a view to discuss how different societies living in different geographies of the globe approached the culture of architecture through different lenses.

2 Method and Content of the Study

Within the framework of the study focusing on biennales and triennials of architecture for potential solutions to current issues and problems of global architecture, the discourses developed were employed to present a qualitative research approach. The discourses were

analyzed within the context; data were gathered true to the form and content of the discourses; data sets were developed and analyzed; and a synthesis was developed by descriptive analysis method.

The descriptive analysis method comprises four stages. The first stage of descriptive analysis is about the development of thematic frameworks. These thematic frameworks are identified in line with the objectives of the study. In the second stage, the previously identified thematic framework is employed as the means to organize and reorganize the discourses. At this stage, direct quotations from the discourses may be employed for the analysis of data. The third stage engages in characterizing the findings by utilizing the discourses quoted within the framework of thematic frameworks. The fourth and final stage, the interpretation of findings, seeks associations between and assignment of meaning to discourses [6]. The stages of descriptive analysis grouped in their own right, provide the structure of the study, (Table 1). The development of thematic frameworks and the organization of the discourses refer to the "presentation: upline" step of the study. The stage of characterizing the findings represents the "evolvement: meanline" step. The interpretation of the findings gathered, in turn, is the step where the "conclusion: buttomline" of the study are expressed.

Table 1. The Structure of the Study according to Descriptive Analysis Method.

PRESENTATION: UPLINE				**EVOLVEMENT: MEANLINE**		**CONCLUSION: BUTTOMLINE**
Development of Thematic Frameworks	→	Organization of Discourses	→	Characterization of Findings	→	Interpretation of Findings

The study attempts to identify different approaches to the culture of architecture on part of different societies living in different geographies worldwide, with reference to "biennales and triennials of architecture". To achieve a holistic reading of the global architecture environment, the discourses of the abovementioned biennales and triennials were analyzed. With a view to preventing potential problems to arise because of variations which may arise in architectural culture through the years, the study was limited with a set of 20 biennales and triennials which were held in approximately the last 10 years. The biennales and triennials are listed in the following Tables, along with the theme of the biennale of that year.

3 Presentation

3.1. Upline: Development of Thematic Frameworks

The first step of the descriptive analysis led to the development of three thematic frameworks for the comparison, evaluation, and critique of contemporary problems of global architecture: "The architectural and/or urban contents of the topics discussed", "local and/or global nature of the topics discussed", and "the time frame referred to the topic discussed (extensive/past/present/future)".

- The purpose of establishing the architectural or urban contents of the topics discussed as part of the discourses of the biennales and triennials is to understand the relationships

between the topics discussed at a given biennale or triennial through the years, or between the topics discussed at different events. Doing so will enable the categories employed to discuss the issues and problems concerning the architectural culture.

- A second thematic framework is about the local or global nature of the topics discussed at biennales and triennials. The purpose of establishing this thematic framework is to identify the geographical domains where the issues and problems discussed were influential. In this context, the borders of the areas of the biennale or triennial discourses focus on, and the target groups they reach out can be determined.

- It is impossible to think the culture of architecture without the context of time. Concordantly, the third thematic framework aims to determine the time frames specified by the issues discussed at the biennales and triennials. The time frames discussed are extensive, past, present, and future, with reference to the contents of the issues and problems rose in the discourse of biennales or triennials. The culture of architecture is always in action through time and space, providing references for the past, present, and future. The biennales and triennials, which represent the footsteps of architectural culture, can be tracked through these temporal and spatial references.

3.2. Upline: Organization of Discourses (According to the Thematic Frameworks)

The second stage of the analysis, the organization of discourses with reference to the thematic framework, led to a table where the discourses of the biennales and triennials were arranged in a chronological order. This allows the comparison of a given biennale or triennial through time, and understanding its relationship with other biennales and triennials.

- **The Architectural and/or Urban Contents of the Topics Discussed**

The biennale/triennial discourses in which the architectural and/or urban contents of the topics discussed are given in Table 2.

Table 2. Discourses according to the Architectural and/or Urban Contents of the Topics Discussed.

Biennale / Triennial Years / Themes	Discourses
Venice 2009-2011 People Meet in Architecture	*"In such a rapid-changing context, can architecture clarify new values and a new lifestyle for the present? Hopefully, this show will be a chance to experience the manifold possibilities of architecture, as well as to account for its plurality of approaches, each one of them being a different way of living. The idea is to help people relate to architecture, to help architecture relate to people, and to help people relate to themselves."* [3]
Venice 2011-2013 Common Ground	*"The discipline of architecture involves diverse and often contradictory concerns, but I believe we share ideas and visions that can be confirmed through architecture itself. Common Ground invites us to find these shared ideas from our individual positions of difference."* [4]
Venice 2013-2015 Fundamentals	*"After several architecture Biennales dedicated to the celebration of the contemporary, Fundamentals looks at histories, tries to reconstruct how architecture finds itself in its current situation, and speculates on its future. Elements of Architecture looks under a microscope at the fundamentals of our buildings, used by any architect, anywhere, anytime: the floor, the wall, the ceiling, the roof, the door, the window, the façade, the balcony, the corridor, the fireplace,*

Biennale / Triennial Years / Themes	Discourses
	the toilet, the stair, the escalator, the elevator, the ramp." [5]
Venice 2015-2017 Reporting from the Front	*"We believe that the advancement of architecture is not a goal in itself but a way to improve people's quality of life. Given life ranges from very basic physical needs to the most intangible dimensions of the human condition, consequently, improving the quality of the built environment is an endeavor that has to tackle many fronts: from guaranteeing very concrete, down-to-earth living standards to interpreting and fulfilling human desires, from respecting the single individual to taking care of the common good, from efficiently hosting daily activities to expanding the frontiers of civilization." [6]*
Venice 2017-2019 Free Space	*"With the theme of Freespace, the Biennale Architettura 2018 will present for public scrutiny examples, proposals, elements - built or unbuilt - of work that exemplifies essential qualities of architecture which include the modulation, richness and materiality of surface; the orchestration and sequencing of movement, revealing the embodied power and beauty of architecture."* [7]
Rotterdam 2009-2011 Open City, Designing Coexistence	*"In the history of utopias, the reflection of the ideal society often takes the form of a city. In this way, we can view the Open City as a spatial translation of an open society."* *"The structure of the Open City functions as an operating system in which city life can nestle. A complex network of public spaces, physical and electronic, is the most important component of this operating system, where exchanges among people, ideas and goods can take place. The Open City is therefore not a utopia or a clear-cut reality, but rather a situation, a balance between open and closed between integration and de-integration, between control and "laissez-faire."* [8]
Rotterdam 2011-2013 Making City	*"The 5th IABR was therefore developed as a search for a new relationship between the governance and the transformation of the city, between politics and design. How do w ego about making city?"* [9]
Rotterdam 2013-2015 Urban by Nature	*"The boundary between the city and the countryside is blurring but also the boundary between nature and society. We become gradually aware of the hybridization of the biosphere with the techno-sphere at large. Hence the observation that urban landscapes form our habitat, ecology and our nature. We are a social species with a propensity to cluster together and to build cities: we are Urban by Nature."* [10]
Rotterdam 2015-2017 The Next Economy	*"In half a century, twice as many people will live in cities as do now. The city will then truly be the motor of the global economy. What does this urban Next Economy have in store for us?"* [11]
Rotterdam 2017-2019 The Missing Link	*"How can we get from agendas, knowledge, and plans to truly effective spatial transformation? What is the new metanarrative that can bring us, as a society – that is: truly together – to the future? How can we organize that transition as a spatial, but at the same time social project that both takes our resistance to change into account and mobilizes our longing for it? How do we realize change fast enough, in enough places at a time, both affordably and socially inclusive way? And what does the new design practice we need to meet that objective look like? The actual problem surpasses this and is also much more challenging: we need to give up our addictions, our slash-andburn consumerism, and our blind faith in growth, our mortgage on the future. We need a radically different interpretation of 'value,' 'prosperity,' and 'future.' The actual problem affects the roots of our existence. Can we, collectively, deal with this?"* [12]
Lisbon 2009-2012 Let's Talk about Houses	*"The Triennial starts with the house as the representation of dwelling in the knowledge that a house always exceeds the intentions of the architect, who created it, because a house is the representation of an existence, be it long or fatuous, brief or as boundless as the houses of Kavafis."* [13]
Lisbon 2012-2015	*"Close, Closer is an investigation into the expanding field of contemporary architectural practice. The Triennial is considering the condition in which*

Close, Closer	*architecture is practiced and the way it is framed, expressed and understood."* [14]

Lisbon 2015-2018 The Form of Form	*The different perspectives on architecture will be presented through their aesthetic, technical, social and political aspects. Understanding architecture as a profession that is committed to a complex social context will make it possible to further advance the implications and possibilities of architectural decisions, enhancing their technical and cultural importance in society.* [15]
Hong-Kong 2009-2011 City Mobilization	*"The 2009 Biennale set up theme of "City Mobilization" aiming to test the possibility of large-scale, effective social mobilization in an age that lacks centralized force, spiritual solidarity and practical organization, and to create a top biennale which was also accessible for all participation."* [16]
Hong-Kong 2011-2013 Architecture Creates Cities. Cities Create Architecture	*"The exhibition theme portrayed the endless interaction between architecture and cities, and provoked an in-depth discussion on sustainability and urban vitality."* [16]
Hong-Kong 2013-2015 Urban Border	*"The exhibition theme of "Urban Border" featured the distinctions of Shenzhen and Hong Kong, and the biennale has reclaimed two neglected industrial sites in the Shekou, Nanshan District of Shenzhen, transforming them into cutting-edge exhibition spaces."* [16]
Hong-Kong 2015-2017 Re-Living the City	*"It proposes architecture that reflects the reuse and rethinking of existing buildings, the reimagination of our cities, and the remaking of our daily lives by design. It will be a biennale of fragments, not abstract plans, of collage, not grids, of tactical urbanism, not top-down infrastructural strategies."* [17]
Hong-Kong 2009-2011 Cities Grow in Difference	*"Cities, Grow in Difference" fundamentally signifies a recognition and inclusion of things of different origins, status and values at social, cultural and spatial levels. It is a revolt against the mainstream culture ruled by "centralism".“* [18]
Chicago 2013-2015 The State of the Art of Architecture	*"...the Chicago Architecture Biennial brings an international and intergenerational network of architectural talent together to explore the ambitions, challenges and possibilities that are fuelling the architectural imagination today and steering the future of the field."* [19]
Chicago 2015-2017 Make New History	*"The Biennial will foreground questions and ideas regarding the making of a new history: what political role has history played in the regulation of buildings and the city, how can buildings speak to history without being nostalgic or pastiche, and how might we build connections to the past that are relevant and valuable to our present?"* [20]

- **The Local and/or Global Nature of the Topics Discussed**

The biennale/triennial discourses in which the local and/or global nature of the topics discussed are given in Table 3.

Table 3. Discourses according to the Local and/or Global Nature of the Topics Discussed.

Biennale / Triennial Years / Themes	Discourses
Venice 2009-2011 People Meet in Architecture	*"Nowadays, it feels as if we are living in a post ideological society. We are more connected than ever, our culture, as well as our economy, has become global. Because of this, people's consciousness and lifestyles change, theoretically and substantially."* [3]
Venice 2011-2013 Common Ground	*"This Biennale, coming at a time of global economic anxiety, offers us a chance to put into perspective the undeniable individual architectural achievements that have given identity to the recent years, and to provoke a more focused*

Biennale / Triennial Years / Themes	Discourses
	consideration of our shared concerns and expectations." [4]
Venice 2013-2015 Fundamentals	*"Absorbing Modernity: 1914–2014 examine key moments from a century of modernization. Together, the presentations start to reveal how diverse material cultures and political environments transformed a generic modernity into a specific one. Participating countries show, each in their own way, a radical splintering of modernities in a century where the homogenizing process of globalization appeared to be the master narrative…"* *"Monditalia In a moment of crucial political change, we decided to look at Italy as a "fundamental" country, completely unique but also emblematic of a global situation where many countries are balancing between chaos and a realization of their full potential. ...Each project in Monditalia concerns unique and specific conditions but together form a comprehensive portrait of the host country."* [5]
Venice 2015-2017 Reporting from the Front	*"REPORTING FROM THE FRONT will be about sharing with a broader audience, the work of people that are scrutinizing the horizon looking for new fields of action, facing issues like segregation, inequalities, peripheries, access to sanitation, natural disasters, housing shortage, migration, informality, crime, traffic, waste, pollution and participation of communities."* *"... we would like each country to share with the rest of the world, what are the fights they face at home, so that we can be warned about challenges we might be unaware of but also share some knowledge because we shouldn't be alone in the effort of improving the places where life occurs."* [6]
Venice 2017-2019 Free Space	*"We see the earth as Client. This brings with it long-lasting responsibilities. Architecture is the play of light, sun, shade, moon, air, wind, gravity in ways that reveal the mysteries of the world. All of these resources are free."* [7]
Rotterdam 2009-2011 Open City, Designing Coexistence	*"Global networks can shape transnational communities, whereby mutual ties within a community are stronger than those with the city in which it finds itself."* [8]
Rotterdam 2011-2013 Making City	*"With this aim in mind we looked for partners with whom we could form alliances based on locally urgent challenges for the purpose of actually making city. We found these partners in our base of Rotterdam, in Sao Paulo and in Istanbul, and in The Dutch government."* [9]
Rotterdam 2013-2015 Urban by Nature	*"This positive angle on urbanization as a highly successful model of spatial organization must not eclipse the observation that most global environmental problems have urban roots. If we want to solve these problems we have to solve our urban problems. And moreover: we have to solve them by retrofitting the existing urban landscapes. And moreover: we have to solve them by retrofitting the existing urban landscapes."* [10]
Rotterdam 2015-2017 The Next Economy	*"Together they offer an abundance of possible futures: from radical scenarios for an energy transition to examples of an experimental, cooperative local development strategy, and from megaprojects on the North Sea and in Africa to neighbourhood initiatives in South America, China, and Rotterdam."* [11]
Rotterdam 2017-2019 The Missing Link	*"The Missing Link paves the way for a wide public debate, for new research by design and for international exchange, and for the further development of knowledge about the link between more sustainability and solidarity, between our current system and the radical change that is necessary, between the multitude of initiatives and the ambitious goals we have set, and between the fear of and the longing for change."* [12]
Lisbon 2009-2012 Let's Talk about Houses	*"The theme of the 2010 Lisbon Architecture Triennial is LET´S TALK ABOUT HOUSES, a phrase from a poem by the Portuguese poet Herberto Helder. And its inherent urgency is nowadays fully justified. The idea is to debate the question of housing, both literally and in a broader sense of housing in the world."* [13]

Lisbon 2012-2015 Close, Closer	*"The museums, project spaces, libraries, journals and magazines all around the world which frame the practice of contemporary architecture, commission and write its future history, are arguably as influential on today's landscape as the credited authors, the architects."* [14]

Lisbon 2015-2018 The Form of Form	*"Under the title The Form of Form, and aimed at a national and international audience, this 4th edition of the Lisbon Triennial sets out to further the debate around a wide spectrum of contemporary approaches to architectural practice today; in other words, to debate the ways in which the world is transformed."* [15]
Hong-Kong 2009-2011 City Mobilization	*"The 2009 Biennale set up theme of "City Mobilization" aiming to test the possibility of large-scale, effective social mobilization in an age that lacks centralized force, spiritual solidarity and practical organization, and to create a top biennale which was also accessible for all participation."* [16]
Hong-Kong 2011-2013 Architecture Creates Cities. Cities Create Architecture.	*"His influence and international recognition has contributed to the success of the biennale and helped attract worldwide attention."* [16]
Hong-Kong 2013-2015 Urban Border	*"The exhibition theme of "Urban Border" featured the distinctions of Shenzhen and Hong Kong, and the biennale has reclaimed two neglected industrial sites in the Shekou, Nanshan District of Shenzhen, transforming them into cutting-edge exhibition spaces."* [16]
Hong-Kong 2015-2017 Re-Living the City	*"It will collect concrete projects and fragments from around the world that we can use to construct social and economic connections."* [17]
Hong-Kong 2009-2011 Cities Grow in Difference	*"As the theme of the 2017 Bi-City Biennale of Urbanism\Architecture (Shenzhen), "Cities, Grow in Difference" represents not only a critical interpretation of the current urbanization in today's China and the world but also an aims to envision alternative models of future cities."* [18]
Chicago 2013-2015 The State of the Art of Architecture	*"The State of the Art of Architecture offers an opportunity to take stock of architectural projects and experiments from around the world, establishing a broad foundation for future editions of the Chicago Architecture Biennial."* [19]
Chicago 2015-2017 Make New History	*"The Chicago Architecture Biennial 2017 will showcase the diversity of work from around the world to examine the underpinnings of this resurgence of historical interest."* [20]

- **The Time Frame Referred to the Topic Discussed (Extensive/Past/Present/Future)**

The biennale/triennial discourses in which the time frame referred to the topic discussed (extensive/past/present/future) are given in Table 4.

Table 4. Discourses according to the Time Frame Referred to the Topic Discussed (Extensive/Past/Present/Future).

Biennale / Triennial Years / Themes	Discourses
Venice 2009-2011 People Meet in Architecture	*"Still, we believe that architecture plays a significant role in this: it has the power to open up new perspectives. We imagine ideas that can have far reaching effects. These dreams come from many sources and may represent a new independent freedom that is essentially inherent to contemporary culture."* [3]
Venice 2011-2013 Common Ground	*"I wanted to encourage my colleagues to react to the prevalent professional and cultural tendencies of our time that place such emphasis on individual and isolated actions. I encouraged them instead to demonstrate the importance of influence and of the continuity of cultural endeavour, to illustrate common and*

Biennale / Triennial Years / Themes	Discourses
	shared ideas that form the basis of an architectural culture." [4]
Venice 2013-2015 Fundamentals	*"Elements of Architecture that reconstructs the global history of each element. It brings together ancient, past, current, and future versions of the elements in rooms that are each dedicated to a single element."* [5]
Venice 2015-2017 Reporting from the Front	*"There are several battles that need to be won and several frontiers that need to be expanded in order to improve the quality of the built environment and consequently people's quality of life."* [6]
Venice 2017-2019 Free Space	*"Freespace encompasses freedom to imagine, the free space of time and memory, binding past, present and future together, building on inherited cultural layers, weaving the archaic with the contemporary."* [7]
Rotterdam 2009-2011 Open City, Designing Coexistence	*"The Open City must not be under stood simply as an appealing 19th-century district with street level access, a finely-meshed network of streets, and an affable mixture of functions, where anonymity is guaranteed, strangers walk around, and pedestrians dominate in short, those qualities that one might extract from a superficial reading of the work of Jane Jacobs."*[8]
Rotterdam 2011-2013 Making City	*"… our premise was our conviction that in an era of extreme worldwide urbanization, "making city" is a project that belongs at the center of the societal and political debate about the future."* [9]
Rotterdam 2013-2015 Urban by Nature	*"We can't go back just as we can't go back to the weather of last month. The relentless arrow of time points in only one direction. Further. We are moving amidst mobility, changing a changing medium. We urgently need to learn riding this tiger."* [10]
Rotterdam 2015-2017 The Next Economy	*"With the use of new and innovative design strategies that effectively address the city as the bigger urban landscape that it is, we can make the city more resilient and thus truly contribute to a more sustainable future World."* [11]
Rotterdam 2017-2019 The Missing Link	*"Architects are invited to imagine the public spaces, neighbourhoods, and urban landscapes the big change may bring. By making the potential qualities of places visible, architecture and spatial design can open the door to subjects we can show and discuss. To a future that we can want."* [12]
Lisbon 2009-2012 Let's Talk about Houses	*"In this sense, the vocative borrowed from Herbert Helder is taken as an indispensable condition of architecture, because architecture, at every moment, operates like an investment in the tragedy of its failure, at times for the purposes of its glory, that is, its appropriation."* [13]
Lisbon 2012-2015 Close, Closer	*"Future Perfect is a fictional, future city. ...The exhibition is a stage set for a collection of fictions, emerging infrastructures and design experiments that can be inhabited as large-scale districts of the future city."* [14]
Lisbon 2015-2018 The Form of Form	*"the programme will highlight the challenges that architects face today."* [15]
Hong-Kong 2009-2011 City Mobilization	*"The 2009 Biennale set up theme of "City Mobilization" aiming to test the possibility of large-scale, effective social mobilization in an age that lacks centralized force, spiritual solidarity and practical organization, and to create a top biennale which was also accessible for all participation."* [16]
Hong-Kong 2011-2013 Architecture Creates Cities. Cities Create Architecture.	*"The exhibition theme portrayed the endless interaction between architecture and cities, and provoked an in-depth discussion on sustainability and urban vitality."* [16]
Hong-Kong 2013-2015 Urban Border	*"The exhibition theme of "Urban Border" featured the distinctions of Shenzhen and Hong Kong, and the biennale has reclaimed two neglected industrial sites in the Shekou, Nanshan District of Shenzhen, transforming them into cutting-edge exhibition spaces."* [16]

Hong-Kong 2015-2017 Re-Living the City	*"It proposes architecture that reflects the reuse and rethinking of existing buildings, the reimagination of our cities, and the remaking of our daily lives by design."* [17]

Hong-Kong 2009-2011 Cities Grow in Difference	*""Cities, Grow in Difference" fundamentally signifies a recognition and inclusion of things of different origins, status and values at social, cultural and spatial levels. It is a revolt against the mainstream culture ruled by "centralism". We must respect the balance of the urban ecosystem like we respect the delicate balance of nature, in which the ecological system exists in a dynamic equilibrium. In the similar way, the balance of contradiction and hybridity in the city shouldn't be broken arbitrarily. On the other hand, respecting otherness is a test of the degree of tolerance of a city."* [18]
Chicago 2013-2015 The State of the Art of Architecture	*"It invites both emerging and established practices from across the world to Chicago to demonstrate how groundbreaking advances in architectural design are tackling the most pressing issues of today."* [19]
Chicago 2015-2017 Make New History	*"The act of looking to the past to inform the present has always been central to architecture."*[20]

4 Evolvement

4.1. Meanline: Characterization of Findings

- All Venice Biennales Architettura held in the last decade were directly related with architecture. The discourses presented within the framework of Rotterdam Biennale of Architecture, on the other hand, are related with urban issues in general. The discourse concerning the biennale theme "The Missing Link", cannot be associated only with architectural or urban issues, for the discourse leads to a discussion of general design problems concerning architecture and the context of urban space. A glance at the discourses of Lisbon Triennial of Architecture, on the other hand, reveals that all are related to architecture. The elements of the discourses at Lisbon Triennial of Architecture usually discuss the practice of architecture. Hong Kong Biennale of Urbanism/Architecture, representing Asia in the sample, is not associated with a single discipline in terms of the discourses developed. The themes "City Mobilization" and "Cities Grow in Difference" lead to definitions against an urban context. The other years' biennales on the themes "Urban Border", "Re-Living the City", and "Cities Grow in Difference", on the other hand, were the scenes of both architectural and urban discourses. The Chicago Biennale of Architecture, included in the sample to represent the Americas, in its turn, is a younger event compared to other biennales and triennials. The events based on the themes "The State of the Art of Architecture" and "Make New History" cover only discourses on architecture, (Table 5).

<table>
<tr><th></th><th>VENICE</th><th>ROTTERDAM</th><th>LISBON</th><th>HONG-KONG</th><th>CHICAGO</th></tr>
<tr><td>2009 - 2011</td><td>People Meet in Architecture</td><td>Open City, Designing Coexistence</td><td rowspan="2">Let's Talk about Houses</td><td>City Mobilization</td><td rowspan="2"></td></tr>
<tr><td>2011 - 2013</td><td>Common Ground</td><td>Making City</td><td rowspan="2">Architecture Creates Cities. Cities Create Architecture.</td></tr>
<tr><td>2013 - 2015</td><td>Fundamentals</td><td>Urban by Nature</td><td rowspan="2">Close, Closer</td><td>Urban Border</td><td>The State of the Art of Architecture</td></tr>
<tr><td>2015 - 2017</td><td>Reporting from the Front</td><td>The Next Economy</td><td rowspan="2">The Form of Form</td><td>Re-Living the City</td><td rowspan="2">Make New History</td></tr>
<tr><td>2018</td><td>Free Space</td><td>The Missing Link</td><td>Cities Grow in Difference</td></tr>
</table>

	Architectural		Urban		Both Architectural and Urban

Table 5. Distribution of the Themes according to the Architectural and/or Urban Contents.

• On the local or global nature of the issues discussed at biennales and triennials, the discourses of Venice Biennale Architettura were found to revolve around global issues in general. Yet, the biennale held in 2014 around the theme "Fundamentals" exhibited examples of global architectural culture at the exhibition "Absorbing Modernity", and those of local (Italian) architectural culture at the exhibition "Monditalia". In parallel to Venice Biennale Architettura, the discourses of Rotterdam Biennale of Architecture usually entail global portrayals. The biennale on the theme "Making City" leads to global definitions with reference to local architecture and urban issues. Another event from Europe, Lisbon Triennial of Architecture, also focuses on the issues and problems of global architecture. The event in 2009, based on the theme "Let's Talk about Houses" led to global definitions regarding housing problems, with reference to the poetry by a local poet. Four of the discourses developed within the framework of Hong Kong Biennale of Urbanism/Architecture, exhibit global characteristics in terms of their contents. Only the biennale based on the theme "Urban Border" dwelt on local urban issues. The Chicago Biennale of Architecture included in the sample from the Americas, focuses on global issues and problems of architecture, in parallel to the other events analyzed, (Table 6).

<table>
<tr><th></th><th>VENICE</th><th>ROTTERDAM</th><th>LISBON</th><th>HONG-KONG</th><th>CHICAGO</th></tr>
<tr><td>2009 - 2011</td><td>People Meet in Architecture</td><td>Open City, Designing Coexistence</td><td rowspan="2">Let’s Talk about Houses</td><td>City Mobilization</td><td rowspan="2"></td></tr>
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<tr><td>2013 - 2015</td><td>Fundamentals</td><td>Urban by Nature</td><td>Urban Border</td><td>The State of the Art of Architecture</td></tr>
<tr><td>2015 - 2017</td><td>Reporting from the Front</td><td>The Next Economy</td><td rowspan="2">The Form of Form</td><td>Re-Living the City</td><td rowspan="2">Make New History</td></tr>
<tr><td>2018</td><td>Free Space</td><td>The Missing Link</td><td>Cities Grow in Difference</td></tr>
</table>

	Global		Local		Both Local and Global		From Local to Global

Table 6. Distribution of the Themes according to the Local and/or Global Contents.

• In terms of the thematic framework on the time frame concerning the topics discussed, the Venice Biennale Architettura discusses issues or problems through different time frames. The biennales on the themes “People Meet in Architecture”, “Fundamentals”, and “Free Space” discuss issues extending from the past to present and beyond. That is why these biennales are listed among those focusing on an extended time frame. The biennales organized around the themes “Common Ground” and “Reporting from the Front”, on the other hand, discuss architectural issues and problems only with reference to the future. All Rotterdam Biennales of Architecture analyzed seek answers to issues and problems concerning the future. Among the Lisbon Triennials of Architecture, the one on the theme “Let’s Talk about Houses” focuses on an extensive time frame, while the ones on the themes “Close, Closer” and “The Form of Form” focus on issues and problems afflicting the future. The discourses discussed in the context of Hong Kong Biennale of Urbanism/Architecture pertain to various time frames. The discourses under the biennale with the theme “City Mobilization” were about the future, those of the biennales with the themes “Architecture Creates Cities-Cities Create Architecture”, “Re-Living the City” and “Cities Grow in Difference” were about extended time frames, and those of the biennale with the theme “Urban Border” were about the present. In the context of Chicago Biennale of Architecture, the discourses around the theme “The State of the Art of Architecture” focused on the present, and those around the theme “Make New History” discussed the past, (Table 7).

	VENICE	ROTTERDAM	LISBON	HONG-KONG	CHICAGO
2009 - 2011	People Meet in Architecture	Open City, Designing Coexistence	Let's Talk about Houses	City Mobilization	
2011 - 2013	Common Ground	Making City		Architecture Creates Cities. Cities Create Architecture.	
2013 - 2015	Fundamentals	Urban by Nature	Close, Closer	Urban Border	The State of the Art of Architecture
2015 - 2017	Reporting from the Front	The Next Economy	The Form of Form	Re-Living the City	Make New History
2018	Free Space	The Missing Link		Cities Grow in Difference	

	Past		Present		Extensive		Future

Table 7. Distribution of the Themes according to the Time Frame (Extensive/Past/Present/Future) Content.

5 Conclusion

5.1. Buttomline: Interpretation of Findings

The thematic frameworks "the architectural or urban contents of the topics discussed", "local or global nature of the topics discussed", and "the time frame referred to the topic discussed" established during the analysis stage led to a number of interpretations. The interpretations developed in this context are as follows:

The vast majority of architectural action takes place in urban environments. That is why architecture and the city are in an endless interaction. The discourses developed for biennales and triennials can lead to an easier reading of this picture. The areas the discourses focus on can often be categorized. In this context, the contents each and every one of the biennales and triennials organized in the last 10 years had focused through the process are presented in Table 6. Venice Biennale Architettura, Lisbon Triennale of

Architecture, and Chicago Biennale of Architecture focus on architectural contents. Rotterdam Biennale of Architecture, on the other hand, focuses only on urban issues. Hong Kong Biennale of Urbanism/Architecture, on the other hand, engaged in discourses concerning both areas, as the name would suggest.

The biennales and triennials concerning the architectural culture do not differ from the world exhibitions, the first events of a comparable character. The biennales and triennials serve as the locomotives of globalization in terms of architectural culture, given the extensive influence of their discourses. Discourses with a local focus, on the other hand, are exceptions. Even though these events act as the locomotives of globalization, the discourses of some biennales and triennials stand in opposition to unrestrained globalization.

In general, the biennales and triennials expressing a reflection of architectural culture, were scenes of solid findings regarding the past and of encouraging discourses shaping the future about the themes discussed. That is why the curators consider the biennales and triennials as a starting point for developing a view of architecture, with reference to the issues and problems discussed. In this context, architecture is likely to continue to come up with and develop visionary perspectives about shaping and organizing the social life through biennales and triennials.

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CHOREOGRAPHY OF CHANGE; UNFOLDING ARCHITECTURAL POTENTIALS OF WEAKNESS

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Abstract

Environmental forces and processes (entropy) are inevitably and substantially affecting the built environment. In most cases, these changes are unintentional and are visible as weathering of surfaces, structural disintegration, et cetera. In an age in which architecture is increasingly image-based, the ideal state of a building is often conceived as immediately after being built and still appears as it was drawn by the architect. Considerable resources are then used on counteracting wear and tear to keep the buildings in this fixed ideal state, *working against* the forces.

Opposing the idea of architecture as a strong and rigid entity, the paper discusses how *weakness* can act as a response to environmental influences. Weakness is a term that usually comes with negative connotations. The paradox and ambiguity of this term are intriguing. Unfolding the subject, weakness conducts vital tasks – and in some cases what makes a system 'strong' and resilient.

The paper examines the philosophy of weakness from a theoretical perspective, and further connecting to Umberto Eco's concept of '*open work'* that opens up for discussions of anticipation and uncertainty. Through this theoretical framework, specific *tectonic examples* of systems with an embedded weakness are explored.

The overall research project, *'Weakness in Architecture; Changing Spatial Environments and Tectonics´* (2017-), is in the early stage and investigates how weakness can foster a dynamic relationship between architecture and environmental forces and processes. This paper intends to unfold potentials, pose questions and open up a discussion. More than providing clear answers, it suggests possible directions for further architectural speculations.

Keywords

Weakness, open work, process-based architecture, Oslo Opera House, choreography of change

1 Introduction

In an age in which architecture has become increasingly image-based, the ideal state of a building is often conceived as immediately after being built and still appears as it was drawn.

According to the philosopher Gernot Böhme, 'the representation of the work in photographs has become just as important as, if not more important than, the building itself.'[1] However, environmental forces and processes (entropy) are inevitably and substantially affecting the built environment, causing material and structural changes that diverge from the grand plan. Considerable resources are used to counteract wear and tear - *working against* environmental forces and processes (entropy) - to maintain the building as this ideal static image.

A notable example is the Opera House in Oslo – exceedingly published in magazines and one of the most prominent architectural icons in Norway. With its significant appearance of ice floes floating in the water and its walkable roof surface, *'the building is as much landscape as architecture'* - quoting the architects of the building, Snøhetta.[2] However, preserving this perfect image requires considerable resources, and the record of activities related to maintenance is extensive. A budget of 20 million NOK is spent every year to keep the marble clean from dirt, stains of coffee and general wear from the many tourists visiting. The building is treated with chemicals on a regular basis to prevent the marble from undergoing a (natural) process of discolouration,[3] and fight yellow stains – which, ironically, are caused by the use of chemical impregnation of the stone. Moreover, plant seeds are (unintentionally) brought in from all over the worlds by unaware tourists. As the marble's inherent material properties offer excellent growing conditions, weed needs to be removed two times a year from the gaps of the marble tiles.[4] Substantial cracks have emerged between parts of the building, as one part is built on solid rock and the other part on unstable deposits in the water.[5]

A landscape is characterised by its dynamic and constant change over time. If the Opera House really was developed as an actual landscape – *and not just an image of one* – the building would have been integrated into and developed in response to these local environmental dynamics. Although a successful project in many ways, the building appears as a lost opportunity for developing an architecture of changing spatial conditions - that could generate unique experiences over time.

Figure 1. Oslo Opera House, Norway

2 Weakness

Opposing the idea of architecture as a strong and rigid entity, the paper discusses how *weakness* can act as a response to environmental influences.

Weakness is a term that usually comes with negative connotations. In the dictionary, the entry on weakness describes it with characteristics as 'lacking the power to

perform physically demanding tasks,' not able to fulfil its functions properly,' and 'of a low standard.' However, in the field of biology, *weak bonds* are vital. Most of the molecules that are essential for life have many interchangeable elements, which would demand too much energy to rearrange if they were strongly bonded. An example of this is the weak hydrogen bonds, which help to determine and stabilize the shapes of biological molecules.[6] Introducing similar properties in a building-architectural context would allow the building to adjust and respond to the environmental processes - and potentially provide expanded margins for negotiation with forces and uncertain future circumstances.

The overall research project is in its early stages. This paper intends to unfold potentials, pose questions and open up a discussion. More than providing clear answers, it will propose possible directions for further architectural speculations.

The paper will examine theoretical ideas centred around the philosophy of *weakness* and *open work*. Through these theoretical perspectives, specific *tectonic examples* of systems with an embedded weakness are explored – which generates further architectural speculations.

2.1 Vattimo: 'weak thought', Branzi: 'weak urbanism'

The philosophy of weakness derives from Gianni Vattimo's theories of *'weak thought'* (pensiero debole).[7] Vattimo's concept of 'weak though' was developed in relation to the postmodern movement - against a globalizing model based on truth, unity, and totality. The basic premise of this theory is the idea that there is no longer possible to pursue a complete, stable, metaphysical truth. Instead one must rely on a hermeneutical truth, which is interpretative, partial, and provisional.[8]

In an architectural context, the concept of weakness has been used as a response to modernism, claiming 'the necessity for a philosophy denying any kind of strong, definitive and universal solution.'[9] Based upon Vattimo's 'weak thought,' the architect and theorist Andrea Branzi further developed these principles into weak urbanisation. According to Branzi, the concept of weakness follows a more natural logic than the geometrical, as it 'proceeds following more incomplete, imperfect, disarticulated types of cognizance and transformation.'[10] This weak concept is not seeking one definitive and universal solution of architecture, and 'renounce the final state of stable perfection.'[11] Instead, it proposes more *fragmented* and *heterogeneous scenarios*, where the unexpected is valued.

2.2 Eco: 'Open work'

Umberto Eco's concept of openness shares a similar approach as Vattimo's 'weak thought.' His classification of 'open work' and the idea of *works in movement* present ideas of interpretation and productive ambiguity in modern artworks. The work is rendered open by their author, consisting of 'unplanned or physically incomplete structural units'[12] - which is further completed by the performer, viewer, reader or audience. Through this, the work created rejects the definitive, concluded message and rather multiplies the formal possibilities of distribution and performances.

Eco uses *'Klavierstuck XI'* by the composer Karlheinz Stockhausen as an example. The work is created as a single music sheet with a series of note groupings, and the performer is given the freedom to 'mount the sequence of musical units in the order he chooses.'[13] The

open and incomplete choreography of the work is characterised as *field of relations*, which possesses 'specific structural limits and formal tendencies.'[14] The premises of the work, despite its openness, are partly controlled and qualified in the original data provided by the author. This *authorial intention* is crucial. Without an authorial intent, there would be nothing more than a conglomeration of random components ready to emerge from chaos, in Eco's view.

2.3 weak tectonics – choreography of change

The author has identified a collection of existing tectonic examples with *embedded weakness*. These examples derive from various fields, spanning from architecture (vernacular building technologies), traffic and transportation engineering to smaller devices and components. All of the examples have an embedded weakness that provides a direct intentional response to external impulses.

This embedded weakness implies an acknowledgement and acceptance of forces. Instead of trying to resist or avoid, the dynamics of forces are incorporated as an integrated part of the design - and in this way controlling and qualifying a desired *choreography of change*.

Examining through the theoretical perspectives of weakness and open work, the following paragraphs attempt to unfold the identified examples and extract some principles. The examples are approached as *works in movement* as they are composed of a pre-defined set of structural units, and when being affected by a force performs an anticipated change.

This opneness is in some ways a controlled change that in similar ways as Eco's open work, can be seen as an *authorial intention.* The examples of weak tectonics are relational, and possess embedded capacities and emerging potentials, which is triggered by forces. All of the examples are dynamic and never in a state of being stable or finished. Time and change are vital aspects. The different categories unfold a diverse span in relation to linear and cyclical time - and gradual or instant change.

TRANSMISSION of forces

The first category deals with transmission of forces - an intricate balance of forces and equilibrium - through the use of *weak links* between components.

The traditional building techniques in Venice are an example of this category. The various components of a building do not rigidly lock into each other but are free to move in relation to each other, adapting to the unstable ground conditions.[15] The exterior walls are not fixed to the bearing walls, but are anchored with metal *tie-rods* – which act as weak links - to the floor structure. The inherent elasticity in metal provides a margin for negotiation of forces. Furthermore, this (restricted) displacement capacity keeps the components overall in place, while allowing each component to settle and shift freely. The weakness facilitates a response to changing dynamics, and is engaged in a constant dialogue between forces and adaption.

HIERARCHY of lifespans

In the second category the weakness is a component, where that part is potentially sacrificed to protect more valuable parts of the system. This involves a hierarchical approach within a system - a grading of value among the components. This principle takes advantage of lower value to protect more important parts and to control and reduce inevitable damage, and introduces different *lifespans* and *temporal overlaps*.

An example of this category is the galvanic anode, which is a sacrificial component of a boat. Placed on the hull, it protects submerged metal structures from corrosion. It is usually made of zinc, created from a metal alloy with a more negative electrochemical potential than the different metal it protects. This causes the anode to be consumed in preference of more valuable parts as the engine and rudder, which are more difficult and expensive to replace. Over a summer one can observe the anode slowly degenerating. A similar example is parge coating**,** a weak lime based mortar, which acts as a sacrificial layer on old buildings. It protects the brick masonry from capillary water, as the layer attracts the capillary salt water solution. The damage is limited to the sacrificial layer, which is replaced.

ANTICIPATION of failure

This category is based upon a set of examples, which have in common an anticipation of failure and choreography of destruction. The essence in these examples is to control *how* it fails, to minimize damage of the collapse.

The examples are principles of weak points from seismic design, the Icelandic Highway system[16] and hurricane break-away walls. In the first two examples, forces are directed to certain spots that are designed to break, dissipating some of the energy and thereby saving rest of the structure. The break-away walls, which is a structural concept of architecture in hurricane-exposed areas, are developed with similar principles. The ground floor of the building consists of lighter walls that will easily detach from the main structure in case of disaster and blow away, allowing the wind to penetrate and saving the rest of the house.

CHOREOGRAPHY and event

The last category is concerned with aspects as *choreography*, *event,* and temporal perceptions of *suspense* and *surprise*.

A circuit breaker (in an electrical system) performs an instant reaction to electrical overload. When detecting an overload, the mechanical components inside the device perform a predefined *choreography*. Weak links are triggering the movement of components and lead to the next movement of the component nearby: a succession of steps in a process, each of which triggers or initiates the next. This sequence culminates with an *event*: breaking the circuit and cutting the electricity. This is one of the few examples that are reversible, and represents a cyclical aspect of time. The breaker is reset by pushing the operating switch, which repositions the components and re-creates the circuit.

2.4 Architectural speculations

This paper raises a discussion of how to develop architecture that acts in a dynamic environment. Eco's concept of 'open work' lends itself to approach architecture as *a work in movement.* Instead of one ideal state of a building, this paper argues for an architecture that (deliberately) acts as a choreography of changing spatial conditions over time, *in-sync* with its environment. Quoting Eco, the artist leaves the arrangement of some of their parts open, giving the performer '*not a single definitive order but a multiplicity of possible orders.'*[17] Deriving from the example of Stockhausen's series of note groupings and the examples with embedded weakness, further architectural speculations can be initiated were an anticipation of environmental influences would cause a pre-orchestrated choreography of probable change.

Following this line of thought, some preliminary speculations could be made on the Oslo Opera House. The building is built on ground with different geological properties; half of the building is constructed on solid rock and the other part on unstable sediments. An anticipation of this situation is the point of departure for the following speculations.

The same way as the example of Stockhausen groupings of notes in a non-defined order, the different building parts could be designed as individual sections that were allowed to move freely independently from each other. Following the previously mentioned category 'Transmission of forces,' this would provide a choreography of movement where the parts are allowed to settle and shift freely. From a design perspective the meeting points between the parts would be crucial to articulate - both to allow this repositioning and avoid unintentional cracks.

The weed should be considered as a poetic interplay between a place and plant seeds brought in from all over the world. Anticipating this situation, the articulation of the topography of marble could create intentional gaps and indentations where seeds would naturally accumulate and have better growing conditions – thus, partially controlling *where* weed was growing. This would keep some kind of order and serve as an *authorial intent*, clearly expressing an intentional articulation and not something out of control and chaos. The same way as the category of 'Hierarchy of lifespans,' the building would be approached as individual building parts, with different lifespans and performance.

The marble would not be chemically treated but rather allowed to naturally develop a change in colour, which would act as a visible sign of the time. This aspect underlines a second point, which requires a change in mentality – acknowledging that it is impossible to control everything. By developing some 'focal points' based on anticipations, a potential choreography of change is embedded within the architecture. In other cases, the unpredictable forces of nature take control and the structure constitutes a framework that time and processes can work with and within. The architecture performs and changes over time, and would look differently from each visit.

3 To conclude: unfolding alternatives

The paper argues for a 'weak' approach to provide a change of mind-set in regard to architecture, where, first and foremost, the changes that the built environment undergoes after being built is approached as a quality. However, weak tectonics can qualify these changes, and be incorporated into the architectural design. Weakness involves both tools for

anticipating some of the changes, and act as a theoretical perspective; a way of thinking – and, ultimately, designing.

This approach provides an alternative and sustainable way of approaching architecture and environments, saving resources while generating changing architectural experiences related to space, time and phenomenological effects. Architecture is approached as a process of several stages instead of a final product, where potential future influences are incorporated into the initial development.

The same way as weak architecture is not about creating final solutions, this paper seeks to unfold alternative ways of approaching architecture, more than providing clear answers. The concept of weakness reveals alternative perspectives that complement more stratified conceptions of architecture.

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MAHALE OF SARAJEVO - BETWEEN PUBLIC AND PRIVATE

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Abstract

The development of the city core as we know it today started in the 15th century when the ottomans established a typical oriental urban typology with functional zoning: the bazaar business district (čaršija) and residential districts (mahale). This typology was the result of a process dominated by lifestyle and religion, in which the relation towards private (family, neighbors, friends, nature) and public (trade, business, communication, culture) was essential.

The privacy was the basic idea in formation of housing quarters, that are spread in an amphitheater – like pattern around the city Centre – bazaar. Residential quarters within this geomorphological specificity, have formed spatial organization based on a principles dominated by religious and lifestyle customs. The urban conditions are a direct result of this process – an organic growth of the neighborhood, with instinctive and intricate vowing and gradation of spaces between public, semi-public and private. The private domain consisted of houses with courtyards and gardens with elements of water and greenery, and public domain of street branches cul-de-sacs that followed the natural configuration of the terrain. A neighborhood was gathered houses around the central focal points. Spatial organization of a house was the basis of urban form expression. It was an ambient ensemble surrounded by high walls with entrance gate and semi-public courtyard, stables and servant's auxiliary objects and residential area with rooms, inner courtyard and gardens – a private domain dictated by lifestyle.

By the end of XIX century a central European lifestyle was introduced, and from this point transformation of residential neighborhoods begun, with all the subsequent periods more or less subtly eroding the urban matrix. Current transformations of space are most intrusive with "contemporary" architectural expressions that do not adhere to the inherited sedimentation of historical layers nor to the quality of its expressions. Therefore, there is a need to analyze and revalorize the current state of mahalas, their urban matrix, architectural typology in order to see if any of the sophisticated public private domain sequences can be a part of contemporary use of the space. It can also be a form of study for future guidelines for inclusive design – contemporary with traditional spatial logic.

Keywords

private-public, mahala, tradition, urban matrix, transformation

1 Introduction

Territory of present day city of Sarajevo was considered suitable for inhabitation even since the prehistoric times – due to its geomorphology, trade routes crossings, water resources and fertile lands along the river valley. Initial settlements have been formed during neolith (Butmir culture) and inhabitation and civilization here has a five millennia continuity.

In this long time frame the character of the urban matrix has been influenced by two key factors: spatial factors (geomorphology and strategic position of the settlement and social factors (political, economic and religious) overlapping or overriding each other through different periods.

Early phase of urban development of Sarajevo is based on formation of permanent dispersed settlements on slopes surrounding the valley interconnected by routes (prehistoric localities -Butmir, Ilidža, Obhođa, Vratnik, Bakije, Zlatište, Debelo brdo, Kotorac, Gradac, Kokorevac, itd.). Natural conditions of the ambient were favorable, so 48 permanent settlements gradually merged into an early urban agglomeration. The so called „Golden Valley“ claimed new opportunities as it begun to function as an initial city-form.

During the middle ages a municipal unit or parish Vrhbosna was stretched out through Sarajevo fields and surrounding slopes with one fortification Hodidjed – as a crown city of Central Bosnia. In Vrhbosna parish there were several settlements, with Brodac being the significant one, on the right riverbank of Miljacka, as the initial location for formation of the city at the start of the ottoman period.

The ottomans established an oriental type of city organization with its main characteristic – separate zones for business and trade/crafts (carsija) and residential (mahale). Spatial organization of Sarajevo was shaped by new imported feudal social relations, religious c and lifestyle customs with its specific relations towards public and private domain. Public was trade, business, state and religious customs, while privacy was for family, neighbors, friends and nature.

Spatial organization of residential areas was based on a lifestyle molded by religious customs and reflected itself on the public – private relationship. They were formed by private living quarters for a family with courtyards and gardens walled up to enclose the privacy. Public domain streets and cul de sacs led to local focal points – mosques with cemetery, schools mekteb, bakery water fountain and a small square – majdan. Outline of the house followed the family dynamics and usual pattern of discerning private (female or family) quarters and semipublic (male or visitor’s) quarters. Such organizational scheme became an urban code and defined the system and genius loci of residential urban units as a self-sufficient functional organizational unit within townscape.

It is the relationship private – public urban scheme that is the main issue of this paper –the idea that became the overriding logic for spatial processes.

By the end of XIX, Sarajevo became a part of Austro-Hungarian empire that introduced new forms of urban living. Feudal society was replaced by early capitalist, and process of transformation of social and physical typology of an essentially oriental town into central Europe type was sudden and intense and changed the course of (urban) history. The concept of public and private separation was reflected within new architectural and urban solutions. Large structures with public ground floors for shops and private apartments on top, usually

lined the street in form of blocks. Organic and grained urban structure of oriental Sarajevo, collided and contrasted by large volumes created a surreal image of a city in between two worlds.

Process of transforming the soft tissue of mahalas has begun and continued in the subsequent periods and is a permanent perhaps an unavoidable process. But this process can and should be managed. The original urban format of weaving between private and public slowly eroded and in current transitional and capitalist systems it does not seem to have any validation. In such ambient culture, tradition, inherited spatial peculiarities are banished from its original urban heritage.

By engaging the inherited culture, in transformation of residential areas it is necessary to see the evolutive genesis behind the architectural and urban forms. One must appreciate the contemporary needs for development and growth, so therefore the main issue of the paper is – how to intervene within these residential areas and still keep the basic principles of their original formative process – sophisticated relations and transitions from public squares and streets into private houses and courtyards?

2 Formative process in residential areas

Formation of urban area of Sarajevo begun in the XV century, when at the heart of the valley (river Miljacka) the Ottomans have established a stable political and cultural dominance. A regional political unit was formed– Vilajet Saraj-ovasi, named after the word “court” in as a center of new ottoman province and permanent military camp. Establishment of the province was boosted by favorable geographic and hydrographic conditions, and that the area (so called Golden Valley) was already inhabited. During the medieval Bosnian state besides the already mentioned parish Vrhbosna and Hodidjed fortification there were villages Brodac, Budakovići, Koševo, Bjelave and Radilovići on the right side of river bank, and Bistrik, Hrid, Žagrići and Komatin on the left river bank of Miljacka. On the very location of Brodac, the ottoman administrator for Bosnia Gazi Isa-beg Ishaković initiated the urbanization process. As a state representative he carried out land allotment designation - gentrification of land and moved the locals to the village of Vrančić. It was this process that clearly demonstrated the intentions of Istanbul’s administration – to form new urbanities based on their own cultural perceptions [1; 2].

First urbanization phase was earmarked by structures built by endowment system (waqf) that became the center of spiritual and material culture in a conscious city planning endeavor. This was a period of fast urban development in which Sarajevo claimed a status of so called kasaba – small urban municipality (Figure 1.a). Second phase of urban development begun in the first half of XVI century, by broadening of the endowment system, significant spatial nucleus formed that gave shape to the urban tissue that is still recognizable in its authentic scope. Sarajevo became “šeher” a large city and its structures gained regional significance (Figure 1.b).

Third developmental phase started in the second half of XVI century when the city reached its peak, both in spatial configuration and status as the capital There was no substantial expansion until the Austro-Hungarian rule in the XIX century (Figure 1.c), and building activities were only in maintenance and restorations in cases of natural disasters (mainly fires or floods) [3].

Figure 1. Phases of urban development of oriental phase of Sarajevo [4]

Within the four centuries of urban development of Sarajevo its oriental typology and functional polarization between the trade and craft zone – the business public quarter – čaršija and residential private quarters mahalas was persistent (Figure 1.). In that sense as by urban gene code both zones gradually evolved from their nuclei into local and regional centers of political power, cultural and religious centers and mahalas placed into an amphitheater like manner on the surrounding hills supported the specific lifestyle of its inhabitants (Figure 2.). On the fields around river Miljacka, on the site of Brodac village, the business district developed and engulfed the slopes with the residential structures. By the end of XIX century Sarajevo consisted of 104 mahalas [1] and they were the base urban units of the city. Čaršia held the heart of the economy and grew into Balkan/regional center. At the same time mahalas were introverted systems, tuned into private family life and lived according to the Islamic lifestyle code. So therefore public domain remained with the city and private domain was claimed by mahalas.

Figure 2. Residential quarters - mahalas, urban shape of an amphitheater [5; 6; 4; 5]

3 Mahalas: relationship between public and private

Internal spatial organization of mahalas was based on Islamic lifestyle, so the space evolved around the idea of differentiating spaces between public and private and protecting the family zones. The basic building module was a single family unit (Figure 3.).

The concept and gradation of spatial relations between public, communal and secluded private (family) was the predominant urban concept of development. The concept actually begun within a housing complex itself. The areas of the house were divided into segments depending on the views from the house First sequence the entry that was turned towards the streets and cul de sacs were a semipublic zone for guests or business visitors, and it was

closed off to the street by high walls with a single large gate (scheme a. on Figure 3.a). Spatial organization of this separate unit followed the religious customary use of housing complex and was still further segregated into sub zones and variations of semi-private and private spaces [4; 7; 8; 9].

The street was public space and the inner courtyards were guarded by a gate and high walls. The first entrance gate was still partially public (selamluk) while the inner courtyard was the center of family life or so called haremluk. Residential complexes would typically have a garden and fruit yard. Cult of family and neighborhood was the backbone of society and it usually consisted of several surrounding houses (6-7 houses, cca 60 people). In further social and spatial gradation of spaces, the neighborhood was a semipublic zone that was interconnected by system of courtyards and gates without access to the pedestrian street or alley (Figure 3.a).

Several neighborhoods formed mahala units (around 40 houses), walled off to the street built by a local benefactor who was wealthy enough to offer this endowment. Since the mosque and the cemetery were oriented towards a specific neighborhood it was a space of and each had their own semipublic focal point. Local a mosque with a cemetery was oriented toward a relatively closed population of one neighborhood this was one more spatial gradation of semipublic space. Along with a mosque there was an educational facility – mekteb, water fountain and bakery that were in spatial stratification still further away projecting into more public segment of space. The most local public space was a small square – mejdan that was a focal point of several mahalas (scheme b. on Figure 3.b). Traffic circulation towards the ever increasing zones of privacy was accented by the width and importance of streets that were part of public domain. From mejdan and towards the city center a larger collective street led the way into the public life. The street would be of milder slope or stepped with the width of 5.80 (width of a person leading two laden horses) meters depending on the configuration of the terrain. Residential streets (sokaci) connected the local mejdan (square) with individual housing units. It width was 2.30 meters (one person with laden horse). Final cul de sac (čikma or budžak) was the way into furthermost houses that finished at the gate and its width was usually 2.15m [4] (Figure 3.b).

This gradual street system was the way in which the residential mahalas communicated with the business core. The urban stratification of mahalas that was laid out in three spatial gradations: public, semi-public and private was also reflected on the street scheme that was an essentially public domain. Transitions from the city core into the residential areas are gradual, almost procession-like as the street becomes tighter and introspective. Concept of public and private relationships is also echoed on the city scheme, with clearly differentiated spaces but still cohesional and unique in their functional sense (scheme c. on Figure 3.c). In urban harmony is achieved between these zones is gradual as well, even though they are functionally separated, the refined transitional spaces acted in physical and metaphysical sense - a transition between two key aspects of life – public (cultural, administrative, trading) and private (family). In architectural sense the volumes of the business district corresponded with the volumes of residential quarters, only with mosques and minarets acting as landmarks – both on local and city level. Without any steep or sudden spatial transitions, a harmonious relationship was thus formed between the urban, functional and natural components which is a universal civilizational quality [1; 10] (Figure 3.c).

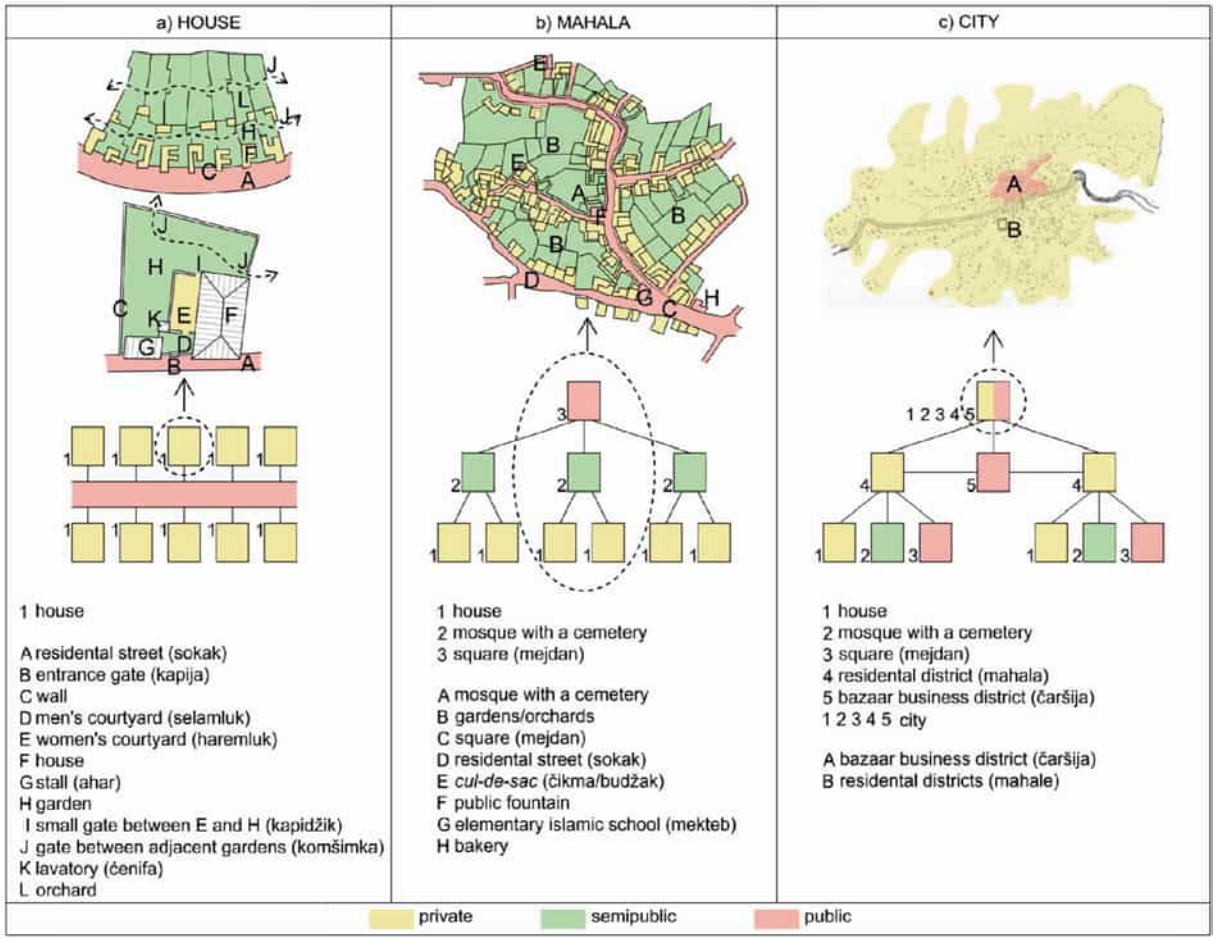

Figure 3. Development of public-private concept within the residential quarters [11]

4 Transformations of public –private relationships

Centrally directed and streamed lined urban growth of Sarajevo during different rules from the ottoman to Austro-Hungarian has had substantial transformations. In that time frame feudal social system was replaced by capitalist, and oriental model of the city started to grow as a typical central European model of guilds and traders shaped by directives from Vienna and Budapest. This conjunction of influences of the inherited oriental typology and central European concept became a foundation for formation of a specific urban confluence of cultures.

"Westernization" was marked by rapid transformation and growth of functions and destructuralization of its urban form. The inherited urban concept that was highly adapted to the geomorphology and lifestyle was abandoned and new strategy was adopted that favored new streamlined functional zones and streetscapes. Basic city territorial unit was no longer a mahala, but it became a mixed business and residential street [9], and the notion of public and private space redefined its meaning. Instead a social cohesion of small residential neighborhoods, new building typology was introduced – street block and soon they begun replacing the dispersed and organic tissue of the precedent. In these multistory units more families resided on top floors, while the ground floor was or public domain for rent mainly as shops or dexterities. This building style led to social changes, as families and neighborhoods were no longer at the focus, and started a process of individualization and sometimes

alienation. It was a true meeting of lifestyle cultures, and inevitably changed the ways in which residents perceive public and private spaces. (Figure 4.).

Figure 4. Westernization of Sarajevo– first phase of redefining public-private [5; 5; 12; 5]

In periods that followed the Austro-Hungarian since the first world war, such processes were exacerbated, transforming the society and space profoundly. This does not by any means suggest that that was an entirely negative process, perhaps it was necessary for the development and inclusion of Sarajevo into current streams of contemporary life. The issue is that there should be slightly more regard and acknowledgment that traditional use of space and composition of architecture was in harmony with the natural and built context.

By the end of XX century radical social and economic changes took place in Bosnia and Herzegovina. New social reality is shaped by lack of strong and centralized governance, and early capitalist transitional processes. In urbanism and architecture this is manifested through enormous pressure on central city zones that have high financial yields, but are in collision with sustainability and inherited spatial values. In this situation, the casualty is fragile and sensitive historic tissue, and architecture generated now usually is consumerist and copied from other realms. In disregard for context and the urban process that created such context, sometimes even without an intent, there is destruction and negation of the spatial logic and traditional (and as elaborated here, universal) values.

The analysis of spatial manifestation of private-public relationship, has clearly demonstrated it critical role in establishment of urban matrix and individual residential complexes. Walled off from the public street, and with further internal differentiation of spaces into private and semipublic followed a specific family and religious dynamic. According to the same logic houses formed semipublic partnerships, relayed this principle further towards the square and the most public business core čaršija. In other way of looking is through the human scale and needs - it is hat space was oriented according to humanistic principles rather than exploitation of space. This resulted in overall harmonious architecture and ambient (manmade or natural) in general.

However, there is a lack of understanding for historic spatial logic and organization of mahalas. Taken by seductive profits in transitional society, even architects consider traditional architecture as a backward conservative notion, and all new is “better and advanced”. The current trends encourage spatial impoverishment and simplification, reducing the urban space to plots devoid of their cultural or natural context. There are no more courtyards or transitional spaces, subtle divisions by walls, concepts of neighborhoods, and streets and squares are lined with cars. In general parking space and traffic are modern day amenities and demand an overall general solution within the city. There are no more gradations between public and private, and large volumes have arisen in fine grained urban space colliding both visually and functionally with its surroundings. There are of course

individual examples of structures in which the architect uses the language and visual code appropriate for the ambient. In most cases it is narrowed to superficial resemblance and use of architectural elements that cannot even be supported in a theoretical sense when one talks about authentic transformations of an existing urban context (Figure 5.).

Figure 5. Contemporary architectural articulation disregards the traditional concepts of private – public [13; 14; 15]

The idea that architecture must, just like humans, belong to a certain group or a region is affirmed over and over through history of architecture as well as through trends that emphasize positive qualities of regionalism and social aspects of building. Complex historical circumstances, and surprisingly simple forms have created an expressive architecture, highly adapted to local morphology, climate and lifestyle. The housing complex from the ottoman period was an elaborate product of local processes, material and metaphysical aspects of its time. Today, the strong stylistic appeal of the Bosnian ottoman style house, has been reduced and simplified to profanity in new housing objects that are slowly but constantly being built in the residential urban areas – mahalas. As the number of such dwellings grows the traditional tissue is disappearing thus distorting the memory of place, where people identify with the new architecture. By implementing and preserving some of the aspects of inherited traits: functional or social/human organization, gradation of space and sequences in traditional architecture. Elements such as walls, gates, gardens and courtyards, striking elegance and simplicity of forms.

One principle should be established – the principle of urban and architectural evolutive continuity, that can be established with creative assimilation and deeper sense of understanding [16]. In order to establish this link one must carry on the association of spatial gradations between public and private spaces, as well as elements of nature, proportion, interplay of volumes and rhythm of soft urban tissue of mahalas as a cohesion factor. The idea I of neighborhood is not sustainable in current lifestyle, just like the strict division of oriental city, but some of the urban matrixes can be preserved if we become open to the ideas of its genius loci and basic concepts of exposure and seclusion in residential dwellings. One must understand the tradition in order to be able to transform it with innovative architecture that will establish the evolutive continuity [16].

5 Conclusions

In articulating an answer to the main question of the paper – how to implement a contemporary expression of spatial relations, with respect to the historic urban process that was expressed through variations in between public and private domain? By analyzing the

urban code of mahalas and its culturological context and process that was framed by public and private relationship. It was established that daily lifestyle customs dictated the larger urban scheme and became an essential part of spatial logic and in general the genius loci of the historic urban core of Sarajevo, in mahalas but also in the overall organization of Sarajevo as a typical oriental urban structure. This process was oriented towards life, and human relations and resulted in concordial spatial relationship between buildings, morphology and nature, thus creating a harmonious and unique ambient.

Process of transformation the social and spatial relationship begun in the late XIX century and has only been gaining momentum ever since. Since the loss of social cohesion and lifestyle changes their urban/architectural articulation has naturally ceased to exist. Today this process is characterized by current quick transitional social system and is manifested through architecture that is not connected to the ambient, furthermore it is in most cases degradation of the ambient and negation of its traditional values.

It can be concluded that the main reason of current spatial and architectural articulation lies in disregard for social, culturological and spatial context and inherited values and sophisticated interplay of public and private spaces. There is in general lack of policy making and consisted valorization and guidelines on how to approach the design in such delicate urban fabric. Guidelines should define the spatial composition, the capacity of space and quality of architecture, with two goals to develop the areas but mainly to preserve their spatial qualities and architectural heritage.

The guidelines should be based on positive building experiences, collected through analytical process, and revalorization of traditional urban and architectural values. As one of the main principles for building should be a sophisticated architectural process of building in sequences and gradation of spaces. Even though this was strongly correlated to lifestyle religious customs it is essentially a universally positive value of architecture. Within this process one should find ways to reinterpret the elements such as: Gates, walls, courtyards, volumes, proportions, roof projections, color scheme with attention to materials and details. It calls for undoubtable contemporary architecture – one that absorbs the positive and universal values of local building concept and its culturological context.

This regionalist or essentially localism approach is assimilation of past and its spatial articulations into current architectural creative design in order to achieve spatial and urban continuity, humanizing the ambient and preserving existing historic and valuable ensembles.

It would be important to emphasize that guidelines should not be a catalogue typological, unified or predetermined architecture, but should allow the process to be authentic and worthy of the inherited architecture and its fundamentally timeless concepts. If the guidelines followed the proposed model they can become the corner stone of transformation of historic ambient and in general a contribution to theory of re – design.

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THE PHOTOVOLTAIC SOLARIUM AND OTHER PARADOXES

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Abstract

This paper reviews a series of green ideas, objectives, products and applications that undermine the notion of 'green', that are self-serving or self-defying schemes, or that are not quite a sensible remedy for environmental issues. As greenwashing spreads, a more informed and holistic approach to green design is necessary, aiming at the root of problems and seeking a multi-level effectiveness of solutions. A "low-tech, hi-sense" approach seems essential in order to ensure that 'green' can also be 'sustainable', two terms often taken as identical.

Keywords

Greenwash, green design, sustainable, contradictions, low-tech

1 Introduction

An urban legend has been around the web for years: During the space race of the 1960's, NASA recognized that the classic type of pen is impractical in space conditions and a different writing tool was needed for the astronauts. The solution came after several years of research and some millions of dollars: engineers managed to develop a pen that could put ink on paper in conditions without gravity, at a broad temperature range, under strong acceleration forces, and the like. During the same years, the Soviet cosmonauts were using fare less advanced technology for writing at such special conditions: they were using ordinary *pencils*.

This story may not be entirely correct, but it does offer a good example of simplicity and economy in solving practical problems, highlighting also the lack of common sense in the bureaucracy. Something similar can be observed in the recent green architecture, which is often attracted by new technological inventions, bypassing simple and time-proven solutions that offer the same benefits at less cost.

Figure 1. The Photovoltaic Solarium of the title epitomizes an absurdly complex approach to green design: Solar rays create electricity that powers a solarium for those who dislike the direct effect of solar rays. The embodied energy of the various components cancels any arguments about 'ecological solution'.

2 Green technology

The most advanced green technology today includes new exotic materials with special physical and chemical properties that are utilized in buildings and energy production, such as

- photovoltaic films with high efficiency,
- low-transmittance glass,
- 'cool' colours that reflect more IR heat,
- thermal insulation of high resistance,
- phase-change materials [PCM] that retain or release heat as they alternate between liquid and solid state.

Such materials have been developed thanks to the impressive progress in applied physics and chemistry. Many of them are by-products of the space-race between US and USSR, proving the validity of Heraclitus' words *"War is the father of all things"*.

There is no doubt that all such high-tech products help us to improve the environmental performance of buildings and urban space. However, they are usually costly and they frequently require special know-how in their application. Thus one can ask whether they are suitable for widespread use or just for a few demonstration projects.

Apart from new materials, current innovations include new or quasi-new construction techniques such as *green roofs*, which are said to rescue us from the urban overheating. In the past, one would whitewash the roof or put a pergola with a vine to provide shade in summer and sun in winter. Today such simple and modest means without special products would not promote the 'green economy' of a country, or the eco-friendly branding of a company.

So we do not add insulation or a reflective paint on the roof, which usually is detached from the functions of the building. Instead, we prefer to add extra load on the building top, to spend money for special types of waterproofing, and to install irrigation systems for some plants left at the mercy of sun and wind.

And we do all that in order to improve the thermal conditions of the top floor only. The thermal effects of the green roof hardly reach the other floors of the building below, and even less the ground where city life is. Are the benefits proportionate to the extra money, natural resources and continuous care that a desolate green roof requires?

Another example is *glass*, a relatively recent building material with many practical and ecological advantages, but also with shortcomings if used unwisely. The special types of glass that we use to control heat flow in large glazed facades are constantly advancing at amazing speed. Yet we might have similar thermal results by using conventional -hence cheaper- glass in smaller openings.

In many other cases, we add *shading devices* to reduce overheating and glare caused by glazing of large size or unfavourable orientation. It is a remedy to a problem created by our design that some proudly label as 'bioclimatic'. Of course we could have achieved the same result by just avoiding the cause of the problem, without needing any additional measures and expenditure.

Two increasingly iconic green gadgets are *photovoltaic panels* and *wind turbines*. Their manufacturing costs are dropping and the subsidies promoting their use are rising, so we can expect more and more of them on buildings –at least in virtual architecture.

It is certainly positive to cover our energy needs with renewables. But prior to that we should check what exactly those needs are, as well as their cause them and to what extent. For instance, does it make sense to use electricity from wind turbines to illuminate empty streets continuously all night? Or to add geothermal heat pumps on a building that has excessive cooling needs because it is fully glazed? If we do not control the origin and true nature of our needs and concentrate only on how to satisfy them, then we resample the mythical Danaids struggling in vain to fill up a leaking tub; an impossible task even if we dye our water green.

3 Discussion

To create a problem with incorrect design choices and then to alleviate it using various remedies, is not exactly a good example of green architecture even if we name those remedies 'bioclimatic', ‘sustainable’, or ‘eco-friendly’. We were doing that in the past, adjusting the environmental conditions of buildings through various mechanical means and under the impression that the energy expenditure is insignificant. Today our delusion is all too obvious.

In recent decades we have been aiming to substitute our energy-hungry technologies with natural means. But frequently we overlook something fundamental in doing so: That the energy and environmental performance of a building is mainly determined during the *early* design phase when fundamental architectural decisions are taken, such as orientation and proportions, form and envelope size, spatial layout, amount and arrangement of openings,

main construction materials. What we do after that preliminary stage is largely an effort to cancel or moderate the side effects of our early decisions.

Therefore, many green components added to a building intend to lessen problems caused by faulty design decisions and could have been avoided earlier. Furthermore, a number of issues could be resolved by a more skilful use of the standard building components instead of employing high-tech ones, as demonstrated by the low-tech yet high-sense traditional architecture of the past, when technology was very simple. Ironically, a successful green design is one that employs the least special means for the final goal: to harmonize the building user with nature.

But simple solutions, like all unassuming deeds, have two shortcomings: (a) they do not promote special remedies business, and (b) they are too modest to be easily detected. Thus they defy the deities of our *"bread and circuses"* era: profit and ostentation. In contrast, the new green products sustain a growing market and decorate PR campaigns. That explains why they are often advertised more than they probably should be. In addition, certain green gadgets provide a semantic element to a building, which allows to advertise it to the unaware as 'ecological', 'sustainable', etc. in a deceptive process named 'greenwash'.

The latter probably explains the choice of complex and expensive solutions instead of something simpler and cheaper, as the space pen and the pencil at the beginning. Using the words of a developer in Athens, *"It is not enough for a building to be green, it should also look green"*. In an era of hollow perceptions where many think that "the clothes make the man", appearance takes priority over substance.

4 Conclusion

All those remarks do not imply that advanced green technology is worthless -quite the contrary! But so far we utilize technical advances to prolong a wasteful lifestyle rather than to sign a pact with the planet. The emphasis on green *high-tech* solutions instead of less flashy *high-sense* ones highlights a key difference between bioclimatic and sustainable.

In our efforts to curb the advancing environmental degradation, we look for pretentious remedies and avoid to deal with the actual source of the problem. Thus, we look like a addicted gourmand who struggles to reduce his weight by taking special medication instead of starting a diet. Or like someone who uses the escalator to go to the gym.

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THE BRAZILIAN SHANTYTOWN AS AN URBAN PROBLEM AND A COMPLEX METAPHOR: THE DESIGN OF THE CAMPANA BROTHERS

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Abstract

Countries on the periphery of the global economy have turned squalid, unhealthy and precarious conditions - among other adverse features often disapproved of by society - into ´different´ and exotic images that can acquire a new value. This aggregate value and the resulting imagistic transformation is, for certain societies, turning these sights into a consumer spectacle, as is apparent on the hillsides of Brazil. Manipulating the image can distort the reality of a locality, society or culture, with a view to selling and purchasing a visual world that is seeking to become commercialized. The attempt by the global economy to take hold of certain peculiarly Brazilian features has reached the point of being "seemingly paradoxical", although in this case, key strategies can be noted that increase the consumption of its specific products. For example, there is the sale of particular Brazilian images to consumers in the tourism industry that seek to reconcile the "beautiful" with the "ugly". These include the commercial exploitation of slum tenements, the shacks in the shantytowns, all of which provide evidence of the social inequality in Brazil and in particular, the insecure state of the poor dwellings scattered throughout the country. All this is being appropriated and marketed as package tours or even as objects of design. In the light of this, this study seeks to analyze the appropriation of the irregular shapes of the shacks in the shantytowns formed by the duo of Brazilian designers Fernando and Humberto Campana, known as Campana Brothers, who aim to create different images and hence, make their products like the "*Cadeira Favela*" [Favela Chair] better known and more widely used. This provides striking evidence of the current economy strategies and seek to capture the peculiar urban space's features for the creation of images of products of design.

Keywords

Architecture; Visual Arts; the Campana brothers; Interdisciplinarity; Image.

1 Introduction

Based on the theoretical framework of the research studies conducted by Edgar Morin on Simplifying and Complex Thought, the Simplifying mode is regarded as being rooted in reason,

in rationalism and in rationalisation, in other words, in a simplification of thought. It can be noted that the foundations of this classical mode of scientific thinking, often referred to as "simplifying", are undermined by the development of a new, more global way of thinking, which does not aim to create a rupture with previous thought, but rather to develop a way of thinking together. This new way of thinking is called Complex Thought [1].

Complex Thought is based on complexity. The word is derived from the Latin *complexus*, meaning "to weave together". This contemporary approach to thought is capable of bringing together, contextualizing, globalizing and, at the same time, recognizing that which is unique, individual and concrete. According to Morin [2]:

> *"It should be noted that the principles that rendered scientific knowledge more dynamic, and which have proven to be extremely fruitful, now pose serious problems. What are these principles? We can summarise them as follows: it is the principle of simplification. The objective of scientific knowledge is to say: 'You see, we are apparently in a universe of multiplicity, of diversity, of chaos'. However, this apparent chaos dissolves as we discover the simple laws that govern it."*

From a contemporary viewpoint, it must be understood that the Simplifying Thought has been supplanted and that Complex Thinking is still in development. The principle of simplification still remains largely dominating and this is reflected in the project-oriented design process. Some designers promote the espetacularization of "specificities", or peculiarities that make up the identity of certain communities and differentiate them from the whole of mass culture society, as a means to produce and market different products, thus turning this cultural singularity into a consumer good.

In this context, the main theme of this article can be introduced: the complex metaphor of the Cadeira Favela. Despite its various contradictions, many of the images that have been produced and sold of particular aspects of the *favela* (or slum) foreground it as a place that is different, exotic, eccentric, an area wherein multiple social and cultural dynamics converge, and not only as a place that is irregular and problematic, and the basis of drug trafficking and violence. In a certain sense, it is about rendering the problematic differential as something romantic, turning it into a saleable commodity. Grounded in a "Simplifying Capitalist Thought", the gravest, most important problems of the *favelas* are "relegated as second-order issues" when businesses champion their interests and needs for appropriating and exploiting different aspects of an image of the *favela* deemed as exotic. In this way, the real problems are trivialised for the sake of selling an exotic image solely intended for consumption, which will ultimately only bring benefits to and generate profits for big business owners.

In this way, the images of the labyrinthine/excluded/physical and social spaces of the Brazilian *favelas* are incorporated into products to boost their consumption and play up an image of slums as exotic and eccentric pieces of merchandise, "gift-wrapped" for the consumption of a global elite. Yet, merely carrying out an analysis of Simplifying Thought centred on capitalist profit strategies will only weaken the analysis of the aggregate whole, which essentially is the perspective we seek to provide through this study.

2 Critical Reasoning

In the global economy, images of what is deemed unique and distinctive are easily turned into products that are potentially suitable for consumption and marketing, in turn generating high

profit rates for companies. In this context, one of the main strategies adopted for generating profits is the creation of images considered different or 'novel' and unique, which can be rendered into "products" that can be commercialized in the global market. In many cases, the process of capturing particular aspects as well as encapsulating the product's specificities vis-à-vis cultural, local, urban, architectural, artistic and musical elements that are distinctly Brazilian, provides a unique image that is then used to promote products that are classed as "symbolic capital" to boost sales.

Corporations and/or designers frequently appropriate images related to "the minorities", such as blacks, Indian peoples, slum dwellers, converting them into a "commodity image/product". Individuals and/or companies that capture images pertaining to or involving minorities and those living under inequality, merely to improve sales performance, and are not concerned with the social problems affecting these communities, nor with ideals of equality of race, ethnicities or gender, but rather with the "use of their images of identity" as a product looked on as different and "exotic".

The creation of images interpreted as different, extravagant, exotic and eccentric - mainly to add value to the products - is one among many strategies of the global economy: image-consumption-profit.

In Brazil, both the specificities and the identities of Indian peoples, of the Amazon, of Carnival, of mulatto women, of beaches and the slums are often appropriated and manipulated by and for the market, qualifying them as marketable commodities offered as an "exotic view" of the country.

2.1 Tourist strategies and the image sale of that which is unique

Tourism features as one of the main economic activities that make use of the image of "uniqueness" as a product for consumption. The invention and mythification of cultures and places by the media and travel agents, which offers the advange of selling them in advance as a commodity for symbolic and immediate exploitation characterizes tourism as a phenomenon of communication and consumption. Within this context, images, the landscape and the physical and visual attributes of places can be turned into products and enterprises - namely, into "invented places" [3], whereby consumption and fruition begins even before the consumer's actual physical displacement, simply by means of image contemplation and through the circulation and dissemination of information.

Goodey emphasizes that at this time and age the differential impact of tourist destinations is the variety of content and particular appeal of each destination. In this way, "any building, association or event can be marketed and consumed" [4]. Still, all things needs to be prepared and made suitable for commodification based on leisure and consumption criteria formulated and inspired by the media, which transforms elements of daily life into a simulacrum, into fantasy, into representation and/or images packaged and sold by tourism.

In this sense, tourism directly promotes and even appropriates the creation of "scenarios", converting them into a commodity. This is no different in Brazil. Tourism was predominatly structured around the multiple cultures present in the country and their particular historical contexts and traditions, and around the remolding and blending of folklore and popular festivities into tourist goods, ultimately transforming culture into a spectacle for consumption.

Research studies such as "The Production of Tourism: Fetishism and Dependence", by Helton Ricardo Ouriques, and "Popular Cultures in Capitalism", by Nestor Garcia Canclini, are extremely important to enhance and deepen the understanding of the production and consumption of the "unique image of Brazil" in contemporaneity.

Ouriques [5] states that:

> In the field of tourism, it can be observed that the issue of the "exotic image" is one of the principal dynamics of the production and sale of tourist commodities. (...) for example, it is not surprising that Caribbean voodoo rituals are staged for tourists, nor that visits to Candomblé ceremonies are offered on a regular basis in Bahia... The 'whimsical' and the 'exotic', namely these "primitive rituals" transformed into commodities, inevitably end up reaffirming the colonial stereotype: on the peripheral areas of the large cities, 'they' still perform barbarian rituals.

The different, the "exotic" are notions that structure the general capitalist dynamics of tourism. In their respective works, both Ouriques and Canclini address the production and consumption of a number of "exotic" images related to tourism which are also very close to the "images of singularity and uniqueness" employed in the production and consumption of fashion and design goods.

The commercialization of the image of culture and of place has long become an important product of the tourism industry. In many cases, for example, the image of the Brazilian Indian is sold, thus commercializing expectations about the traditions of the "exotic", the diverse and different Other. However, it is not always possible for the "scenario of the spectacle" to reproduce the image of that which is thought of as exotic, and at the time of consumption cause disappointment to tourists when they see that the Indians are not covered in body paint nor clothed in loincloths and headdresses. In this case, the image which is 'sold' of that "minority" no longer coincides with current reality, but the market (re)builds this image and sells it as an image of the singular.

Canclini [6], using this same line of approach, says that popular culture has become a commodity of global capitalism, and that traditional popular culture serves both for the reproduction of capital as well as for a hegemonic culture:

> What does the tourist see: ornaments that he can buy to decorate his apartment, 'savage' ceremonies, evidence that their ["globalized"] society is superior, symbols of exotic trips to remote places, and hence, of their purchasing power. Culture is treated in a similar way to nature: as a spectacle. The past blends with the present, people have as much meaning as stones: a ceremony of the day of the dead and a Mayan pyramid are both scenarios to be photographed.

Thus, for the consumption of natural images, the spectacle and its scenario are (re)created, becoming important tools for the production of income. The spectacularization of culture/place creates expectations in the minds of the consumers and in this context as a whole, and the use of the landscape, either natural or constructed, as the scenario for the spectacles is absolutely essential. The consumption of the scenario of slums, paradisiacal beaches, urban regeneratons and renewals (ports, central areas), areas of architectural heritage, architectural buildings, among others, are strategic for the consumption of the image of that which is different.

The manipulation of the image can distort the reality of a place, society or culture in favor of the sale and consumption of something intended for commercialization. The capturing of

some Brazilian singularities by corporations is "apparently contradictory" noting, in this case, important strategies to encourage the consumption of a specific product. For example, the sale of unique Brazilian images for tourism consumption that promote the reconciliation of the "beautiful" and the "ugly" (wholesome/insalubrious), such as the commercialisation of a landscape of tenements, *favela* shacks or squatter settlemets set up by Brazil's Landless Workers Movement (MST), which reveals the social inequalities present in Brazil and, most importantly, the precariousness of housing across the country. Currently, all this is appropriated and traded as a mere commodity - in some cases as tourist packages and in others as objects of design.

Corporate business strategies transform the ugly, the insalubrious, the precariousness into images rated as different and exotic and render them into a spectacle for consumption across specific market segments and societies, as happens with the Brazilian *morros* (or hills, where most *favelas* are located, in the case of Rio de Janeiro), which became a marketable commodity.

Discussing and understanding the production and consumption of the image of the singular in tourism helps improve the understanding and the development of critical analyses of other areas where the same issue arises. In tourism, the use of the image of uniqueness transformed into an organized spectacle of consumption can be more easily diagnosed due to its recurrent use in advertising and propaganda. When it comes to capturing and making use of the image, the dynamics of consumption is generally the same for most categories of products. What changes is the means employed: tourism, design, architecture, urbanism, natural landscapes, society, physical, urban or open spaces, among others. Based on the understanding of this correlation, an analysis of the "Cadeira Favela" and "Sofá Boa" is presented below - created by the Brazilian designers Fernando and Humberto Campana, known as the Campana Brothers - as the objects of study of unique design artifacts transformed into commodities that sell the image of specificities and elements of Brazilian identity worldwide.

2.2 The formal irregularity of *favela* shacks as the image matrix of the design

To extract the peculiarities of the Brazilian *favelas* for use in their project-oriented processes, the Campana Brothers found inspiration in the precariousness and in the irregularity that is typically found in the construction and erection of Brazilian *favela* dwellings. These traits were incorporated by the designers as a distinctive attribute of their new creations, being absorbed as symbolic capital and monopolistic income. With this appropriation, they worked with a mixture of forms, elements and constructive features, in addition to the feeling of disorganization and deliberate messiness that prevails in the reading of the shack-ridden *favela* landscape.

In Brazil, an array of different types of materials are often used in the construction of *favela* shacks, among which we can highlight the use of plywood and particle board, as well as wood shavings, masonry, clay bricks and clay tiles, asbestos-cement tiles, among others. In Figures 1 and 2, we can observe the "jumble" of shapes and materials used for the construction of the shacks of slums. This multiplicity of irregular elements together determine the formal characteristic to be transposed and incorporated as a factor of differentiation.

The capturing of aspects of brazilian favelas is reflected in works of the Campana Brothers such as the "Sofá Boa" (Figures 3 and 4) and the "Cadeira Favela" (Figures 5 and 6), which

allows one to demonstrate the use of the irregular shape of the favela shacks for the construction of an image used to leverage the sale of designer products.

Figure 1: Photo of the *favela* shacks - Campinas-SP-Brazil

Figure 2: Image details of the *favela*

It is important to note here that in the case of the "Cadeira Favela" and the "Sofá Boa," there are important differences that changed and/or defined the initial reflections of the authors for creating the objects. In the case of the "Cadeira Favela", the creation process was instinctive for the designers, however, in the case of the "Sofá Boa", they were given a briefing by a furniture company.

Concerning the elaboration of the Sofá Boa project/product, it was found that one company in the sector requested the creation of a product that clearly exhibited the peculiarities or the precariousness of urban spaces, like the disordered forms of the *favelas*. In this way, different images were incorporated to the range of products developed by this company with the intention of increasing profits through the sale of this new item. This guideline can be identified in the discourse of the designers during a lecture held at the International Seminar on Design - Brazil Design Business Diversity, which took place in São Paulo in December 2002, wherein they cite the briefing produced by Massimo Morozzi, creative director of Edra, one of the major furniture brands in Italy, which manufactures various pieces conceived by the Campana.

> The Sofá Boa was a briefing that we received, and a very funny one too. It was also to Edra by Massimo Morozzi, who said that he wanted an embedded sofa or armchair with no structure, which looked like a favela, a striking piece. We devised a sofa with metallic no metal or wood structure. [7]

Although the designers emphasize that "they live in a poor country and try to draw beauty from impoverished contexts, taking special note of the dwelling forms that exist in Brazil," it should be observed that in many cases those who seek to appropriate the "poverty" and "precariousness" of urban spaces are Brazilian companies in the sector that aim to incorporate different images (exotic or eccentric, to be specific) into their range of products. It is noteworthy that both these companies' headquarters and the consumer market for their products are not located in such poverty-stricken, precarious places. This strategy of appropriation of local aspects and the creation of different images is largely due to the capitalist need for innovation. The inclusion of the image of precariousness of the Brazilian *favelas* (or at least, the ideological discourse related to the creation of furniture design), and particularly in the case of the Campana brand, makes each piece of the Sofa Boa line is sold at approximately US$ 24 billion (twenty-four thousand U.S. dollars) [8].

Figure 3: Sofá Boa

Figure 4: Sofá Boa (detail)

Besides the Sofá Boa, the capturing of the irregular shapes of the *favela* shacks was also used for the creation of the Cadeira Favela. However, this was an instinctive creation related to the project-oriented design process. In this specific case, the project was developed in 1990. It should be noted that the designers could create "freely", as there was no briefing to speak of concerning specificities. Hence, the designers appropriated the image of only one type of material used in the construction of *favela* shacks, namely pieces of pinewood, and with this, created a “designer product" [9].

These chairs (Figures 5 and 6) are produced with pieces of wood fixed together in an apparently irregular and disorganized manner, just like some of the shacks found in the Brazilian *favelas*. This appropriation of the "different" in slums also underscores the idea of handicraft and the utilisation of cheaper materials, "values" which are also incorporated into the product’s image. In the case of the Cadeira Favela, it can be verified that the use of a " low-cost" material does not bring down the price of the product. Quite the contrary, it actually increases its value, mainly as a result of the discourse in favour of using simpler and/or recyclable materials, in other words, on account of the need to express concern for the natural environment. In this project, the designers have incorporated the Campana brand into the product, as well as a rejection of serial production, ultimately confering a character of exclusivity to each piece and transforming the chair into an object that starts to be viewed as a work of art, which in turn also raises its economic value.

Figure 5: Cadeira Favela

Figure 6: Cadeira Favela (detail)

The appropriaton of the *favela* shack as a different image bestowed a "distinctive status" on the design of objects. This "distinctive status" produced "symbolic capital" that led to the creation of a monopolistic income for the Campana Brothers, who hold the product patent.

Like the Sofá Boa, the Cadeira Favela is produced by the Italian furniture manufacturer Edra. This company has purchased the exclusive right to manufacture and sell the product, which is produced by this manufacturer since 2003. Many of the products made by Edra are considered "handicrafts" and are only produced by order, that is, through a system called Just-In-Time (JIT). That being so, this chair can be considered a work of art, made by an artisan, whose price is based not only on the cost of production, namely the labor force utilised and the capital invested, but above all with the rarity factor. In some cases, Edra assigns only one employee responsible for the manufacture of a given product, thus also sustaining the image of the artisanal process - the unique and the rare.

Even the production and sale of the image of a product regarded as "simple" like a chair requires a great effort to have success in selling it. The strategies implemented on the production and promotion of the product vary according to the objective or the needs of the consumer market. In many cases, the construction of the image is based, first and foremost, on the appropriation of peculiarities, specificities and/or singularities, on the distinctive factor, on the symbolic capital, on advertising and on monopolistic income.

3 Conclusões: "Simplifying and Complex Thought"

The creation of images, especially of images considered "different, exotic and eccentric", consolidates itself as an important product for commercialization, and can effectively generate high profit rates for corporations. In many cases, the very act of capturing particular aspects and cultural specificities, and to the local, urban, architectural, artistic and musical domains, can be transformed into images, and subsequently transformed into products of high "symbolic capital". Some designers use the spetacularization of "specificities" for the production and marketing of different products, appropriating even the irregular shapes of *favela* shacks to transform them into "different and exotic images", as paradoxical as may first appear. This is the formula for their success.

Despite the various contradictions, many of the images produced and sold of aspects of the slum present it as a place that is different, exotic, eccentric, a realm where various social and cultural dynamics coexist, rather than a place for all that which is irregular and problematic, the nerve centre of trafficking and violence. This is a romanticized view of these such communities, and an unreal one too. It is widely known that more often than not the *favelas* are set up in high-risk areas, formed by strips of land on hillsides, on upslopes and on downslopes and near streams, and are hence subject to flooding. *Favela* shacks are often self-constructed housing units, insalubrious, without propor ventilation, lighting or access to running water, set amid "open sky sewers”, with several *gatos* in the electricity grids (namely illegal and improvised forms of electrical installation). In other words, these places face high risks of landslides, floods, fires, etc. on a daily basis. As the access to these areas is often poor with narrow and winding passages, communities have great difficulty in designing and installing water, sewage and electricity grids, among others. And to top it all, solving or at least mitigating the problems of *favela* residents is not as simple and easy issue as the images incorporated and customized by designers portray.

In these cases, the most important and serious problems of the *favelas* are "relegated as second-order issues" when companies advance their interests and needs for appropriating and exploiting the space of the favela in different ways to create an image that is interpreted as “exotic”. In this way, they banalize and trivialize the real problems of slums to their own advantage to promote the sale and consumption of an exotic image, which only provides benefits to the large company owners.

From the perspective of Simplifying Thought, based on capitalist profit-yielding strategies, it can be verified that the creation of designer products Cadeira Favela and the Sofá Boa by the Campana Brothers aim at stimulating consumption and boosting profits through the creation of an "image of the different", apparently showing no concern for the the social and housing problems of the slums. However, analyzing the critics who study social and urban issues, that the *favela* is evidently much more than design and architecture; rather, it is home to thousands of families, and therefore it could be said that it is not conherent to analyze it in such a simplifying way.

This banalization of the real problems of the *favelas* can be verified in the images that are assimilated by tourism, by the music industry or by the industry of furniture design. In the case of tourism, what is promoted is a fantasy adventure in a "forbidden" place, where customers can face challenges and experience danger in a trafficker-dominated area. In music, hip hop lyrics take the reality of life in the *favelas* to other social groups. In design, what is explored is the precariousness and the element of irregularity found in the construction processes and dwelling types for the creation of different products, which evince the disorganization of forms.

In this way, the images of the spaces of the Brazilian *favelas* are incorporated into products to boost their sales. Transformed into commodities, their image is sold as an exotic and eccentric product, "gift-wrapped" for the consumption of a global elite.

It is important to emphasize that it would be of great value if the designers and architects could balance their capitalist profit-making strategies with the social and environmental issues reflected in their design. However, this is not something that can be specified as a requirement, but should rather be exercised by design professionals as a choice. It is believed that reflecting on the *complexus* (weaving together) would in itself be a great learning experience, with the purpose of trying to strike a possible balance between the individual and the whole.

However, if examined closely from the standpoint of Complex Thought, and not just from the perspective of Simplifying Thought, it can be argued that this appropriation of urban space in the *favelas* made by designers is an "inadequate" appropriation. Inadequate because nothing is given in return to the favelas, and there is no positive social or economic return to the local population, consisting only of appropriation made in an irregular way of the construction of shacks for the creation of an image with the sole aim of increasing consumption of a given product, rather than forming a view of the whole.

Creative professionals can and should be transdisciplinary, and question the mode of Simplifying Thought, and even that of Complex Thought. This is necessary to ensure that the design practice evolves and does not become "vulgarized", or be rendered into a profession that is solely focused on the "production of new objects".

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FROM "ORDER" TO "LIFE" --DISCUSSING THE "GRAND THEATRE WAVE" PERIOD IN CHINA BY TAKING THE HENAN ART CENTRE AS AN EXAMPLE

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Abstract

After the 21th century, many cities in China have experienced a special period of urbanization. A large number of new towns have been rapidly planned and finished. Grand theatres, usually being set as the landmark in the new town, are built up in a short time and aimed to promote the urban cultural atmosphere in a rapid way. This construction mode reflects the government's attempts on exploring urban culture formation. Meanwhile, it has become a shortcut way on building the urban culture image. As a cultural symbol of Western art, the use of the Grand Theatre has to go through a longer run-in process when being compared with other cultural buildings, because it cannot be accepted in the short term by the majority public. A top-down command-style construction usually occurred in the early stages of construction period. While at the beginning of the using process, grand theatres in China encounter the cold reality of large gaps between expectations and actual using effects.

Keywords

Grand theatre, Urban context, Star Architect, Culture, Design

1 Introduction

After the opening policy in the year of 1978, China has been experiencing a specific urbanization period. The development of economy has been growing fast. After stepping into the 21st century, many cities in China have been experiencing a special period of new district constructions. A large number of new towns have been rapidly planned and put in construction process. Grand theatres, usually being considered as the landmark in the new town, are generally built up in a short time and aimed to promote the urban cultural atmosphere. This mode becomes a particular phenomenon in China, especially for the local authorities who have strongly pollical desires to build up the city iconic name card.

This construction mode reflects the government's attempts at exploring urban culture formation. A remarkable cultural building is obviously a shortcut way in shaping the urban culture image. Cultural buildings like the art gallery, museum, grand theatre are all their

choices. Among these cultural building types, grand theatre should always be the impressive and memorable one.

As a cultural symbol of Western art, the use of the grand theatre has to go through a longer run-in process when being compared with other cultural buildings, because it cannot be accepted in the short term by the majority public. A top-down command-style construction usually occurred in the early stages of construction period. what's more, when they are first put into use, grand theatres in China usually encounter the cold reality of large gaps between expectations and actual using effects.

This article attempts to explore some questions that related to this phenomenon. They are mostly the following ones. Why the government always choose grand theatres? How do grand theatre buildings work with the daily city life? Do Chinese cities and local people really like grand theatre? What kind of theatre buildings do they really like? What do the government and "star architects" have brought to the Chinese city?

The article tries to understand these phenomena from the angle of architecture and find the answer to these questions based on the example of the Henan Art Centre, which is a typical case located in the northern part of China. The article also tries to explore the reason for the special period from 1998 to 2005 when some "star architects" show very active attitudes towards grand theatre projects in China.

2 The "Grand Theatre Wave" in China

Since the beginning of the 21st century, the urbanization rate in China has entered a new stage. New districts of various scales and standards are planned and built in order to satisfy the demand of urban development and expanding. A large number of cultural buildings have appeared in these new district planning, such as grand theatres, libraries, museums, exhibition centres and so on. In this period, the phenomenon of "Grand Theatre Wave" has always been one of the most eye-catching topics which can stimulate waves of discussions from many different fields, as the grand theatres among all kinds of cultural buildings are always the most costly and compelling ones. Therefore, the grand theatres are known as the "crown pearl".

Usually, these new districts in cities represent a new lifestyle and better living environment as well as the passion and decision from the government to reconstruct the urban life. Seeing from the space construction of some new designs, the newly planned urban space texture shows a great difference from the original ones. Grand theatres, which are normally been settled in the central part of the newly planned districts, seem to play a leading role in the space construction as well as an expression of political decision making.

The grand theatres are chosen by the government as an achievement project, which is the product of political decision-making. But they never admitted that it is a symbol of power. On one hand, the cultural buildings are not an administrative building, and its political attributes are not strong. On the other hand, from the planning, it seems that the government does not wish to reflect too many political decision-making traces under the figure of serving residents. As a result, the original intention of the theatre-related constructions and district plans are seemingly trying to adapt to the historical development trend, reflecting the meaning of opening and equal attitudes. Examples can be seen from the Zhengzhou New District and

Chongqing Jiangbeizui CBD. Administrative buildings cannot be seen in the Zhengzhou New District. The entire area is mainly constructed with cultural and commercial buildings. The Henan Arts Centre is located in the central part. Chongqing Grand Theatre is located at the junction of Jiangbeizui CBD. The district is also dominated by cultural and commercial buildings. And the location and meaning of Chongqing Grand Theatre are closely related to the city's tourism axis.

Zhengzhou New District

Henan Art Centre

Chongqing Jiangbeizui CBD

Chongqing Grand Theatre

Figure 1. The grand theatre and city context

3 The “order” period with oversea “star architects”

One disputable issue of the “Grand Theatre Wave” is that many of these grand theatres are design by overseas architects and design firms, which in fact, stimulates waves of discussions from different fields. These overseas architects and design firms are almost all known as their special design concepts and styles, which is called the “star effect”. These “star architects” are invited to design the building as well as the city context and cultural atmosphere. They are trying to understand the exist city context and give their answer to the new landmark. The government and the residents stand on the own views and expect the grand theatre more than the buildings pure construction meaning. These views give the city tons of discussions on this special phenomenon.

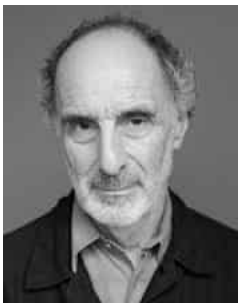
The year 2000 is a very significant point for China. Chinese people prefer the integral number of year in the traditional ideology and culture for some memorable events. They usually plan

for something big and influential on that point year and for the new coming period. Accordingly, as a remarkable year, in the year of 2000, grand theatres which are considered as the essential buildings in an urbanized city were planned and under construction in some cities with advanced economy standards.

The big event happened in China about theatre first and sensationally is the National Centre for The Performing Art. In the year of 1998, the Chinese government started the bidding for the National Centre for The Performing Art and invited famous architects all over the world at that time to participate. This event had received both pride and doubts from home and abroad through the whole design and construction process. From then on, other cities with advanced eyesight and economy standards began to copy the central government's style on grand theatres.

From the year 1998 to 2006, oversea architects participated in the theatre design projects in China are dramatically fixed with the exact four or five "star architects", who is very active and popular in the international design stage at that time. The Uruguayan star architect, Carlos Ott, can be taken as an example. In 1997, he was invited by the government to take part in the bidding of Jiangsu Grand Theatre, located in the city of Nanjing, which might have an influence on his career in China. He won that competition at last, but unfortunately, due to some political reason, the building was not built later. Then he was luckily invited by the central government for the design bidding of the National Centre for The Performing Art. Although he was not the winner, in the next few years, he was favoured and admired by other local authorities of Chinese cities and won several grand theatre projects successively. During the year from 1998 to 2005, he got four grand theatres designed in China. Similar experiences as Carlos Ott can be dramatically seen on Paul Andreu and gmp. That was quite an interesting architecture phenomenon happened in China.

Table 1: Active overseas "star architects" in China from 1998 to 2006



Paul Andreu

Carlos Ott

gmp

Zaha Hadid

The local authorities chased for these architects' fame and design style after the central government's projects had been put in progress. The following chart can give a summary on these "star architects". In this period, architects, especially Paul Andreu, Carlos Ott, gmp were the ones who got fruitful benefits. In their projects, personal styles could also be seen more or less from the shape, material and interior space. Their practice surely not only represented their styles but also reflected the authorities mind and flavour to some extent. Therefor, we can say, it is a mixed style that could be summarized as style of that history period, which embodied of the government's will as well as the authority aesthetic taste. They might copy the round shape of the National Centre for The Performing Art. They might try to copy the

successful example of the opera house in Sydney. They don't really care for their own city cultural, or rather they cared for the cultural too much.

Table 2: Oversea architects and projects in China

Architect	Nationality	Project	year	Detailed information
Paul Andreu	France	National Centre for the Performing Arts	1999	
		Shanghai Oriental Art Center	1998	
		Jinan Grand Theatre	2005	
Carlos Ott	Uruguay	Hangzhou Grand Theatre	1999	
		Henan Art Centre	2001	
		Wenzhou Grand Theatre	2001	
		Dongguan Grand Theatre	2002	

gmp	Germany	Chongqing Grand Theatre	2003	
		Qingdao Grand Theatre	2004	
		Tianjin Grand Theatre	2005	
Zaha Hadid	U.K.	Guangzhou Grand Theatre	2004	

4 Henan Art Centre

As one of the theatres designed and built at the beginning of the 21 century in Henan Province, Henan Art Centre is one of the remarkable buildings located in the CBD area of the Zhengzhou New District, especially for the stand of local people. With small scales, low equipment quality and outdated furniture and decoration style, old theatres in the city at that time are all below average standard. According to the unsatisfactory situation, the government considered that it was a serious shortage of culture buildings and performing art market for a province with a long influential history on culture and archaeology in China.

In China, Henan Province, the result of the international design bidding of Zhengzhou New Town has faced a long time criticises, but it, in fact, changes the urban life status. Whether it good or not, under the order of the government, many buildings have been stood in the urban context. Among these buildings, grand theatre is always the one which attracts people's attention. Although the architect attempted to conform to China's geographical features in the grand theatre design and tried to partially break off its original design routines, the Henan Art Centre has been criticized by the public to some extent after the opening. However, it gradually integrated into urban life after experiencing the running process of rethinking from the government and the public, improvement in details on the overall planning, and adjusting the market position. With the continuous development on the economy and the increasing level of public cultural appreciation, the Henan Art Centre steps in a stable acceptance period, and gradually becomes the "new logo" of city culture.

4.1 "Order" Process

The Henan Art Centre was set up by the government of Henan Province in 2002. From the perspective of the leadership, Henan is a province with a large population, and it is famous for

its archaeology and history culture in China. With the cultural accumulations, the construction of an art centre may be completed more smoothly with these iconic cultural figures.

Prior to the construction of the Henan Art Centre, architect Carlos Ott had already designed the Wenzhou Grand Theatre and the Dongguan Grand Theatre. Later he was invited to Henan. When he first arrived in Henan, he did not have very mature ideas or design solutions. Therefore, the government led him to visit the Henan Museum to learn about Henan's culture and history, so it may be a sense that the government's will on him made the current architectural style.

In the bidding, there were more than 20 design companies participated. The final winner was Carlos Ott. From the process, it is clear that the "order" from the government's showed not only on the decision of the building's setting up, scale and position, but also strongly affected the architect's design on the final outcome. With the building built in the new district, the urban context was totally changed in the new area. It really takes a long time for local people to accept the new urban morphology.

4.2 "Life" Narrative

At the beginning, the operation of Henan Art Centre was very difficult. In the first two years, there were less than a hundred performances each year. The attendance rate of the audience is pitifully low with less than 50%. There were many policies that the theatres' manager came up with to raise the brand and popularity.

With the rise of average attendance rate reaching about 80 percent, the Henan Art Centre had more than 420 performances last year, which means they may have more than 1 performance per day. And unexpectedly, their performances during the well-known traditional festival, the spring festival, had a surprisingly good effect on the audience combining the traditional opera with modern art, which they had never had the courage to try before.

The plaza and open stage at the back have now become lively activity space of the grand theatre, and also of the whole CBD district. In the summer, when the climate is proper for show in the open air, there will be free performances put on the back stage with traditional music and opera, the purpose of which is not only attraction on audiences but also save the traditional cultural for the local people and actors. These kinds of actions help the management team find a regional way to engine the negative spaces as well as raising the awareness of potential audiences passing by. Through diversified strategies on attracting audience, the Henan Art Centre now have more than 40,000 registered audiences, which is a very proud thing for the manager when we interviewed him two months ago.

The above situation illustrates a phenomenon in China with grand theatres currently that the local people are trying to accept the grand theatre from the appearance to the performances, with their new understanding of the traditional culture in the particular city. This probably means that the grand theatre has been drop down from the upper order to daily city life gradually. Local people tend to spend more money on cultural issues. This will also change the space lively index to some extent.

People doing activities in the plaza in front of the Henan Art Centre.

Exhibitions about traditional music culture in the hall.

Figure 2. The grand theatre and city context

5 Conclusive Remarks

The theatre building is an ancient architecture type dating back to ancient Greece. There is quite a big difference between Chinese theatre and western theatre. Nowadays when we talk about theatre buildings, we are talking about the modern grand theatres. It is the result of modern civilization and the spread of western culture, which is totally a direction of our city culture development for the new period, and of course has a big difference with the traditional culture.

A grand theatre is a pride of a modern city because it embodies the cultural sign and strength. Cultural buildings construction boom in China in the 21st century become a very special historical stage. These cultural buildings have led to the development of urban cultural atmosphere, created new cultural spaces, and reflected the growing cultural demand of urban residents.

Obviously, the "Grand Theatre Wave" phenomenon has gone far beyond the general meaning of performing function and cultural entertainment. Grand theatre building has become one of the most significant competitive means between cities. some famous oversea architects take part in the construction process of grand theatres is a necessary demand, the influence of mixed cultural background and context needs to be discussed. Every oversea architect or firm has its own cultural background, design practice and design concepts. Their understanding of the city varies. Therefore, their way to deal with the city and the building differs, which means they are spreading their own concepts and try to adapt them to Chinese people and city. That may indicate many unknown results and even change the development of the whole area.

With the government decisions and strength, together with the special changing era, grand theatre similar to the construction process of Henan Art Centre are facing with the new challenge of how to combine the culture from western country to the traditional city life, in order to get a better operation. It will take quite a long time searching for new ways and it will become a new mixed-culture phenomenon in the future. It needs more academic investigations to talk about the new way.

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NEUPERLACH RELOADED

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Not later than the statements manifested within the Club of Rome, the era of an unstoppable believe in innovation, that shaped cities in the years after the war and during the ,,Economic Wonder'' in Germany, ended. Since then, our economic system is evidently affected by economic plundering and exploitation. To face such corruption and plundering we must look closely at and seriously deal with the socio-cultural challenges of our time.

In order to tackle this complex challenge, one must look closely at the individual partial aspects of the problem. Many regions in Germany are facing crucial changes, mainly because of insufficient resources, a continuous flow of people out of cities or simply the lack of financial means. Though interesting and of great importance, the hardships and opportunities of these regions are not our focus here.

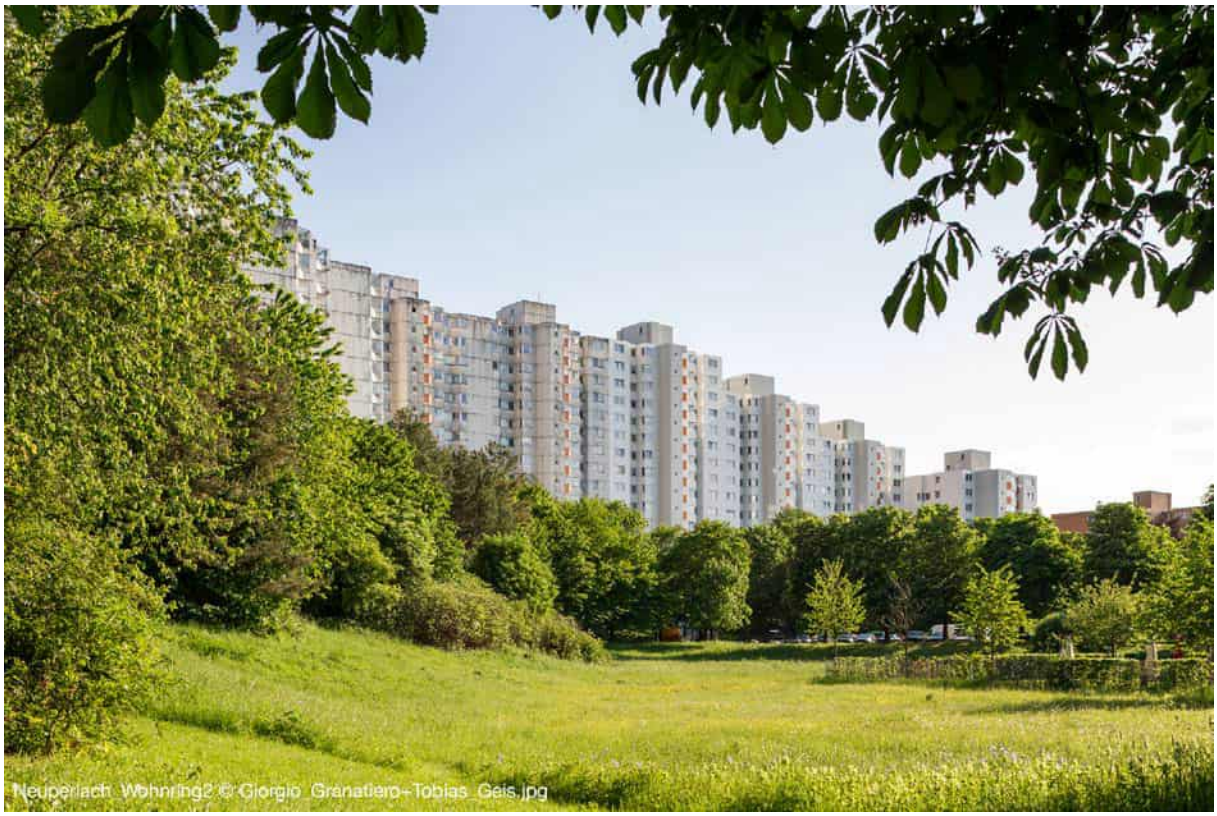

Figure 1. Characteristic Sight of Neuperlach showing the Megastructures and the Green

Neuperlach is exemplary

Munich's Neuperlach represents satellite-towns that were built on the outskirts of large cities; Munich is one of Germanys 5 largest metropolitan regions. Shaping the development of cities, it is in these three economic and demographic conditions 1. *Prosperity*; 2. *Resource consumption*; 3. *Population growth* that lies great potential for just progress and sustainable innovation.

To make the current condition of Munich's outskirts more comprehensible, firstly, I would like to highlight the issue of density. Nowadays, a common understanding of the term ,,density'' has cemented itself in the minds of planners, architects, politicians and other stakeholders involved in the process of city making. Density can be understood twofold: 1. Building Density (Units per base area), 2. Population Density (Inhabitants per base area). After the war, population densities have decreased strikingly, due to the growing high comfort requirements of living space. And it is because of this, that issues concerning the decaying and unhygienic conditions of core cities, that were criticized during the modern age, were deliberately put aside.

When talking about examples of core cities, such as Paris and Berlin during the turn of the century, it is always associated with these previous unhygienic living conditions, as well as other aspects concerning city density. Due to a possible misunderstanding of the modern age, that was accompanied by a fading urban population density and a stark separation of land uses, an apparent decrease in land use density and city-experience density has emerged. These very same properties (functional and building densities) that have been transforming cites into desirable and interesting cultural melting pots since time immemorial.

As a result of available financial resources, rapidly growing cities are redirecting their efforts towards reutilizing and refurbishing existing buildings and mitigating extensive land use. In this context, it is important to harness the potential, that lies within the unpredictable migration flows from rural to urban areas and immigration flows from abroad for a positive and sustainable development of cities.

This investigation focuses on Neuperlach in Munich. An area that is predominantly occupied by homogenous building structures, that were simultaneously built in the 1960s and 1970s. Building densities here are relatively low. The building substance is outdated and is missing vital urban components, that would turn Neuperlach into, not only a satellite city, but more into an overflow city for Munich and that would create a well networked city district in the existing urban fabric. Because of available finances, high migration rates and the necessity to reduce excessive land use for new settlements, Neuperlach comes to the foreground, better than ever before.

Figure 2. monouse dwelling-Blocks an lost playgrounds of Neuperlach

Deficites: Seperation of uses

Separation of land uses has been a reoccurring feature in post-war settlement development in Germany. In the years between 1919 and 1939 central components of modern-day city planning were discussed during the CIAM congress: ,,.....1. dwelling, 2. working, 3. relaxing‘‘[1]. The implementation of these components was further defined: ,,a) The division of land, b) The organization of traffic, c) Laws and regulations‘‘[2]. Surely enough, can we claim that such functional and spatial separations can be traced back to different sources, such as Theodor Fritsch, Joseph Stübben, Theodor Goecke or Robert Schmidt in Germany[3]. Even if such monofuncionality was almost never set in the modern era, strict separation of land uses is still, to this day, a foundational component in the laws regulating current large housing schemes. Modernist attempts to create settlements in the post-war era have imbedded the idea of spatial and functional separation into our social and urban perception. Therefore, incorporating such a feature into the genetic code/identity of these settlements.

Large-scale implementations of these theories can be found repeatedly in post-war Germany. Recovering from the dark years of the Third Reich, efforts were mostly made in

1 1928, Erklärung von La Sarraz aus Carsten Jonas, Die Stadt und Ihre Geschichte, S.234

2 Ebd., S. 234

3 vgl. Carsten Jonas, Die Stadt und Ihre Geschichte, S. 239

the strategic reconstruction of cities. While during the 1950s efforts were almost only directed towards the deployment of the necessary, growing prosperity characterized the period starting from the mid-1960s. Various attempts in creating new settlements, proved an unstoppable aspiration for innovation in finding alternative modes of dwelling and living.

One can understand these questions, when looking at the history of Neuperlach, which is located on the south-eastern side of Munich. The 1960s saw the launch of the planning of Munich's largest housing-settlement scheme, Neuperlach. Intended as an overflow city, ,,A-New-Munich'', for Munich, a target population of 80.000 inhabitants was set for Neuperlach. Because of several previous attempts, planning schemes aimed for spatial closeness of different uses ,,Dwelling, working, relaxing''. Within this overall purpose, a special attention was put on a cultural offer of trans-regional relevance. Nevertheless, residents are still missing to this day the ,,pulsing [...] urban[...] life''[4] they were promised and are familiar with from public squares in southern countries.[5]

That ,,Neuperlach never made it to become a city, lies at the very core of neglecting public space, in the midst of an enormous pressure, coming from naive and heterogeneous ideological conceptions, resulting in the loss of any kind of urbanity.''[6]. This was especially obvious in the unabated importance of cost-efficient and industrial production of buildings, which was the narrative force of construction and urban means of expressions at that time. This resulted in perpetuating the architectural concept of a free-standing building block. The construction of Neuperlach continued rapidly until the early 1970s. Housing blocks were the first to be built as they were the most needed. In 1972, Munich was home to the Olympic games and soon after followed by the energy crisis, significantly affecting the development of Neuperlach. As a result, a planned center for Neuperlach, that should have housed vital commercial spaces and a conservatory, was never built, turning the city into yet another unfinished urban utopia. Neuperlach transformed from a visionary new Munich into a regular satellite city. As built today, the incomplete Neuperlach stands as an example of similar large-scale settlements across Germany and possibly in all Western Europe. Still, the situation does beg the question as to if the large-scaled plan for a new urbanity would have ever turned reality.

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6 Hartard, Christian: Komm, wir bauen eine Stadt. In: Mitteilungen der Geographischen Gesellschaft München (Sonderheft), 2006, S. 61. Siehe auch: http://www.hartard.com/texts/stadtrandbemerkungen.pdf

Figure 3. Decaying building substances of Neuperlach

Opportunities: Overlapping of uses

Surprisingly enough, lies in those very same critisized properties of the fore mentioned satellite cities great potential and opportunity for a sustainable and crucial development today.

To begin with, the urban layout shows low building and functional densities, a spatially open structure and a systematical logic. We were able to prove, that by means of different strategic spatial concepts, one could double the building density of an area.

50 years after construction, building substances in Neuperlach are decaying and in need of rehabilitation. Due to the existing building typologies, it is possible to add extensions or create various add-ons to the building blocks. The layouts of the units are of exceptional quality and rational autonomy. Reinforced concrete slabs and masonry walls can be found in almost all houses, creating a solid base for a possible energetic restoration and a sustainable refurbishment.

Inadequately large free-spaces between building blocks and disproportionately wide streets found in Neuperlach, encourage the concentration of green spaces in the outskirts of the city and offer opportunities to further strengthen and differentiate between public and private spaces.

Figure 4. Author´s Collage connecting the characteristic building structure of Neuperlach with one of the Germans most yearning sights

The Sound of the Future

Looking back at the well-intended theme of protecting people from unhealthy living conditions, a sustainable and sufficient development of urban structures was only in the rarest cases achieved. Nevertheless, it is of such fundamental importance, not only because of its historical significance, but also due to the large bulk of buildings and the characteristic spatial properties of this settlement. In light of a generation change and a dire need for restoration, today Neuperlach is subject to this matter. Present challenges such as sustainability and globalization and their immediate effects, offer great opportunities for a qualitative development of these settlements. Neuperlach stands here exemplary for a settlement located on the outskirts of a metropolitan-region in Germany (growth forecast München). The economic drive of such regions attracts citizens from outside and leads to prosperity as well as an economically strong public sector. Simultaneously the city of Munich is going out of space. A large portion of the land is already populated and further extensions of the city into the green hinterland is undesired. Also, resettling industries in the surroundings would have adverse effects on tax-incomes and is therefore also unwanted. In light of this challenging problem we are confronted with, I wish to put forward a couple of statements, that aim to enrich and foster the discussions on necessary and desired change:

1. Learning from the sixties: Be brave!

Munich is facing huge challenges. The history of the city will transform just as it did in the 60s and 70s. We have the chance to positively shape this change. Determination and assertiveness are important when tackling these changes. The report ,,Faktor 4'', written by Ernst Ulrich von Weizäcker, Amory and Hunter Lovins in 1995, and addressed to the Club of Rome is as recent as it was back then.

2. From the Center to the Web

Reaching a population of almost 2 Mio inhabitants, Munich is on the threshold of a polycentric and web-like urban fabric. The center of the city cannot accommodate all functions any longer and new centers on the outskirts of the city, such as planned in Neuperlach, but are still missing to this day, are inevitable and necessary.

3. Conversion instead of Demolition

Munich can be understood as a conglomerate of clods that are rather separated from than connected to each other, especially beyond of its core center. In our case Neuperlach is also a conglomerate of clods. Many of these clods within settlements need restoration. Through conversion and addition, we can eliminate deficits, while at the same time preserving the qualities and character of such clods. Along with the embodied energy (grey energy) these clods are part of our history and the identity of the city. The spatially open structures of that time are surprisingly a good example.

4. Network hubs are places for exchange

Nowadays, the shopping mall is a symbol for built sub-centers, the same in Neuperlach. Nodes and networks emerge differently, seemingly unplanned and unsystematically. Today, this is happening mostly in a digital way. In reality, opportunities for the emergence of hubs and networks arise, whenever various and diverse elements come together. It is important to provide the proper space for such occurrences. Space for cultural, intellectual, religious and sports activities, not outside the gates of the city and spatially segregated from the rest, but in the midst of monofunctional residential and business districts should be provided. The days have past, where loud, smelly industries are key component, when planning multifunctional areas and innovative communities, offering new opportunities and imposing dire necessities for creating diverse residential and business neighborhoods.

5. Density as a necessity

Today, population density in areas like Neuperlach have reached only 100 inhabitants per hectare. This is mainly due to the amount of living space per resident that has been growing steadily for years. Regional centers, such as the Plettcenter, Quiddecenter have been all shut down, due to decreased demand. In order to create and foster areas for communication and social exchange, it is important to increase residents-density in the area, until a proper amount of people has been reached. Life behind

closed doors of one's own private apartment and in the office should be translocated onto the public space again. Due to the increased requirement of living space per inhabitant, a densification of residents is inevitably accompanied by a relevant building densification, that will certainly transform the face of the area.

6. Private and public space

For such social and communicational activities to arise, we must rethink public space, transforming and converting it into a place for communication and social interactions between people; a matter beyond the provision of functional infrastructures for city-spaces. Also, private spaces should function as places of retreat and should be noticeably separated from public ones.

7. Concentration of traffic

To increase the chances of contact, pedestrian and car traffic should overlapped and therefore not be separated from one another. Innovative mobility concepts would enhance street life (public transport, car sharing and autonomous driving). Streets will accommodate less traffic and therefore road widths can be reduced.

8. Green Veins

In the midst of all this densification we should preserve, maintain and further develop adequate free-space. A long tradition in Munich of connecting the landscapes around the city with green spaces within the city, should be taken into consideration and made use of. Currently, pedestrian and cycle lanes, that are separated from roads, can be used for such green spaces, especially when street widths are altered and changed.

9. Collage-City

Large migration flows from rural areas to the city, as well as migrations from abroad, can lead to healthier and more diverse environments, a prerequisite for urban life.

10. Age-appropriate dwelling

A wide range of different apartments should be offered. Most of the apartments in Neuperlach can be accessed only through a split-level leading to the apartments at the lowest floor, making them inaccessible for handicapped and elderly people. Even if we find a majority of suitable floor plans of the units, it is necessary to provide a higher number of handicapped-accessible apartments, along with an increased offer for health care amenities. Improved neighborhoods can and will certainly enhance city life.

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MEASURING ABSENCE: A CASE STUDY IN BUILDING PUBLIC IN PHOENIX'S BUILT ENVIRONMENT

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Abstract

Phoenix, Arizona has become known for its urban sprawl. It is a place of absence, a land of objects-in-field with no center or boundary. It is through this absence that tech companies and others find Phoenix a land of opportunity. It is also through this that The United States' executive branch finds feasibility in erecting physical borders between communities of people and itself. It has created a divide between citizen, urban environment, and public institution. This all in a manner which recalls Superstudio's *Supersurface* (figure 1).

Source: www.architectureplayer.com ; Copyright: architectureplayer

Figure 1. Superstudio's *Supersurface*

It is through this that this paper and the new Environmental Design program at The Design School at Arizona State University (ASU) questions design education and its role in integrating these subjects (culture, climate, and context) as a form of public development and protection. This paper argues that the only method with which to engage these aspects of environment in Phoenix are through a publicly active research-driven design program, establishing an "Urban Room" and a system of citizen-designers in between The Design School at ASU and The Phoenix Art Museum. In doing so, this public university can finally create a "public" through nomadism, providing experimental examinations on cultural and physical borders between ASU environmental design students, the Phoenician "citizen insane", Tempe Campus of ASU, and the absent environment of Phoenix. By having the university itself cross these borders, we can begin to "measure" them, creating citizenship by binding the personal, deep-interiority and the stark urbanity of Phoenix together through paths. This application has relevancy in Venice, a place, although an urban opposite to Phoenix, shares questions about its sense of public, environmental, and natural resources.

Keywords

Absence, Research, Phoenix, Urban, Education

1. Introduction

Arizona is a place of meeting cultures and constant flows. In a place of imposed borders, malleable borders are still the strongest reality. Try to measure borders can help us to remove them, and can show us the link of new dimensions of citizenship in motion. In Spring 2018, a group of environmental design students at Arizona State University (ASU) compiled data, memories and ideas they have as citizens of their city to improve their own ability to analyze an urban reality through an act of measuring the plenty of "nothingness", or the absence of their city. The EDS 200 studios, "The Experimental Room" together with the Phoenix Art Museum, collaboratively explored "Measuring Absence" as the common research ground and design problem, by having on-site experiences in specific urban locations to discover existing rituals of the city. The coordinated studios are part of *The Phoenix Challenge: Desirable Urban Futures* research, a collective design initiative within The Design School at Arizona State University which focuses on outlining desirable futures for American Cities in the 21st century, to project and foster enhanced scenarios and renewed urban experiences in metropolitan conditions. Extreme conditions have pushed Phoenix, the city evoked as 'the bird on fire', to face critical challenges in terms of ecology, sustainability but also social and cultural urban issues as a modern and constantly growing city [1]. Its relative weakness can be turned into a valuable strength by becoming a model for change and progress that speaks to growing urban phenomena around the globe. The associated 'challenge' of such a research is developing methods for measuring the built environment in Phoenix, Arizona, for measuring a place of constant flows and impermanence. In a place of imposed borders and many centers, absence is Phoenix's truest reality. Measuring this reality, through "precise perception" and the "hyperreal", to measure the difference between visible and perceived reality, can become a method in building cultural identity where identity is hidden. The paper speculates that a link to a new dimension of citizenship, a central topic to the US Pavilion at the Venice Biennale 2018 where the authors represented Arizona, can be formed in increasing postmodern urban situations.

2. Arizona

Due to borderland conditions separating the south-western United States from Mexico, Arizona is a place of cultural-transition. it's a place where dimensions of citizenship are organized according to circuits rather than permanence. In this borderland, people have historically been able to deconstruct their culture and identity by living nomadically, unknowingly crossing imposed borders. The plot-generating setup of western films measures this absence in something compelling but ephemeral: the western town or the 'fragile' as the figure of a man riding a horse across an empty landscape. As seen in Sergio Leone's *Once Upon a Time in the West*, this cowboy is not born here; while crossing alone, he writes his story over the desert, measuring with his presence, the absence, self-produced and self-given in the act of perception while walking.

3 Phoenix

When Romulus in 753 BC physically plowed the boundary of Rome as a rational space divergent from the irrationality of the natural world and the irrational interaction of humans in nature, he created a center that started to exist as a place in the unlimited space. Rome formed as a relation between that boundary, beyond which there was no scenery, no image of belonging, now resumed in what it indirectly marked as a foundational center. Designating the "here" and "there" between chaos and order, he allowed the conflicting tribes of the region to form a unified identity, ceasing battle, and to form the image of their collective belonging as Romans [2]. Now they could prosper in shared regard to the reign of their humanity and their citizenship, transcending the destructive and dividing irrationality of nature. But unlike Rome, Phoenix is a Postmodern city, a plastic entity with many replicated and recreated centers. What is citizenship in the Postmodern state of the western town, built without physical borders? [3] As a borderless city, Phoenix, Arizona developed in the 1960's to the recent present with certain Postmodern ideals about the development of suburban and urban regions and the vast separation that these two designations and a city are permitted with the popular use of motor vehicles. The development of the first stretch of freeway, The Black Canyon Freeway, marked the beginning of Phoenix's absent urban rituals controlled by the car in 1950 [4]. As a black canyon, the freeway is the new moving center as a horizontal infrastructure crossing the borderless landscape (figure 2). It marked the advent of the acceleration of the growth of an environment of absence, where the divide between suburban, living, interior spaces, and public continues to grow [5]. Cities built in this manner contain no center because there are no boundaries, no plowed earth to contain the matter of the city and its sense of citizenship. Individual senses of belonging diminish as a result. Like a cowboy in *Once Upon a Time in the West*, Phoenicians become solitary, writing monologues inside an absent city as they move. They are bipolar, constantly in drift between the deep-interiority of the suburban space and the simulated urban space as connected by the hyper-rational Ford-centric transportation systems.

Figure 2. The Black Canyon Freeway

4 Absence

In an interview with Hans Ulrich Obrist, Rem Koolhaas noted absence as created by the dissolution of borders, as a worldwide movement out of historic city centers, and its significance is a revelation on how absence can be stronger than presence, how entirely missing urban presences can generate *alter* urban conditions:

The Berlin Wall as architecture was for me the first spectacular revelation in architecture of how absence can be stronger than presence. For me, it is not necessarily connected to loss in a metaphysical sense, but more connected to an issue of efficiency, where I think that the great thing about Berlin is that it showed for me how (and this is my own campaign against architecture) entirely missing urban presences or entirely erased architectural entities nevertheless generate what can be called an urban condition. It's no coincidence for example that the center of Shenzen is not a built substance but a conglomeration of golf courses and theme parks basically unbuilt or empty conditions. And that was the beauty of Berlin even ten years ago, that it was the most contemporary and the most avant-garde European city because it had these major vast areas of nothingness [6]. [1]

These alter urban conditions detail a lack of architecture as generative, as creating something which is just as significant as (or perhaps more significant than) architectural presence. As cities move further into urban schemes defined by vast areas of nothingness, deeper into postmodern structures, citizens struggle with the difficulties associated with the lack of identity that these types of spaces create. We all want to belong and to have a sense of identity wherever we exist, naturally, by identifying one another. Driving becomes a performance-oriented city theatre against the presence of people, a personal intensity belonging to European cities. As a Royale de Luxe performance[2], citizens in their cars are the actors of a theater of absence. Their stories as insertions in oblivion can define a border to measure, and short cut, momentarily, the inactivity that continues in many places such as Phoenix where a lack of diverse experiences in the daily lives of people is made common through the necessity of driving. The vast areas of nothingness of deep-interiority and stark urbanity, become the perfect set design as the only part Piranesi depicted of Rome in the *Campus Martius* where cars freely move to stage and dramatize nomadic life performances. In this city, citizens incessantly reinvent amenities by projecting them from the up-above mind's eye, building an imaginary map as a collage of episodes of memories.

Phoenix exists both in reality as the physical space of vast areas of nothingness and in its inhabitants' imagination, filling the nothingness with virtual images. In those images, history is contained not as a memory but as the re-representation of something not representable, something absent and momentary as the "here and now" of viewers. What Phoenicians derive

[1] Rem Koolhaas and Hans Ulrich Obrist discussed the significance of Rem's work. Rem's discussion of absence as the most present makes the subject all the more significant.

[2] Royal de Luxe is a company of artists that perform across the world using massive, urban scale puppets which require 10-30 people to puppeteer. In many of their performances, empty urban spaces are engaged with momentarily and "public" is made through the gathering of people and the engagement of those people with said puppets; they are a sort of machine at a proper scale for engaging urban absence.

in their constant state of imagining in the absence are images of the "hyperreal", the same Baudrillard describes as the present condition of a true reality: the continuation of individual perceptions of reality, *simulacra*, and visible reality distorting and altering one another [7]. Piranesi's views of *Campus Martius* or Hitchcock's representation of Phoenix in the first 10 minutes of the movie Psycho are personal visions to measure absence as the true reality of a place [8]. As the Nolli Map of Rome, they represent not the built world but the void of the image, the state of an inter digestion of presence and absence of a system. Images abstract true portions of an existing system and deliver their message through exaggerations, using a whole sequence of alterations like changes in scale, changes in perspective, and changes of sense and place [9]. Authors of images as ruins move towards something that might not exist in visible reality to uncover something in the invisible. They were never real Rome or Phoenix, but portraits of what authors hope other people will see. In an environment of absence, citizens as authors constantly produce images of the hyperreal. One of these authors, is Alfred Hitchcock as the Piranesi of Phoenix in 1958.

5 Islands

In his movie "Psycho," one year before the death of Frank Lloyd Wright, Alfred Hitchcock portraits Phoenix above midtown section, sun blanched white with drifted up noises muted in their own echoes. In the director's script, there is a description of a camera flying lower, seeking out a specific location of an old hotel with large painted letters advertising "Transients-Low Weekly Rates-Radio in Every Room" (figure 3). In a climate of nefariousness, back-door-ness, dark and shadowy, and secret, before reaching the shower where she will be murdered at the Bates Motel, Marion is seen in four interiors that describe the value of interior life of a transient city: a cheap hotel room where she meets her lover, the office where she works, the bedroom of a modest conventional home she shares with her sister, and the car to get away. Marion is seen in displacement, as Hitchcock is rendering the gaps of absence in between those interiors. In a scene detailing Marion's psychotic ruminations in the car, Hitchcock measures absence; we become involved in a precise perception or imagining of the hyperreal. In between her life's scenes in interiors, the blank space of the desert city of Phoenix is not shown. It is present in the heat, but absent as a distantly separated element. Hitchcock portraits Phoenix as a theater of absence. Its citizens are like Marion, actors involved in a drama of precise perception and of the hyperreal rather than an audience viewing the drama. Hitchcock celebrates an unprecedented Phoenix establishing the city's relationship with psychosis, the presence and absence of its citizens, and their personalities in the first 10 minutes of the movie. "A sun-blanched white" as they approach the downtown section, the character of the city appearing darker and shabbier with age and industry [10]. Phoenix is physically absent much of the time but not its two personalities, the two voices, the two minds, the black and the white of the photography are the one of the city, of Norman, of every citizen. His sequence of interiors of architecture and of the car generates a dialogue between presence and absence. In the film, Phoenix exists only in its disconnected interiors as those four rooms where the life of Marion develops. It is a postmodern theatre of where we experience the fabrication of presence, self-produced in the act of perception in transit between islands of interiors. When nobody is on stage to assume the responsibility of presenting and representing, when nothing is being shown, then the spectator must discover things themselves. How can we exist without human beings around, if the lack of visible dramatic action disperses the place of a center while displacing the subject?

Source: movies.nm-unlimited2.net ; Copyright: movies.nm

Figure 3. Filming the intimate love scene between Marion Crane and Sam Loomis in the interior of the Jefferson Hotel in Downtown Phoenix

6 Measuring

The task of creating citizenship for Phoenix requires the engagement with “nothingness” as a cultural quality, as a sustainable means. Considerations of vast formal absences, reliefs from the assured incredible density of the future’s cities are necessary. By 2050, 66 percent of humanity, 6.4 billion people, are expected to live in urban areas and the square miles of urbanized land is set to triple to more than 1.1 million square miles in the same time span [11].

Prior to the invention of the international metric system in 1799 in Western culture, measuring was largely done through the physical body as an activity of calculating relatively, a way of measuring through folkloric precedents and personal, intimate subjects. The measuring of absence is an act of defining space and culture in the American Southwest. Measuring thusly requires its people to imbue the city with themselves, and their rituals, to measure through non-standardized, anti-contextual ways that negate the necessity to exchange commerce as measuring was standardized to do so [12]. Measuring absence is thus defined similarly, as an act for students to define space through their most personal interior spaces as citizens; an understanding of collective personal experience, the local campus, to measure non-personal public space. In order to make significant absence as a tool on a cultural level, it must be given identity: it must be measureable. Building citizenship, finding belonging in these postmodern spaces requires a different way of measuring to create belonging: an act of defining space through its citizen’s most immediate, intimate, and interior spaces; a movement through the full spectrum of the bipolarity of the “citizen insane”, the local Phoenician, from deep interiority to stark, exposed urbanity.

Measuring is to set forth a development of culture and citizenship for the future. It assures that the types of spaces which define Phoenix, which create an intense psychosis, a bipolarity between interiority and public-self, are utilized in order to maintain and develop according to Phoenix's only unique urban aspect: nothingness.

7 Experiment

To investigate this issue, an experimental studio was formed as a case study. It observed movements of the students in the ASU Campus, Tempe, a stage empty most of the time, a theater of absence par excellence, since it is a *campus*, a field. Involved in a kind of drama of precise perception, the students as spectators of their campus discovered things about themselves and documented them inside the absence. In the void of the absence, with a sequence of assignments, they fabricated their presence, self-produced and self-given in the act of perception.

As a case study, The Experimental Room and The Environmental Design program at Arizona State University chose to examine these absences through the students' measuring of natural and built entities of the ASU Campus in Tempe which define borders and their relationship between absence and presence. The maps show a transient point in between edges of built environment. The void in between places is the space for the ritual, measured by memory where edges of existing buildings as the direct designation of space in between neighborhoods and property ownership, are the signifier of the contact between people within the city. They are an intermedium to unite interiority and disconnection from an urban center. They set up a different state of mind bringing the difference between presence and absence to the space, changing perceptions of reality.

First, they measured themselves as David Hockey would measure the interaction between people and objects through photographic compositions known as 'joiners'. Through these photographic compositions, they detailed the deep-interiority they experience between a close artifact and themselves and the external environment that such an interaction produces as a means for them to measure the difference between presence and absence, generating hyperreal imagery.

They then implemented the same examination across a series of maps of the ASU Tempe Campus, creating simulations of students' lives as contemporary citizens not located in a place (a boundary with a center) but on paths between locations. As The Situationists expanded the map of Paris through their personal and objective understandings of environment into a "what really exists" or hyperreal maps, they performed a *derive* through the campus. These maps became samples of an erratic culture built in movement between islands of an urban archipelago rendering the ASU Campus finally as a borderland, a discontinuous territory of islands communicated through their differences (figure 4). They are a cartography of social data provided by students for a new way of understanding citizenship. They mark the building of circuits and modes of exchange between lifestyles, dreams of

mobile identities going together in the same direction using a special precariousness provided by hyperreal images of present conditions.

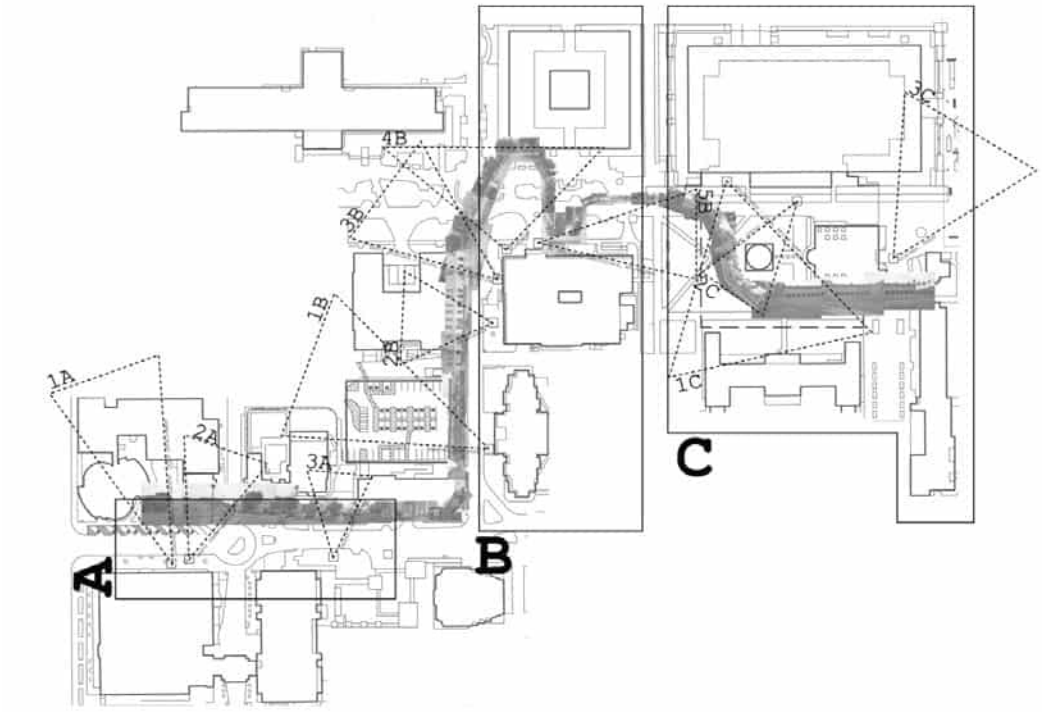

Figure 4. Student map measuring the difference between absence and presence in existing urban conditions.

These exercises produce an understanding of the desire of citizens for the spaces that exist in between destinations and interiors. It describes the nature of the desired path as a border, ultimately becoming designs for how these create specific communities of “citizen designers.” Through these maps, the students then have materials for developing and designing a program education at the university of these “citizen designers”, reimagining the pedagogy of design education and the way designers engage with their public in Phoenix as praxis, through simultaneous engagement with the Phoenix Art Museum.

8 Conclusion

The contemporary situation of hyper-interconnectivity, “The Internet of Things”, teaches us that there is little space which is truly absent, untapped, not interfered or unmonitored by cameras, technologies, and infrastructures which connect an estimated of 8.4 billion objects and 49% of the world’s population [12]. What are we to do with these spaces? Is the emptiness felt by the lack of visible, physical infrastructure enough to negate absence as a tool? Or does absence possess a most contemporary necessity, one which not only deals with the proliferation of images, but also the increased questioning of truth, reality and, through the proliferation of images, the increased significance of the hyperreal, the

increased rate of the inter-digestion and measuring of difference between actual and perceived reality into “precise reality” and the building of increasingly transient identities? In the scenography of our life, urban absence creates a continual invention and discovery of ourselves in an age where absence is inconspicuously filled with the detritus of the interconnectivity of presence, a cacophonous exchange of thoughts and dreams between the Earth’s people, moving toward a singular consciousness. The act of “Measuring Absence” is to establish a development of culture and citizenship for the future. These spaces which create an intense psychosis and bipolarity between deep-interiority and public must be re-examined in order to develop Phoenix in an ethical and sustainable manner. By embracing these real, unpopular urban sensibilities and examining them through the absent-generating phenomena of the hyperreal, the city can finally create a unique culture and sense of citizenship represented in the built environment. In an age of ever-growing presence, absence might be our most significant resource for us to realize precise urban realities in order to build awareness of the individual and ourselves as collective entities and citizens in our built environment.

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ARCHITECTURE OF ATMOSPHERE.

MULTISENSORY EXPERIENCE OF SPACE IN ARCHITECTURAL DESIGN AND ENVIRONMENTAL ARTS

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Abstract

By examining atmosphere in experimental works and the exhibitions of environmental artists, the paper attempts to highlight the potential for developing architectural practice through the concepts of room–size multimedia works and to define the relations between the experience of space in architecture and environmental art. As a starting point, the concept of the atmosphere of space is analysed in regard to the history of phenomenological architectural theories. Spatial situations, environments, experiments and exhibitions are seen as possibilities that allow architects to develop real-scale media works and explore the entire sensory experience of a space. In the paper, various theories formed throughout history are investigated, focussing especially on the current reformulation of architectural thought due to atmospheric interferences. Based on a comparative analysis of architectural practices and the practices of environmental art, the paper aims at theoretically grounding the architecture of atmosphere through a multisensory experience and demonstrating the utility of applying environmental art practices in architectural design.

Keywords

atmosphere, multisensory experience, architectural design, environmental arts, real-scale media works

1 Introduction

The contemporary concept of architecture of atmosphere has become quite up-to-date in theoretical work in the field of architecture as well as in the research of architects in the field of design. In their interviews, the architects offer more and more explanations about the character and atmosphere of the building. A number of theorists and philosophers, on the other hand, refer to the concept of atmosphere as the crucial one when it comes to interpretations of contemporary architecture. The special relation emphasised here is the similarity of architectural atmospheres to the atmosphere in works of installation art.

In 2008 Venice Biennale Manifesto, Aaron Betsky refers to the need to find architecture beyond building [1]. According to Corovic and Blagojevic, besides the issue of the phenomenology basis of the discipline implicated in this topic postulate, Betsky encouraged the participants to reassess the various aspects of architecture in relation to the issues of space perception, atmosphere, ambience, light and climate [2]. Similarly, Ole Fischer analyses the need for the „critical" thinking in architecture in relation to the contemporary research of atmosphere [3]. Fischer states that „new pragmatism" has introduced a new form of reading in architecture through the users' active participation, while dealing with sensory aspects is imposed on the experts (effects, ambience, atmosphere) in addition to the already expected research (based on form, proportion, material, composition, programme and technology) [3]. Akos Moravanszky also reflects critically on the increasing interest and social empathy for immersive artificial environment. This interest is reflected in the popular art installations which attract a huge attention of the visitors. The popularity of these spaces is equally dominant in art as well as in architecture [4]. Atmospheres, or as Suvakovic [5] calls them „spatially-temporal-behavioural events", therefore become the focus where a new relation between architectural and artistic concepts is created.

The relations between the concept of atmosphere and sustainability are very common, this is particularly important considering that both topics are very relevant in current architectural discourse. Moravanszky refers to the fact that the interest for atmosphere within a space cannot be separated from the new relations to environment and the growing awareness about it [4]. The concept of atmosphere itself integrates both of these aspects. Therefore, Moravanszky uses the term techno-pastoral, and remarks it as being obvious in Philippe Rahm's experiments, such as the installation *Digestible Gulf Stream* exhibited at the 2008 Venice Biennale. This installation is both architectural experiment and research at the same time; the factors of climate are understood as both environmental and cultural [4] at the same time. This link is impressed as a logical one; as Gernot Böhme reminds us, the concept of atmosphere itself originated in meteorology as a mark of „environment quality" [6]. As an aesthetic concept, atmosphere is defined through the relation to other concepts as well as the system of aesthetic constellations. The atmosphere is constituted between the subject and the object [6].

In his work called „Spheres", Peter Sloterdijk states that we live within the spheres of meteorology and environment, and that their existence significantly changes the positions of the subjects and objects philosophy deals with. These spheres are not understood as physical spaces alone, but as cultural and social environment [7,8] as well. As Fischer states, Sloterdijk's attitude emphasizes the potential of applying installation art [3] in architecture, especially his statement that Blur Building Pavilion is a „macro-atmospheric installation", and an „immersive climatic sculpture". This type of research implies a completely new relation between the subject and the object, and as such it offers a possibility of interpreting through architectural design.

2 Atmosphere and experience of space

Contemporary determinations of the atmosphere concept are based on the aspects of phenomenology and they require the full potential of human experience. Teresa Brennan opens her work *The Transmission of Affect* with the question whether there is anyone who has not walked into a room and simply „felt the atmosphere" [9]. With this introduction,

Brennan refers to the experience of the architectural space which is close to everyone and each of us has at least once experienced being involved in the space atmosphere, immersed in the space. Juhani Pallasmaa gives one of the most complete definitions of the notion of atmosphere claiming that the atmosphere of space, the environment is shaped through physical interactions with architecture, human body defining the structural qualities of architecture. The character of space or place involves not merely its visual quality as is usually assumed. The judgement of the environmental character is a complex fusion of countless factors, which are immediately and comprehensively grasped as an overall atmosphere, feeling or ambience [10]. The concept of atmosphere of space appeared for the first time in the texts by Hermann Schmitz, a phenomenologist who uses this concept in relation to the theory of perception. Borch names Schmitz and Böhme the pioneering thinkers in the philosophy of atmosphere [11]. Böhme refers to the concept of atmosphere as the colloquial term, but nevertheless he speaks of its usefulness. The problem is often in ambiguities: we speak of tense atmosphere at a meeting, cheerful atmosphere of the day; we refer to the atmosphere in the city, restaurant or landscape. The concept of atmosphere, as Böhme states, always refers to the feeling of space. Böhme thinks that the ambience or atmosphere can be projected as well [6]. Contemporary research by Christian Borch refers to important political and social connotations of the concept of atmosphere [12], which significantly increases its role in modern culture.

A large number of architects and artists also deals with the concept of atmosphere. There is almost no text on the topic of atmosphere without mentioning Olafur Eliasson and his work *The Weather Project* or the spaces by Peter Zumthor. According to Zumthor, immediately on entering a room, in a second we already possess the feelings towards it. Even though the space does not influence us as incentive or affirmatively, we still possess a feeling about it and its properties [13].

Through the theories of phenomenology and hermeneutics in architecture, the issue of atmosphere always instigates the perception issue. Atmosphere constitutes the image of the space, not the space itself. These theories consider the issue of adjustment between the usage (mental and cognitive attitude) and material framework. This is the way to define the relevant concept of the „experience of space“, which is always a multisensory experience. Juhani Pallasmaa states that the multisensory experience of space is not just a series of images but the encounter with the object as well. Atmosphere refers to the sensory properties that the space transfers [13]. Pallasmaa defines the concept of atmosphere through the multisensory experience phenomenon as one of the most important characteristic of the architectural space, and he gives a definition of atmosphere as a comprehensive perceptive, sensory and emotional impression of the environment or social conditions [10].

3 Installation art as an architectural experiment

A new relation between the concepts of art and architecture achieved through the concept of atmosphere is the topic of numerous researches. Juhani Pallasmaa even says it seems that the atmosphere is much more conscious objective in literature, film, theatre or painting than in architecture. The factor that most often unites the whole composition of the painting is a specific light or colouring, much more than its narrative or conceptual content [15].

As stated by Suvakovic, the appearance of environmental art during the 1960s developed the idea of the articulation of the space as a unity [5]. Historical development of the concept of ambience was defined in the theory of art from the appearance of the environmental art

during the 1960s to the modern transformations of this concept into related concepts (as installation art) at the end of the twentieth century. Suvakovic also states that a work of environmental art does not treat space as a passive layer around a work of art, but the space itself is a component and essential part of the work of art. Atmosphere is contained in the continuity of the volume of space [5].

The period of the 1960s in New York became very important for the development of environmental art. Environments denoted art interventions by a group of active artists who thematised the space as a comprehensive work of art in their installations. The concept of environment was used by Allan Kaprow in 1958 in his room-size multimedia works. Kaprow was the first to suggest the definition of environment, further developed by his contemporaries Jim Dine, Claes Oldenburg and Robert Whitman [16]. Nowadays, the concept of „installations" is most widely used in order to determine the site-specific three-dimensional oriented art movement, conceived so that they transform the observer's perception of space. What makes installation art different from sculpture or other traditional art forms is the unique experience of space [17]. The basic characteristic of environmental art and installation art of the modern times is that it actually represents an experiment in time and space, after which it disappears [16].

The idea of application of environmental art in practice of architectural design is based on the contemporary need of a user to be assimilated within space in addition to the basic functional needs and demands of physical comfort. The immersion in the space of a work of art as a separate world, which is a characteristic of environmental practices, is the crucial characteristic of space that is tend to be achieved through the concepts of architectural atmospheres. The works of environmental and installation art increase our awareness of the relations between ourselves and the space, then, the work focuses our attention on the process of perceiving through the size and weight of our bodies. In his essay „Notes on Sculpture 2", Robert Morris says that the size is one of the basic determining factors of works. Large works encourage the act of public interaction, while the small ones emphasize the privacy and intimacy [18]. The minimalistic sculpture is the one that remains between these two extremes, and according to the words of Michael Fried in his famous essay „Art and Objecthood", its humanity enables the work to create the impression of the presence on the stage [19].

In generally, during the twentieth century the artists tried to break the established hierarchy of the observer in a central position and "the world of the painting" that grows in front of him. The concept of environment in the environmental art has been conceived through the active participation of the observer (visitor) from the start. Environment is not observed, a visitor must enter it. Environments are designed having active and rather specific participation of the observer in mind as a part of the complete concept of the work of art [20]. The essence of every work of environmental art is the observer's presence. The type and kind of the visitor's participation differs a lot from one artist to another. In each of these situations the visitor is expected to finish a work of art. A work of art only acquires its full meaning through the interaction with visitors. Trying to reverse the role of the observer from passive to active, Kaprow presented a reflection of a wider cultural change which would expand throughout the 1960s. Passivity would become a negative property (even a threat to the democratic society), and there would be a tendency for partition [16].

James Turrell is often considered a paradigmatic example of an installation artist. Light and space represent both object and purpose in his works. His installations emphasize the phenomenological properties of perception, and rather than pointing to "here and now" they

stop the time and move us away from the real space. [20] This mimetic convergence of the subject and the environment is presented in a suggestive way in Turrell's installation in Stedelijk Museum in Amsterdam in 1976, where he adapted a series of four galleries in the form of one installation called *Arhirit*. The spatial installations with light made such a strong impression on visitors that some of them lost balance and feeling of space, some of them fell on their knees with the feeling that they were lost in the light. Extreme influence of light disabled the visitors to contemplate their perception: the subject and the object were made equal in space which cannot be encompassed by vision [20]. Hill states that Turrell's installations present the famous Le Corbusier's idea that architecture represents the game of forms in the light, stating that Turrell uses the light better than any architect, even Le Corbusier [21].

Nowadays, Olafur Eliasson is among the most influential artists dealing with atmospheres. His definitions of atmosphere are directly related to Pallasmaa and Böhme's definitions. In an interview involving Pallasmaa and Böhme, Eliasson defines atmosphere as spaces which possess mood, emotion, stating that as a very important definition because it emphasizes that emotions do not always have to be inside us, something internal. They can also be outside, they can overcome us. Citing Shmitz, Eliasson calls the atmosphere an entity, a quasi-object [11].

Figure 2. Olafur Eliasson and Günther Vogt, The mediated motion, Installation, Kunsthaus Bregenz, Austria, 2001. (Source: Borch, C. (2014.), Architectural Atmospheres, On the Experience and Politics of Architecture, Birkhäuser: Basel, p 97)

4 Potential for new design model research

In contemporary architecture, the atmosphere becomes a model of thought and design, and establishing relations with art installations additionally increases the range of possible research directions. In its concept and dimension, the installation becomes a medium where architects set, try and confirm new concepts. The installations of meteorological architecture by Philippe Rahm, the famous pavilion The Blur Building by Diller & Scofidio team for 2002 EXPO or Zumthor's proposition for the Swiss pavilion for 2000 EXPO in Hanover are considered

the most famous representatives of this type of research. These architectural researches through experiments with art installations stand for a paradigmatic model for the establishment of new models of design and thinking in architecture.

Experiments with new environmental concepts represent especially fruitful concept for research. Environment becomes especially suitable range for researching these concepts because of the foundations of the concept of atmosphere in meteorology. They are also suitable for the convenience to perceive and conceive the qualities of the environment from two aspects at the same time: technological and perceptive. The projects of Philippe Rahm represent a model of establishing relations between architectural design and installation art through the contemporary sustainability discourse. As Fischer emphasises, the main property of Philipp Rahm's architecture is that it cannot be perceived, but it can be felt [3]. He also emphasises that if architecture wants to be more than a favour for design and planning, and art more than a decoration, they have to be based on the conceptual deliberation, experiments and discourse [3]. This is the way in which Philippe Rahm integrates architectural responses into technical solutions that offer the appropriate type of comfort, thus offering a model of sustainable behaviour. As stated by Rahm, when we are cold or hot, we do not only look for external causes in order to improve our comfort, but we can also search for the physiological causes inside our own bodies [22]. As Rahm states, the experiments-exhibitions such as The New Olduvai Gorges, Digestible Gulf Stream or The Domestic Astronomy show the experiments with architecture which replaces functional and symbolic limitations with the openness in terms of space usage and the possibilities of its interpretations [23]. Through the research of new forms of design and space usage, Rahm encourages the user to new forms and ways of space perception. As Rahm states, his researches are no longer experiments, he has applied his experience acquired through exhibitions in real projects. Therefore, his practice can be divided into the period of research and experiment, and the period of application [24].

Figure 1. Philippe Rahm, Digestible Gulf Stream, Installation view, Venice Biennale 2008. (Source: http://www.philipperahm.com/data/projects/digestiblegulfstream/ [15.11.2015.])

In his researches, Philippe Rahm also refers to Peter Sloterdijk and Bruno Latour's work, where they state that man is no longer in front of an object, but is always included in it. It means that when you look at the wall coloured in white, you may see it because it is in front of you, but in reality the colour evaporates into the air. Therefore, you are within a kind of specific contamination by colour, breathing that air which is inside your body. There is an interaction between a body and a wall so we do not perceive them as separate entities. More precisely,

it means that we are within a wall. Hence, the world is no longer perceived as an object outside of us, but as completely related to us [24].

Figure 3. Philippe Rahm, Domestic astronomy, Instalation view, Louisiana Museum, 2009. (Source: http://www.philipperahm.com/data/projects/domesticastronomy/ [15.11.2015.])

5 Conclusion

The aim of this paper is to attract attention to the field of encounter and exchange between these two related disciplines which can continuously improve the responses of design practices to behavior patterns in contemporary culture. The field of encounter and exchange represents the field of research for the architecture of atmosphere. A new relation between the subject and the object enabled by the research of atmosphere along with other scientific research, that is, the process of immersion into the environment that is not dominantly visual but devoted to all the senses, represents the crucial change in the way of thinking which has opened the possibilities for the formation of new concepts in architecture. Growing awareness about the attitude towards environment has set a double task before architecture, to examine the dual character of the space included in a specific atmosphere through the design procedures: its sustainability character and perceptive quality of the space.

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INVESTIGATING THE EFFECT OF ARCHITECTURAL FORM ON THE STRUCTURAL RESPONSE OF LATERAL LOADS ON DIAGRID STRUCTURES IN TALL BUILDINGS

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Abstract

The inconsistencies between structure and architectural form of buildings are a usual cause of construction problems and added extra costs to construction projects, and designers are often interested in understanding the effects of the architectural form of a building on its structural responses. In this research, by means of the parametric modeling strategy, the interrelationships between the architectural form and the structural response of approximate 60 story tall buildings with diagonal grid (DiaGrid) structures are investigated. Various geometries and dimensions of the lower and top floor plans and the method of form generation which determine the ascending development of the building from base to top resulted in 49 architectural schematic forms. The Diagonal Grid (DiaGrid) members of identical steel tubular section as the structure of the tall buildings are later mapped on the generated architectural forms. Lateral loads, representing the equivalent static actions, are then applied to the structure and a static linear analysis is made. Eventually, results illuminate the structural behavior of initial models mostly depend on the base floor plan rather than other parameters and the architectural models in which the base floor plan has more side count approximately has better structural efficiency. This research can help architects in form generation phase in order that tall building experience better response to lateral loads and economically feasible structure are attained.

Keywords

Tall buildings; Parametric Modelling; Architectural Form Generation; Diagrid Structures; Structure Analysis.

1 Introduction

This research proposes a parametric based workflow that generates Schematic architectural form and structure of tall buildings and evaluates its structural efficiency. In this section a brief introduction to research basics will be present:

The word parametric means all design definitions such as dimension and topology of form and structure can be varied at any time in the design process. Also, computation design has provided researchers with the ability to generate complex models of form and structure where routine structural modeling methods are equipped to meet the complexity and speed requirements. Many changes can be applied to the complete model of a high rise in a glance and parameters which define architectural and structural part of the model are flexible to changes [1].

Tall buildings are great architectural phenomena and necessitate enormous resources with heavy costs due to their large scale. As they become more complicated, it is essential to find compatible configurations in structure. Furthermore, the architectural characteristics should be studied to approach efficient structure [2]. The cost of structure constitutes up to 30% of total construction cost of buildings. Therefore structural consideration should be addressed in the very early stages of design [3].

Moreover, the schematic design phase is the most important stage of design because 80% of resources required to build a structure are committed by decisions made during the conceptual design phase. so this early phase of design is the most crucial part of the entire process [4].

During the modern era, the development of tall building was the product of a great collaboration of architect and structural engineer. This trend disappears gradually and as a result, the structural efficiency of tall buildings has decreased [3]. In the context of current tall building design practice, structural concerns are generally are dealt with not until the architectural form is well established. This approach limits the structural process solely to solving the problem rather than integrating the structural solution into the architectural concept. While merely makes the eruption of a building possible, it will not result in economically sane solutions that “perform fully in the conceptual, formal, technical, financial and material sense,” particularly with reference to structure [5].

2 Proposed design workflow

The geometry and shape of a tall building have fundamental effects on its structural behavior. Many Architects are interested in complicated forms and they want to create fascinating buildings during the design phase, but structural considerations cause limitations for architects in tall buildings. When engineers design structures for these forms, they are faced with numerous problems and extreme costs are added to project construction budget if the design team does not attend enough to structural considerations. In addition to architectural aesthetics, plenty of technical consideration must be applied in the design of tall buildings. This paper focuses on structural considerations to figure out which architectural shapes have better structural responses to lateral loads. A workflow by parametric modeling (with Grasshopper- a parametric plug-in for Rhinoceros) in which architectural forms are generated intelligently will be followed. The structure is mapped on the generated forms and lateral loads are then applied. The static equivalent seismic load is applied to the structure representing the effect of the earthquake. With following steps, the structure is analyzed by Karamba (a parametric structure analysis add-on for Grasshopper). For the sake of comparison, the functional properties of the buildings, such as; total gross area, building substruction, total structural weight, the structural system used and etc. are

remained unchanged. The final results are architectural forms subject to comparison based on their structure behavior to determine their structural efficiency.

3 Architectural form generation

It is important to make a framework by which various variations of forms can be generated. Geometrically primitive forms are focused on at the current phase of research, which later develop into more complex geometrical solutions. The Form generation process is based on the geometry of the base plan and top floor plan and the ascending scheme which connects the top floor plan to the base floor and determines the overall shape of the building. Various geometry and dimensions of the lower and top floor plans and the method of form generation which determine the ascending development of the building from base to top which defined in the parametric environment (Grasshopper) resulted in 49 architectural forms.

3.1 Geometry plans

With the intention of applicability to actual building designs, various functional factors are noticed in geometry plans, such as a vertical core with a constant prismatic shape within the building for vertical transportation within the building and building services. Studied tall buildings are about 60 stories and the core dimension is about 130 square meters on each floor from base to top. This core dimension was studied in standards and regulations according to approximate dimension for vertical transportation, efficient functional area for every floor level, mechanical equipment, ducts and emergency staircases. Another determinant factor is light penetration depth. In addition, the floor to floor height is 4 meters. Geometry plans include a top plan and base floor plan. Recommended dimension for the base floor plan is about 2025 square meters and 500 square meters for top plan. Therefore due to area proportion of base floor plan to top plan, (4:1), all architectural forms which focused in this paper are tapered and the other area proportion will be focused later. It is very important that all generated shapes have a same total gross area which is approximately 70000 square meters. These parameters were designated by authors' overview.

As shown in figure (1), simple polygons from triangle to hexagon and 24-sided polygon with the mentioned dimensions for the core, top floor plan, and base plan were generated. Moreover with considering that all of these 7 polygons for top and base, 49 architectural models were made as shown in figure 2. The ascending methods for form generation are straight section morph explained in next section.

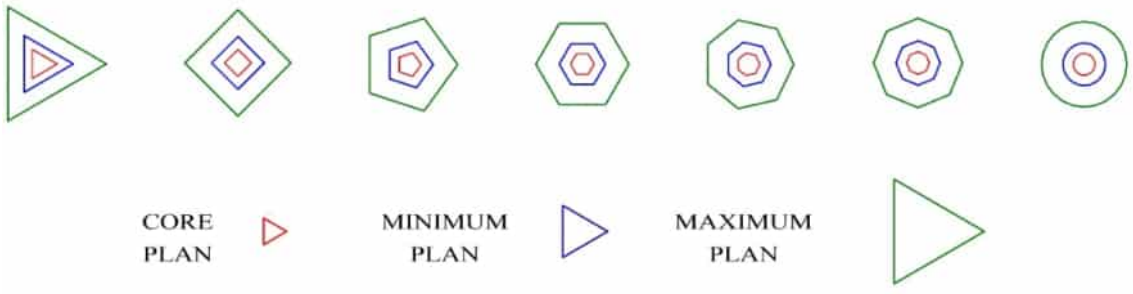

Figure1. The 7 polygons which used for form generation

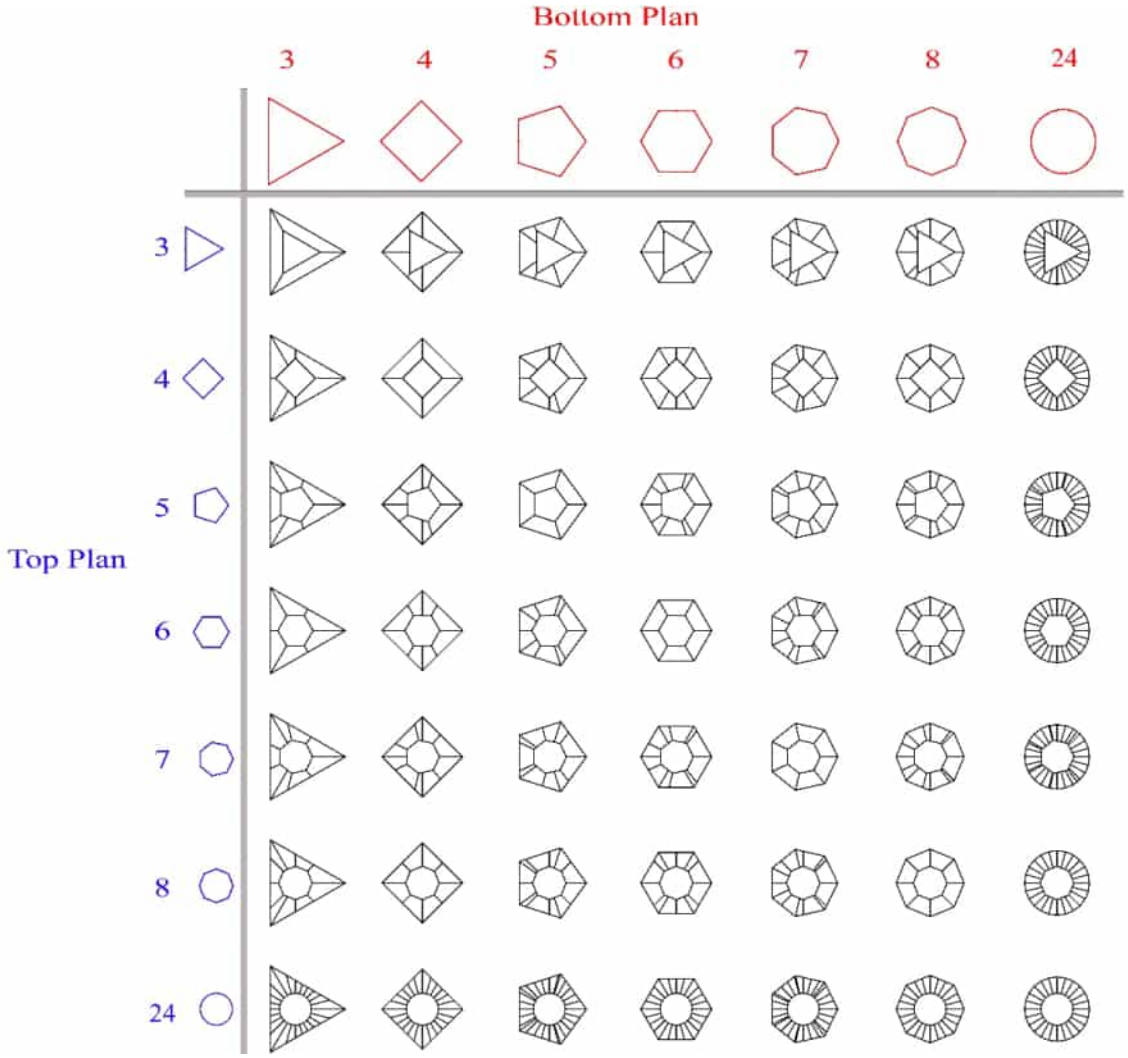

Figure2. The top and base floor plan in form generation phase.

3.2 Ascending scheme

According to previous research 4 vertical transformations from base to top for tall buildings are introduced: Straight Section Morph, Curvilinear, Twist, and Setback [6]. Three of which are under study within this research and the first method (Morph) was used in this paper.

Straight section Morph: in this method for every corner of the polygonal geometries of the top and base floor a corresponding point assigned in the other which are connected directly with straight lines. A maximum second-order surface (most cases a planar surface), sheets the space in-between the resulting straight lines. The union of all these generated surfaces that have a common line with their adjacent ones creates the envelope in which define the form of the building and its structure.

Twisted form: In the twist method the generated forms from the straight section morph method are twisted proportionally from base to top around the vertical axis connecting the centroids of the top and base floor.

Curvilinear form: In this method, the corner points of the base and top floor are no more connected with straight lines but by a curve with a nonlinear form that can be generated with different mathematical functions and resulting in concave or convex forms.

The initial height for all models is assumed to be 300 meters, but in order to maintain identical functional properties, corrections are made to the total height of every sample which is described in the following.

3.3 Height correction algorithm

As mentioned earlier all models should have the same total gross area, therefore after form generation, a correcting algorithm was used for the regeneration of forms. The heights of the models which exceed the total gross area (70000 square meters) were reduced and vice versa. Finally, 49 architectural forms generated as figure 3.

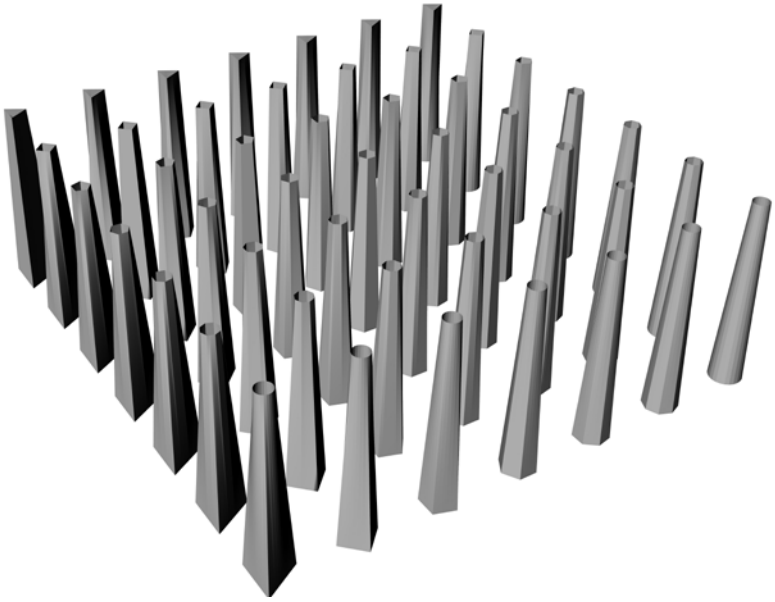

Figure 3. Generated Architectural models after height correction algorithm

4 Structure mapping

As specified, DiaGrid structure system will be used as the main structural system for all samples. the optimum angle of DiaGrid members depends on the height-to-with aspect ratio of building and for taller buildings steeper angle is optimum and vice versa [2]. “The optimal uniform angle ranges from 60 to 70 degree with the height-to-with aspect ratios ranging from about 4 to 10”[7].

The result of architectural form generation process is the peripheral surface of the building. Further on, a structure should be added on to it. A structure of Diagonal Grid (DiaGrid) members is mapped on it with variations over the height and width of every module. The height of DiaGrid modules defined by the count of floors it covers which is assumed 2 floors height. The width of DiaGrid modules is defined by the number of the nodes assigned to the borders of the floor plan at each story level. These parameters are specified in structure generating phase, and for the purpose of comparison are considered fixed for different

shapes. Also, the rigidity of structure should be similar in all architectural model so they could be comparable, so the node counts of DiaGrid should be in a specific range. Since the DiaGrid nodes should be placed on the corner of architectural forms, it is dependent on the number of vertices of the base and top floor plans (in each form the plan in which has more vertices). So a range in which the count of vertices should be divisible should be assumed. Therefore a range of 22 to 30 was considered, so the number of vertices for of all forms could be divisible in at least one number in this range. The count nodes of DiaGrid are listed below in table 1.

Table1. The diagrid count nodes of architectural forms

Model No.	Diagrid nodes	Model No.	Diagrid nodes	Model No.	Diagrid nodes	Model No.	Diagrid nodes	Model No.	Diagrid nodes
1	24	11	24	21	28	31	22	41	24
2	24	12	30	22	24	32	24	42	24
3	28	13	24	23	24	33	28	43	24
4	24	14	24	24	30	34	28	44	24
5	27	15	28	25	24	35	30	45	28
6	30	16	24	26	24	36	30	46	24
7	24	17	25	27	24	37	24	47	30
8	24	18	30	28	24	38	24	48	24
9	24	19	22	29	27	39	24	49	24
10	24	20	24	30	30	40	28		

Furthermore, vertical structural members with no effect on the lateral response of the building are added just to avoid huge unsupported floor slabs. The mapping of the structure is performed with identical tubular members while keeping the total weight of the structure of the building constant.

5 Structural loading

Lateral loads, representing the equivalent static actions, are applied to the structure and a static linear analysis is made. The simplified approximate loads are studied in the initial phase of the research. Statically Equivalent Avenue for determining lateral loads is applied in the following manner. The equivalent loads are distributed on the floor slabs. In this research, a statically equivalent load of seismic was focused and all models which pass through architectural and structural phases were analyzed with same loads.

5.1 calculating Seismic response base shear coefficient

The base shear force was computed by presented equation (1) and (2), which is then distributed on floor slabs based on equation (3).

$$C = \frac{A \times B \times I}{R_u} \quad (1)$$

Where: C is the seismic response coefficient, A is the base considered acceleration, B the reflection factor of the structural behavior of the building, I the importance of building and R_u the response factor of the building. Based on the Iranian National design code for earthquake loads [8] the value of seismic response coefficient for all samples is considered equal to 0.055.

5.2 Earthquake equivalent base shear

In this section, the total earthquake equivalent shear force is calculated according to equation (2) [8].

$$V = C \times W \quad (2)$$

The total weight of all models are approximately similar because all of them has same "total gross area" and the heavier part of buildings are the weight of floor slabs. The total approximate weight which concludes the floor slabs weight and the external structure assumed 44370Ton, therefore the total earthquake equivalent shear load due to equation (2) calculated 24403.5 KN.

5.3 The distribution of resulted earthquake shear force on floors

in the final step of the structure loading, the distribution of resulted earthquake shear force must apply to the structures following equation (4) which suggest that each floor slab gain load base on its weight and the height from the base level. [8]

$$F_i = \frac{W_i \times h_i^k}{\sum_{j=1}^{n} W_i \times h_j^k} \times V \quad (3)$$

"F_i": the earthquake force of the ith floor "w_i": the weight of the ith floor, "h_i": the height of the ith floor, "V": the total earthquake shear forces which calculated according to equation (3).

The structural model of the tall building categorized into 3 parts: The DiaGrid, the floor slabs, and the core. The core just bears the dead load and it has nonrigid connections to floor slabs. It does not contribute to lateral loads bearing capacity of the building. The DiaGrid structure is modeled as complex of beams with pinned joints and all nodes located in floor slabs level. Two steel tube sections were assigned for members of DiaGrid: a tubular section with 80 cm diameter and 2 cm thickness and another section with 60 cm diameter and 1.5 cm thickness.

6 Analysis results and comparison

In this section, structure analysis is performed by Karamba (a parametric structure analysis add-on for Grasshopper) and structural responses of 49 architectural forms are compared according to parameters such as overall Drift, the total mass of the structure, Total structure member count, and the Maximum Utilization ratio of elements in each model.

6.1 Drift and Total Mass

It is observed that forms that are located on secondary diagonals of architectural forms matrix (7 by 7 forms matrix) have similar structural behavior. For example, in the 6th diagonal line (figure 4-a), all forms have low drift and the forms that have the lowest drift are located on the 11th matrix Diagonal. The first form and the last form of second part of diagonals (8th-13th diagonal) have similar behaviors with respect to structural stiffness, e.g. 35th forms and 47th forms; the first one is defined by a 24-sided polygon in base floor plan

and a 7-sided polygon in top plan and the other vice versa. The Total mass Diagram (figure 4-b), as Drift diagram, state that with more sides constituting the geometry, there would be higher total mass and therefore, heavier forms have fewer drifts. Forms presented in this paper, fluctuations of base floor plans are higher than top plans due to the tapering effect of them.

6.2 Simple forms

In this category, top and base floor plans are constituted of same polygons including numbers1, 9, 17, 25, 33, 41 and 49 in figure 4. Due to miscellaneous geometric features, these forms need to be divided into two different categories: Forms with even and odd sides. The difference in side numbers which directly affects their stiffness toward lateral loads is shown in Figure 5. Forms with 3, 4 and 5 sides are loaded within a single vector-green vector (the vector crossing the center and one of the sides – as all the polygons are symmetrical, then there is no difference for the crossed side to be selected). This vector addresses the centers and so as the floor plans perform as structural diaphragms, automatically distribute the load to corners (red vectors). In 4 sided polygon, this vector crosses the axis of two sides, however, it crosses one side in the 3-sided polygon. Moreover, this vector crosses two sides of a 6-sided polygon which is aligned with other 4 sides. Consequently, the stiffness of these forms is different with each other and for an appropriate evaluation, this classification is obligatory. According to figure 4, there is approximately less drift for those with a higher number of sides.

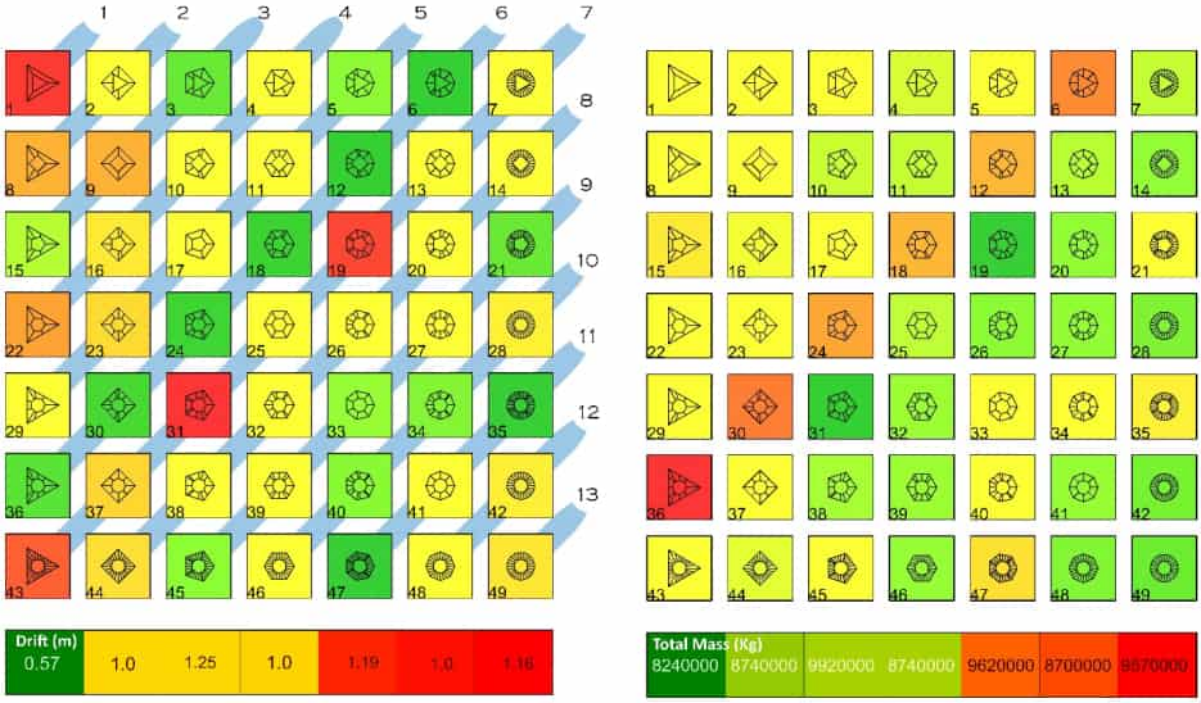

Figure 4. (a)Overall Drift and (b) the total mass of the structure

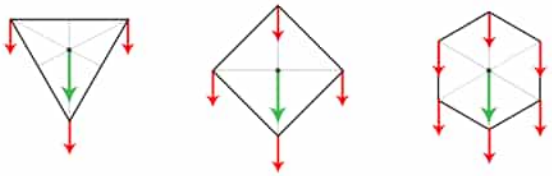

Figure 5. The effect of geometry on the load bearing resistance on same loading vector

As shown in table 2, for those forms with an odd number of sides, from 7 to 3 sided polygons, there is 42% drift reduction and 2% reduction in total mass. Additionally, for those forms with an even number of sides, from 8 to 4 sided polygons, there is 8.5% drift reduction and 3.5% reduction in total mass.

Table 2.Drift and the total mass of forms in which the top and base floor plan are same

odd-sided polygon	Drift	total mass	even-sided polygon	Drift	total mass
3	1.213033	9372100	4	1.098634	8868400
5	0.943904	8856000	6	1.019957	8626500
7	0.701374	9207700	8	1.004548	8556500

6.3 The total amount of the structure members

In the diagram of figure 6, the relative values (the amount of each parameter over its mean in all cases) of Drift, Total Mass the total amount of Diagrid members are shown for each form. Generally speaking, there is much Total Mass and fewer drifts for geometries with a higher number of sides due to higher structural stiffness. As mentioned in section 4 (Structure mapping), total diagrid nodes are defined by a number of polygons' corners in plan and this may restrict the overall structure configuration and because of differences in diagrid nodes (based on table 1), there are differences in structural stiffness. As shown in the diagram of figure 6, this difference in total amount of the structure members, obviously had effects on the total weight as well as structural drifts.

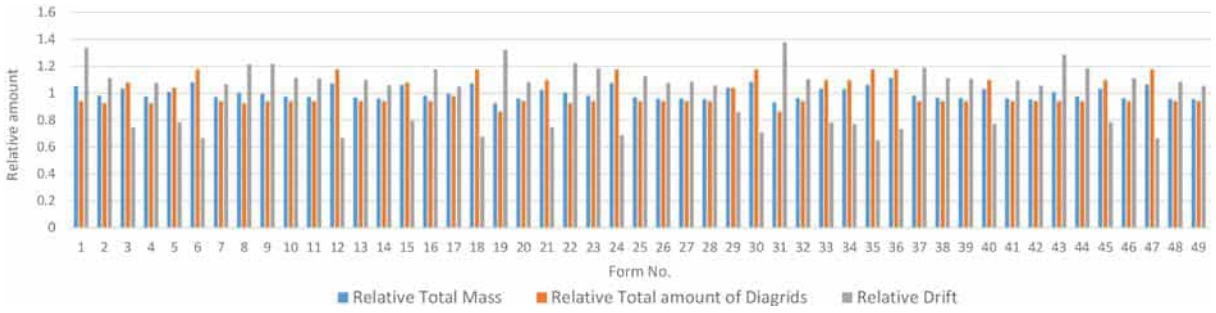

Figure 6. Relative Drift, relative Total Mass and relative Total count of Diagrids members

6.4 Maximum Utilization Ratio

As seen in figure 7, 49 architectural forms are categorized into 7 groups of the matrix rows, which represent the variations in the base floor plan. The left side (7-a) shows lower values of maximum utilization ratio (resulting force in the structural member divided by its load bearing capacity) in all structure members of a model for each group. In right side (7-b), the result of utilization ratio multiplied by the total weight of each category is shown with a specific color. This parameter also illustrates the structural behavior. There is a general trend line for each category in this dialog. This time, the 7 by 7 forms matrix is categorized with columns. Each ellipse demonstrates one category. The number below each ellipse shows the polygon, constituted them. As mentioned in simple forms section, for an appropriate evaluation, forms need to be classified into two different groups. For polygons with even sides and odd sides, blue and red colors are specified respectively. Based on this theory,

forms constituted of same polygons showed similar structural behaviors. With changes in side numbers of floor plans, from odd to even, there seem to find a fluctuation which stabilizes this statement. In respect of the dialog, with an increase in side numbers of base floor plans, the result of utilization ratio multiplied by total mass, decreased which shows a better structural behavior.

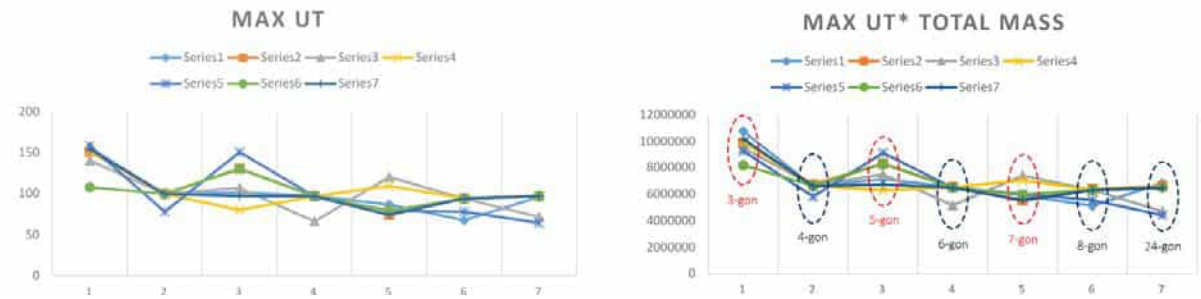

Figure 7. (a) Max Utilization and (b) the multiplication Max Utilization by Total Mass

7 Conclusion

The structural efficiency of architectural forms is investigated by means of design parameters in this paper. Based on various parameters such as top and base floor plan and an ascending method for vertical transformation, and according to supposed planning specification (total gross area, top and base floor plan area, number of floor plans), architectural forms were generated. Due to supposed areas of the base floor and top plans, generated forms became tapered. A diagonal grid (DiaGrid) of steel tubular sections mapped on it and the equivalent statically seismic load applied on. A comparison between the generated forms base on factors which represent the structural efficiency as overall Drift, the total mass of the structure, Total amount of structure members, and Maximum Utilization of elements in each model. The effect of the base floor plan resulted as the most important factor in the structural efficiency of these architectural forms. Also, it was figured out that the structural behavior of architectural forms depends on its base floor plan polygon side numbers. Therefore, architectural forms should categorize into two groups: even-side polygons and odd-side polygons. In both categories when the polygons side numbers of base floor plan increased, the structural efficiency generally improved.

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ARCHITECTURAL AUTOMATIONS – A UTOPIAN PROJECT

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"Once adopted into the production process of capital, the means of labour passes through different metamorphoses, whose culmination is the… automatic system of machinery… set in motion by an automaton, a moving power that moves itself; this automaton consisting of numerous mechanical and intellectual organs, so that the workers themselves are cast merely as its conscious linkages."

Karl Marx, The Fragment on Machines, 1857

Automation and a World without Work

How can the architectural discipline engage in a conversation about automation in our contemporary world? In the last decade, the conversation on automation and robots in architecture has been primarily dominated by a discussion about the capabilities of the tool to facilitate procedures or to create novel formal vocabularies. Conferences on robots and automation in architecture profoundly focus on the technological achievements, and the many variations of material formations that can be accomplished using a robotic setup. From stacking exotic figurations of bricks to fiber winding panels inspired by biological phenomena to the meticulous and precise forming of metal sheets with robots, the research essentially focusses on the technological agencies. These predominantly technical conversations just rarely touched on the larger issues at hand, as to how automation might change aspects of ***cultural, social and political discourse***.

The paper *Architectural Automations* presents itself as an opportunity for the critical interrogation of the role of robots in a future world of building, including the conversations on the impact as a cultural technique advocating the production of an architectural utopia.

Contemporary Automation Tendencies

The main aim of this paper is the critical interrogation of the predominant modes of thinking about automation in the architecture discipline. If a thesis needs to be presented in these first sentences, it would entail the suspicion towards a unidirectional lineage of thinking about the possible futures of robots in a building environment. The currently most common modes of thinking about robots in architecture propose a myriad of sophisticated methods for the manipulation of matter in space. There is nothing inherently wrong with the desire to explore and exploit a novel tool, investigate its potentialities and possibly exploit it to gain an advantage either morphologically or in terms of performativity; the authors of this paper however would like to present an alternative trajectory of thinking about robots and automation at large. *Architectural Automations* describes how the tendency to implement automated systems in the production of material conditions communicates with Materialist Philosophies and the Accelerationist wave. The question is not anymore *How are we going to use robots in the construction of buildings* but rather how this transformative moment will impact the building industry as part of an economic and social system.
Current statistics[1] talk in a very specific language about this transformation: By the year 2030 eight hundred million jobs will be replaced by automated processes worldwide, 75 Million of which in the United States alone. Of course, not all of these jobs will just vanish in thin air. Jobs tend to shift, and as usual new technologies bring new species of jobs on to the global employment market.

The question remains: what happens, if we start to think in nontraditional ways about jobs, economy, profit and capital? What happens if we abandon the current catechisms of capital and pursuit novel methods of remuneration? This of course are the larger questions implicated in this paper; however, the focus of this paper is on the impact in the architecture industry. For this, the authors would like to propose, in terms of discoursive examination, the launching pad of Materialism as a method of interrogation closely knitted to the core of architectural considerations.
Materialism as a branch of Philosophy proposes that all things and processes are defined by material interaction – as matter is the foundational substance in nature- and as such include the areas of consciousness and intellectual reflection. The trajectory of this paper includes the areas of considerations by two thinkers who were profoundly influenced by Materialism: Karl Marx and Gottfried Semper. Whilst the former is famous as a progressive economic thinker, the later obsessively examined the emergence of form in architecture based on the agencies of matter.

Materialism per se is not an invention of the 19th century, as for example Hegel already discussed the aspects of Dialectic Materialism.

Much more interesting is how considerations of Materialism fit into the current conversation of Automation, a world without work, and a renewed interest into the Utopian Project. It has been certainly a while, since the Architecture discipline has engaged in a positive Utopian Project. Archigram, Superstudio and other heroes from the 1960ies certainly were interested to introduce a Utopian vision based on the technological project, at the same time their project was profoundly naïve and ignored for the most part the realities of market situations and the mundanities of dealing with a profoundly conservative construction industry. The times however, they are changing. Even the most conservative construction company these days has heard of the advent of the Industry 4.0, has heard of the software tests, robotic experiments and proof of concepts executed successfully in academia in an ever increasing speed[2].

The authors of this paper have been involved in the application of robotic fabrication methods for the design and construction of architecture since 2005 and have contributed to the field on a regular basis. It is time, to critically interrogate the result of more than a decade of work in the field. Instead of describing, one more exciting method to assemble material in space, this paper primarily examines the current tendencies towards automation not through the lens of morphological or technical achievement but rather asks for the relationship of the overarching, global project on automation in architecture and the political and social realities that this project will produce.

The Accelerationist Project

Accelerationism is a tendency in social and political science with the capacity to formulate a scenario for our current situation, but especially for the things to come in the next decade, as we experience how automation starts to change the world dramatically. It describes an observation of the world and its current tendencies as characterized by capitalism and techno-social processes and proposes the expansion, repurposing and rapid acceleration in order to provoke radical social change. Positioned within the tradition of Gilles Deleuze and Felix Guattari, Accelerationism occupies the conversation on deterritorialisation, so profoundly discussed in Deleuze and Guattari, and aims to radicalize the dynamism of deterritorialisation. The aim is to critically interrogate and finally overcome tendencies of territorialisation (as a typical technique

applied for example by large corporations swallowing smaller economic agents) and foster social transformation.
Nick Srnicek and Alex Williams's proposal[3] in terms of operating the world include the demand for full automation, universal basic income and the future at large. Some parts of their analysis is profoundly informed, such as their description of the rise of neoliberalism, however, their insights into automation appear rather limited. What starts as a broad stroke with a brush can be developed into a delicate painting by combining some of the controversial social and economic ideas presented by Srnicek and Williams, with the current research on automation executed in academia (ICD, ETH, Michigan, RMIT etc), and in increasing amount also by the building industry themselves (Winsun etc).

The Return of the Ornament

One of Adolf Loos's trademark criticism was targeting ornamentation. In his Streitschrift *Ornament and Crime,* first presented as a lecture in the Sophiensaele in Vienna Austria 1910, Loos fiercely condemned ornament as a waste of lifetime. Describing how carpenters spent hours and days in embellishing and carving wooden ornaments in beams, doorways and window frames. Le Corbusier labeled this defining moment of the modern movement as a *Homeric Cleansing*[4]. Albeit this condemnation the career of the ornament is not over. The authors of this paper propose a renewed interest into ornamentation. Per se, nothing new as entire books have been dedicated to the novel opportunities for ornamentation in a contemporary, computationally driven architecture environment[5]. Various aspects have been explored, such as the potentialities of ornament as structure, or ornament as agent of culture. Since Adolf Loos's days, however, ornament was never considered as inherent part of the economies of construction and its ability to generate work.
Considering the 800 Million Jobs that will migrate to automation a new relation between robot, ornament and work can be the subject on speculations on automation and architecture. One of the most successful models in new economies of making is the robot human collaboration[6]. Taking cues from Nick Srnicek and Alex Williams the authors propose a future ecology of work, which operates on remuneration based on UBI (Universal Basic Income). This approach allows for an independent involvement in work per se, and simultaneously the creation of work ecologies in which robots, humans and AI's create a novel architecture positioned between ornamentation, materialist considerations and cultural agencies.

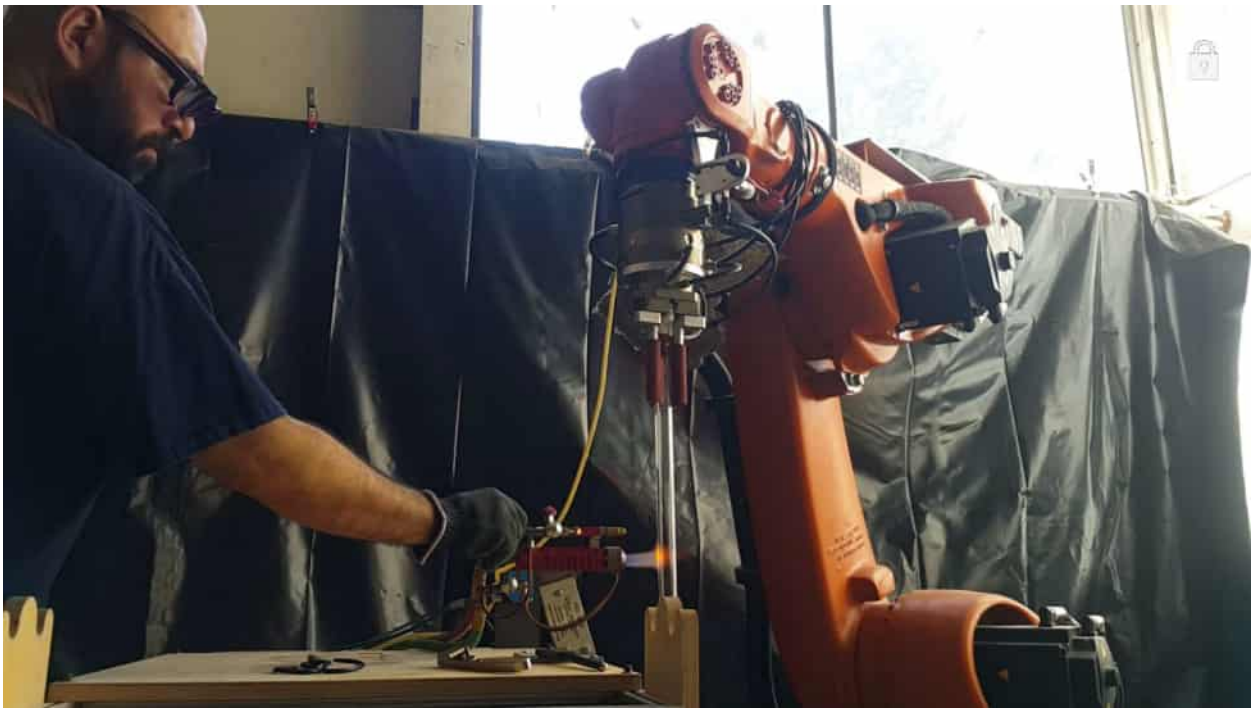

Fig.1: Robot Human Collaboration -

1: McKinsey Global Institute Report December 2017

2: See the work done in Institutions such as the ICD in Stuttgart, DFAB at ETH Zurich, Taubman College at the University of Michigan or RMIT in Melbourne, Australia.

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KITSCH AS A PHENOMENON IN ARCHITECTURE OF CONTEMPORARY HOTELS

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Abstract

Commercialization and favouring tastes of clients, is a strong feature of contemporary hotels' architectural design. Due to an increasing commercialization in hospitality services, networks and individual businesses, race each other to attract as many guests as possible. Thus, hotels are constantly renewed and their offer is updated. Even, in a relatively small edifices, there is a tendency to add multifunctional zones, i.e.: cafes, Day SPA, gyms, casinos, conference rooms, event venues and so on. Such areas, together with halls and corridors, are receiving very vivid and attention captivating design, which should please and surprise varied public.

Thus, the unlimited number of forms and inspirations, like: palaces and castles, tropical jungles, movies, pirate ships or ancient baths, are in many cases placed together in one building. They form an environment that should bring happiness and sense of endless fun to the guests. However, at many occasions, it does not strengthen positive impressions, but frightens users with cheap and random forms. Moreover, manufactured from poor materials and simplified to prosthesis of initial inspiration, they become architectural caricatures. In this process kitsch appears as odd phenomenon, strongly present in hotels' solutions. This article was devoted to presentation of studies on this issue, carried on both literature and selected cases. The conclusions aim at showing possible solutions in order to avoid this negative phenomenon in the future hotel implementations.

Keywords

contemporary hotel design, aesthetics in design, architecture of hotels, kitsch in architecture, kitsch in hotel design

Introduction

Each travel business or touristic for single individuals connects with gathering new experiences and immersion in alien town, cities, architecture and urban structure. Hotels are important element of this journey and as such, are designed in a method to provide interesting and unforgettable moments within overall visitation. Their architecture and interior solutions

– so called physical factors, together with functions – referred as organizational elements, are crucial to proper guest reception in particular establishment. [2], [6]

This article is focused on the first group of mentioned physical factors, which can be designed in three different ways. First method, assumes recreation of home character in the hotel and bases on simulation of spatial functionality in traditional household: dining and sitting rooms, libraries, parlours and bedroom areas. Second, can usually be found in budget accommodation objects, and offers typical hotel plan with traditionally set zones: entrance, reception, restaurant, lobby and guest rooms. And at last, third, which is focused on providing visitors unusual impressions, illusion of immersion in novel worlds and full escape-from-reality experience. [9] In this form rarely there can be extracted typical zones divisions, and public areas have more of a shared space character, without traditional building compartments.

The main issue of this article will be focused on third collection of elaborated solutions, thus they are closely connected to the problem of kitsch in contemporary hotels. Here, this phenomenon is usually an outcome of exaggerated pursuit for uncommonness in architecture. However, there will also be noted examples of standard hotels' design methods from first and second group. There, on the other hand, tasteless solutions appear by mass repetition of selected architectural styles or trends, copied and multiplied with the use of cheap materials and technology of low quality.

1 Aim and method

1.1 Aim

First aim of this article, is to turn attention of scientists and professionals, who are working within the hospitality branch design, towards the problem of kitsch in contemporary hotels' architecture. This issue becomes really severe, by polluting our public spaces with aggressive: forms, colours, textures, advertisements, lights and noise. They are constantly becoming more and more dangerous to physical and psychological health of human beings.

Secondly, authors interest was to show causes and effects of aforementioned phenomenon occurrence, in order to formulate guidelines for gradual elimination of these adversative impacts from the hotels' built environment. And by such, to humanize this space methodically creating user friendly and safe places, without loss of their commercial and competitive character.

1.2 Method

Research consisted of two crucial parts. First, there were case studies during which it was stated, that kitsch is repetitive phenomenon in contemporary hotels. In comparison to other buildings of public use, like: offices, administration, banks, theatres, concert halls, cinemas or even shopping centres etc., the occurrence of tasteless solutions in a hospitality business could be stated as more frequent. For this part of studies over 100 of buildings in Europe and USA were considered. Into account there were taken: external forms, facades and interior architectural solutions, with focus on materials, colours and textures. With the use of conclusion form this part of study, main elements of kitsch in hotels could be distinguished and described.

Thus, second part of research was carried out and it consisted of broad literature review, aiming on the essence of the kitsch phenomenon and possible reasons for the popularity of tacky solutions in the hotel industry. In this part there were used: critical analysis, comparative studies and synthesis – latter for conclusion formulation. Deliberately for article purpose, primary there were presented definitions and conditions of phenomenon occurrence, and then short review of case studies was mentioned. Elaboration, is closed by the authors' conclusions, which hopefully will contribute to improvement of contemporary hotels' architectural and interior design. This research were limited to European and American contemporary projects, due to similar cultural and tradition background. [8]

2 Discussion

2.1 Definitions

Notion kitsch was firstly used in 60. or 70. of XIX century, in Munich, to describe sloppy work, objects of low value and unfair trade. Originally word was written as (germ.) *Kitschen* and *Verkitschen*. Literature sources show also that in Germany and England there were terms like (germ.) *die Skizze* and (en.) *sketch*, meaning unfinished underline for painting, so something that should not be presented to the wide public. [1], [7]

For the purpose of this study, authors define architectural kitsch in contemporary hotels as non-functional and random design solutions, neglecting context of the building; its' cultural, aesthetical and regional or local value. Moreover, it is added that form and substance of the edifice is chaotic, varied without clear purpose, has aggressive features of an alien or odd: shapes, composition, colours or textures; that negatively dominate build or natural surroundings. Alike is treated noise or artificial forceful light influence of exteriors or interiors to the human and animals, that are in or near the building. [Fig. 1]

Figure 1. Kitsch in architecture of hotels: number of styles, forms and advertisements, in Las Vegas (USA)

2.2 Historic background

Kitsch in our todays hotels has a several historic causes, which are connected to political, economic and social events arising in European and American countries during XX century. This requires instantaneous broadening of context of this considerations. World wars, political

changes, economic break downs occurring during this time period, affected in destruction and traumas inflicted to many nations, ethnic groups and communities, on a massive scale. Moreover, as an outcome of job search, many people living in the village areas, stared to seek employment in the town and cities, which at that times may seem as only places providing any income. This phenomenon has had produced a sense of lack of safety and stability for many individuals, that is continued even until today in most societies.

Throughout that interval also many building substance, especially in central and eastern Europe was destroyed, not to mention total demolition of infrastructure. All this events were strengthen by different political systems, like communism – i.e. in central and eastern Europe, which propagated further negligence of many aspect of humane life. Misunderstood ideas of modernism as an international style, with concrete and in many cases prefabricated buildings, shortly manifested itself as a cheap remedy for so many aforementioned problems. Repetitive grey boxes, styles and deprived of any composition or decoration nor caring values of initial modern ideas, stared to take over the panorama of so many cites.

Thus, people intimidated and forced to live in unfavourable condition, pursued to find at least some impression of joy and happiness in their new settlements. The answer for this search was often cheap and low quality products, furnishing and decorations, fabricated on a large scale in random colours, used for covering the actual economic conditions. Such approach was supported by policies, which were aiming at creating an impression, that things will be looking much better in a nearest future. For example Koolhaas [5] states, that in USA kitsch was an answer for a certain way of realisation of the “American dream” vision. While Jencks [4] recalls London on the breakthrough of 60. and 70. of XX century, where hotel design was dominated by historic styles, especially in network buildings, where interior finishing was prefabricated. To be accurate, this type of styles is still popular nowadays, however it is not the only cause for contemporary kitschy solutions.

Figure 2. Global modern style, hotels, on left: Intercontinental in Bucharest (Romania), on right: Victoria in Warsaw (Poland) – uniformity of solutions in culturally different counties

2.3 Nowadays causes of kitsch

As it was aforementioned American and European society was forced to undergo valiant and rapid changes in XX century. The end of this period and beginning of current century, has fruited with dramatically dynamic transformations in: science, economy, industry and IT technologies. Nowadays people are flooded with inventions, concepts and options, which they

are not able to understand, adjust to them or use. At least not all of them at once. As a social outcome of extenuation in cultural, family, spiritual life of societies and as a certain contradiction of growing impoverishment of large groups of city and village residents, consumption is growing rapidly. Thus, commercialization is progressing in these urban structures, and as an outcome also in the hotel industry. In order to maintain the profitability of businesses, hotel owners favour the taste of the mass client.

This is one of few causes of kitsch in hotel design. Here, it cannot be forgotten, that sense of aesthetics of a general client does not necessary has to be of a highest value. Neither reaches or poverty saves individuals from choosing: bright colours, noisy patterns or peculiar forms, for their homes, shops or hotel businesses. At the same time design industry comes up with new, shocking solutions, which aim at shaking the architectural or interior market, in the same way that fashion of car enterprises are pushed forward in their development. Just to give an example, futuristic projects of famous Karim Rashid, which are based on characteristic features of plastic, like: elastic form and bright colour options. In hotel industry this designer marked his presence by on outgoing project of Semiramis Hotel in Athens, distinguished with organic lines and neon colours of finishing. Also works of Jean Nouvel could be recalled here, with an extraordinary designed Hudson building, erected under Morgans Hotel Group in 2000 year. [3]

Such enterprises, are an answer for certain need of narrow group of clients, work well in their context and are produced form reach highest quality materials in up-to-day technologies. Just like fashion trends they excite imagination of hotel owners and designers all over the world. Furthermore, they are associated with elite, richness and luxury, therefore deserve to be copied, by others seeking this values. Unfortunately the uniqueness of such proposals is not necessary understood by mass client. Thus, Rashid's or Nouvel's ideas are recreated in poor attempts of industrial production or low-quality-fabrication. Such fakes will never offer to mass client anything better than odd forms and blatant colours infolded in inexpensive plastic.

Exactly the same process of expansion of unique ideas to mass imagination, concerns all historical styles, like: ancient Greece and Rome, classical period, baroque decoration and all neo and eclectic solutions. It should be stressed, that old resources and manufacturing technologies no longer can be obtained. Especially, if into account are taken limitations of contemporary construction site in time and economy. So, usually nowadays there are created cheap copies and inefficient imitations of historic forms and details.

The next causes of kitsch in contemporary hotel design is mass production. This process is the answer to growing demand for both material goods and need for expansion of building substance in nowadays cities and villages. Unfortunately, what is widely observed is use of not economical or sustainable, but discounted building materials on today's construction sites. What is more they are introduced without sufficient technological of craftsmanship knowledge of underqualified employees. It is especially frightening, when typical and standard solutions are used in cites or regions with unique regional or local building tradition, decoration or ornaments. This process is connected also to disappearance of high quality craftsmanship, which could be a remedy for aforementioned problem.

To sum up kitsch is an effect of following factors:

- Consumption
- Mass production

- Disappearance of high quality craftsmanship
- Commercialization
- Lack of aesthetic and architectural education
- Lack of knowledge on styles of époques in architecture
- Lack of understanding of new tends and their purposes in architecture and design even among professionals

Due to already brought up strong competition in hospitality business branch of market, it is especially exposed to all aforementioned factors. Some examples of such failed attempts will be presented in the case studies part.

3 Case study

Regional architecture mismatch example can be presented on a case study of a hotel in Karpacz. This is a town in southern part of Poland in Karkonosze mountain region, with unique vernacular architecture objects, of a small scale spread all around hilled area. Here, a network building was raised, of a large scale and forms alien to the context. Also decoration detail, thou may seem regional, are in general not characteristic for this (lat.) *genius loci*. [Fig. 3] At the same time it needs to be added that interiors of this edifice do not follow neither exterior architecture nor any regional solutions and have been designed in the very decorative, palace style forms. [Fig. 8]

Figure 3. Large scale and number of odd forms in hotel in Karpacz (Poland)

The other case of alike solutions can be found in the economic and budget networks, which have the same styles outlook, regardless the context. It is worth recalling examples of many European cites, like: Bordeaux (France) and Cracov (Poland), where huge hotels have been implemented adjusted to the significant historic context. [Fig. 4]

Hotels, belonging to different operators, represent simplified contemporary architecture, with naive geometric composition in form and elevations. Itself are neither bad nor kitschy, but as it must be notice, were erected in cites of an amazing cultural and architectural background. This itself could be an indicator for interesting spatial and functional solutions. Moreover, this edifices are just in the neighbourhood of old substance, but neither resemble it in proportions,

nor material. In a way they are continuation of cites degradation process, which started by aforesaid modern blocks. [Fig. 2 and 4]

Figure 4. Global solutions for economic network hotels, on left: two buildings in Bordeaux (France), on right: building in Cracow (Poland) – styles elevations without recall to the surrounding historic context.

Completely different context has a city erected on a desert, which is creating reference for itself. In Las Vegas, a clear form of architectural kitsch is implemented, due to fulfil the "America Dream" idea. This pursuit for happiness is purposely arranged as endless and limitless party. Here, use of expensive materials and sophisticated technical solutions, are aiming at creating the strongest as possible impact at the user, made of colours, lights and sound. All framed by architecture, which designs are sourced in each possible epoch or directly recreate existing famous buildings. In this huge city-sized theatrical decoration everything is pretending something else, in order to bring as much fun to its guest as possible. It is one of many examples in hotels, where kitsch was consciously used to body a specific concept of hotel structures. [Fig. 5]

Figure 5. Las Vegas – "American Dream" implementation in the architecture of hotels.

This intention is deliberately continued in the interiors, where solutions of different styles are stacked together with decoration objects, textiles, mirrors, mosaics and neon lights. All in the unexpected and at many occasions incompatible forms and contrasts. The background blinks and glows, which is supplemented with music or noises from cafes and casinos. [Fig. 6]

Figure 6. Las Vegas – "American Dream" implementation in the details of interiors of hotels and their related spaces.

In a similar way illusion of cheerfulness, colourfulness, enjoyment and variety is implemented in European solutions, no matter what city is in question. Unfortunately, kitsch use in this spaces is much more random and accidently designed, creating chaotic space perception. Mixture of diversified flooring, wall decorations, palace-like curtains and columns with historic and contemporary furniture in unfit styles, contrasted with nowadays electronic utilities, is hard to understand and organize in mind of a hotel guest. It must be stressed that this seemingly expansive solutions are usually complemented with the cheapest light fixtures and air-conditioning outlets. At some occasions, especially if peculiar sculptures and furniture forms were used, such interior arrangement may also be perceived as grotesque and repulsive to some hotel guests. This seems like an effect, that each hotel business owner would rather omit. [Fig. 7, 8]

Figure 7. Entrance lobbies of two European hotels, on left: in Delft (Netherlands), on right: in near Poznan (Poland) – a composition of diversified forms, objects, furniture and technical equipment in varied styles.

During the debate on case studies, the question may arise, whether kitsch should be perceived as negative phenomenon in hotels' architecture. Hence, clear popularity of certain solution, should advice designers to use them in their work. Author answer to this question was reflected in the fourth part of this considerations.

Figure 8. Palace style interiors in hotel in Karpacz (Poland), which do not follow exterior architecture

4 Conclusions

4.1 Effects

Taking into account presented case studies, it can be stated that in the hotel business architectural kitsch decreases feeling of spatial organization, arrangement and order. This may cause in guest a feeling of being lost, disorientation and chaos, which should not be raised in human being, whose already is staying in the foreign city or country. Number of colours and aggressive textures, decrease comfort, aesthetics, but also sense of cleanness in a hotel facility. All this parameters are important elements of overall hospitality service quality evaluation, which is introduced in each organization on daily bases.

At the same time kitschy solutions may be troubling for guest with any type of psychological or physical disability. In this field threats are also strobing, bright and colourful lights, loud music or noise, which at some occasions are purposely introduced into hotels' interiors and exteriors. Similarly large glossy surfaces, mirrors or any other reflective materials will affect space users, if they will be placed in a way to create instance light ray bounces and random glares. It also must be stated, that kitsch not only unfavourably disturbs cities, villages and natural landscape, but also promotes poor architectural, visual and aesthetic education of young adults and children.

4.2 Solutions:

Proposal for long term counteraction towards kitsch in contemporary hotels architecture in the areas of Europe and USA, are focused on solutions, which are possible for all scientists, professionals, hotel owners and users, who are interested in humanization of our hospitality environment. They are as it follows:

- Wide and accessible culture propagation in societies despite the social background of communities
- Propagation of information and knowledge on both: styles of époques in architecture, as well as new tends and their purposes in architecture and design

- Stronger introduction of aesthetic and architectural information and education both among professionals and unprofessional of hospitality business
- Search for high quality design and re-creation of good craftsmanship by hotel businesses owners, especially in places where regional and vernacular architecture is existing
- Supporting sustainable hotel design, which is based on economical (but not cheap) local materials and building traditions
- Perception of commercial values by hotel networks in the individualisation of their particular buildings in different cities

Last remark is based on successful and well introduced current activities of particular hotel network groups.

By acknowledging the existing problem of kitsch in contemporary hotels architecture, there can be a lot of small and large scale activities taken, to bring cities and villages closer to their guests and residents. In this way building fabric will be more aesthetical and friendly to the public, while hospitality business may benefit from increasing interest of clients.

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THE SYMBOLISM OF ARCHITECTURAL FORM IN A TIME OF BIGNESS. LEARNING FROM THE VENETIAN MACAO.

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Abstract

The period of instability opened by the 1973 oil crisis contributed to the affirmation of a new spatial paradigm, which culminated in postmodern architecture. The establishment of a new systemic cycle of accumulation under the hegemonic role of China seems to be associated with a novel paradigmatic shift, and the emerging of a new form of the "classical". This new spatial language, associated with bigness, is questioning both the role of architecture and urban design. This paper investigates this novel paradigm by analysing the spatial structure of Venetian Macao and the symbolism of its architectural form.

Keywords

Bigness, architecture theory, symbolism, architectural form, Venetian Macao.

1. Introduction

1.1 Long economic cycles and architectural movements

Long economic cycles in world-systems theory consists of periods of stable growth and phases of systemic reorganization [1]. These waves of the social-economic base affect the superstructure of society, becoming evident in both theoretical and physical architectural production [2]. The end of the Bretton-Woods Agreement (1971) and the 1973 oil crisis ended the long period of economic stability under American hegemony. Parallel to these events, the publication of *Learning From Las Vegas* in 1972 [3], laid the theoretical foundations for the establishment of Postmodernism in architecture. The period of instability that followed is now coming to an end, and, according to the model of cyclic recurrence of the ''classical'' proposed by Salvatore Settis [4], it is expected to make way for a new architectural movement. While Postmodernism is eclectic, heterogeneous, plural – "We think the more directions that architecture takes at this point, the better" [3] –, and it created a hiatus in architectural form by breaking it into two distinctive parts, we are conversely now expecting function and symbolic ornament to find a new uniform and universal synthesis [5].

Las Vegas was used by Venturi, Scott-Brown and Izenour as the emblem of the radical transformation happening in the American urban landscape, this paper looks at Macao as the place in which the architectural features of a new 'movement' are becoming evident, using the Venetian Macao as a case study.

1.2 *Belle époques*, eclecticism and Postmodernity

Periods of crisis, restructuring and reorganization of the capitalist word-economy have been recurrent turning points since the early stages of the world-system. Arrighi pinpointed four periods of chaos, coinciding with the passage from a hegemonic power to a new one. During these periods, "capital *tends* to revert to more flexible forms of investment" [1], augmenting its liquidity. These phases of crisis are constituted by sudden economic collapses, alternated with short periods of unprecedented prosperity. These "wonderful moments", known as *belle époques*, "rested on a shift of the crisis from one set of relations to another set of relations" [1]. The instability of such gilded periods, the last one opened by the 1970's crisis, finds spatial representation in architecture [5]. Phases of crisis are characterized by the separation of the 'perceivable-forms' from their 'structural-forms': the stylistic elements are not depending on a construction technique, they are no longer linked with a specific function, but they are used as independent features [5]. It follows their mutation into symbols, which are used by architects in the façade composition to convey new significances. This multiplicity of *motif* was recombined – as a collage of fragments– in various styles, namely historicism, revivalism, eclecticism, postmodern. Such collages of fragments can be found in architecture, as well as in music, and more widely in other arts. The subsequent juxtaposition of historical references produces the effect of the collapse of time into only one dimension – the present: "We are in the epoch of simultaneity: we are in the epoch of juxtaposition, the epoch of the near and far, of the side-by-side, of the dispersed" [6]. In the past, the phases of crisis were followed by periods of stability, coinciding with the investment of the capital "in a particular input-output combination in view of a profit" [1]. This passage can be also found in architecture, where eclecticism makes way for the establishment of a new 'classical' in which perceivable-forms and structural-forms are consistent and in a tight relation of dependency [5].

1.3 Replicas and entertainment

The process of copying – defined as imitation or reproduction of an original– allowed the separation of the perceivable forms from their structural forms. Copying an original work of art became a widespread practice during the Hellenistic period – conceivably the first crisis/*belle époque* of the western culture [4]. The cultural decadence experienced at that time and the perceived unbridgeable distance from the cultural heights previously reached, were the reason behind the high demand for classical art. A technical innovation in sculpture, brought by the brothers Lysippus and Lysistratus of Sicyon, allowed the supply of a massive reproduction of art works [4]. The two sculptors developed and extensively adopted an innovative method, which consisted in the use of plaster for capturing a physical form [7]. The method, which boosted the proliferation of copies, allowed the separation of perceivable form and structural form. In fact, the mechanical extraction of the external shape of a human body, or of an original work of art, was no more dependent on the understanding of its proportions and compositional rules [2]. Replicas have been exhibited in museums, world fairs, and thematic parks, where they provide material representation of artefacts from temporally or geographically distant civilizations. This representation can have different aims,

it can be used to educate or to entertain. During *belle époques* replicas are often employed for amusement purposes.

The entertainment industry flourishes in times of financial availability or economic prosperity. For instance, during the Gilded Age, in North America as well as in Europe, the higher economic availability of the masses boosted the booming of amusement parks. Conversely, the stock market crash of 1929 caused the collapse of the entertainment industry, and many amusement parks went into bankruptcy or closed. Within the period of stability which followed World War II, Disney played a key role in their reaffirmation. However, there is a substantial difference between the amusement parks of the Gilded Age/Victorian era/*Belle Époque* and the thematic parks of post–World War II. The first ones were a mere collection of attractions, while the second ones arrange the attractions around unifying pivotal themes.

2 From Las Vegas to Macao

2.1 Las Vegas

Las Vegas is a resort city in the state of Nevada. It is currently home to 648,224 within a region populated by over two million people. The first Western pioneers arrived in the area during the XIX century, but the city was formally funded only in the beginning of the XX century. Nevada legalized gambling in 1931, being the first and only state in the USA to do so, thus laying the foundations for the casino booming of the post-war period. In 1972 – the year of publication of *Learning From Las Vegas* – the total recorded volume of visitors was 7,954,748 and the gaming revenue $476,126,720 [8]. Thanks to the gambling monopoly, Las Vegas shortly came to be an emblem of entertainment and sin. In 2017 the city recorded 42.21 million visitors and $9.98 billion gaming revenue [8]. The gap between Las Vegas and the other American cities has been closing in the last decades, Las Vegas becoming home to a growing stable population and the city expanding real estate development in its outskirts. In comparison, many other states and cities have legalized gambling and the entertainment industry has begun to grown in these places into an all-pervasive presence within many aspects of everyday life.

In their study conducted in the late 1960s and published in the early 1970s, Venturi, Scott-Brown and Izenour used Las Vegas as a case study to illustrate how the popularization of gambling and the widespread access to private mobility would lead to the production of a particular landscape, buttressed by a radical transformation in architectural forms [3]. The separation between what they named ‘ornament’ (perceivable form) and the function (structural form) was the theoretical ground for the use of the ornament as a syntactical element of an autonomous language and for the establishment of postmodernity in architecture. The research of Venturi, Scott-Brown and Izenour focused on the Las Vegas Strip, a 6.8 km road skirted by a long sequence of casinos on both sides. In order to attract drivers and clients casinos adopted a series of visual tactics physically detaching signs and symbols from buildings. The radical transformation induced by the widespread access to automobile transportation resulted in the competition for visibility in a capitalistic logic of consumption and produced the iconic landscape of Las Vegas that came to be one of the emblems of American popular culture.

2.2 Macao

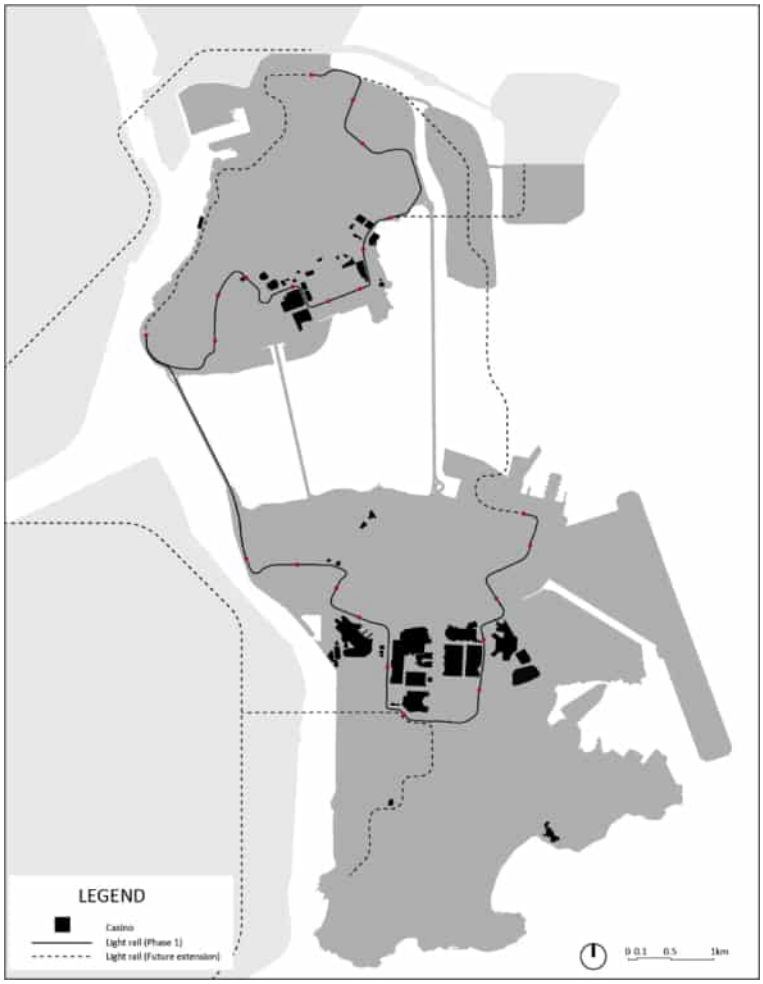

Figure 1. Casinos and LTR in Macao

Macao (Fig. 1) is a former Portuguese colony established in 1887, after it was leased to Portugal as a trading port in 1557. In Macao, gambling has been legal since the 1850s. In December 1999, after four centuries of Portuguese colonial rule, the territory was returned to China, becoming, along with Hong Kong, a special administrative region of the People's Republic of China. Its gambling industry has been flourishing since the early 2000s, rapidly surpassing Las Vegas in 2006. In 2017, the city recorded 32.61 million visitors and gross revenue from gambling totalling MOP265.74 billion ($32.87 billion) [9]. The turning point in the recent history of the city was determined by the governmental opening to foreign investment that boosted the gambling industry, 'remapping' [10] the city and shaping its image on the Las Vegas token. In fact, after a long-lasting monopoly enduring from the 1930s to 2002 [11], in 2002 the casino market was opened to a select small number of the world's largest casino multinational corporations from North America, Australia and Hong Kong [11]. This change in the legislative framework, allowed $25million of foreign investment [12], and produced several transformations in the city's economic structure [11], its cultural identity [13] and its urban image [14]. The opening to foreign capital generated an exponential growth of the tax revenues paid by the gambling industry, increasing from $1.908 billion to $3.877 billion from just 2004 to 2007, as well as the radical transformation of the image of Macao from "City of Culture" to an "Asian Las Vegas" [14]. The revenues, gained in the first decade

of the 2000s, allowed the city administration to follow in the Roosevelt footprints during the economic crisis of 2008, investing in the infrastructural development to sustain the local economy. Part of this 'New Deal' was the construction of the LRT (light transportation system) which is currently under implementation [14] (Fig. 1). The astonishing growth was boosted by the prohibition of gambling in the neighbouring countries and exploiting the locational advantages by securing outbound tourist markets [11]. However, this strategic shift of the local economy transformed the city into an almost monothematic international tourist attraction heavily relying on the gambling industry [11, 15]. The planned new town of Cotai – the reclaimed land between Taipa and Coloane – disappeared from the government agenda, substituted by a conglomeration of new casinos [14]. In here, the typological development of the model produced within Las Vegas reached a new synthesis.

2.3 The Venetian Las Vegas

"No matter what your mood, The Venetian has something for you, from the celebrity chef-studded dine-and-drink scene to smart bites and organic juices to the legendary TAO Beach day club and relaxing times at Canyon Ranch spa." [16]

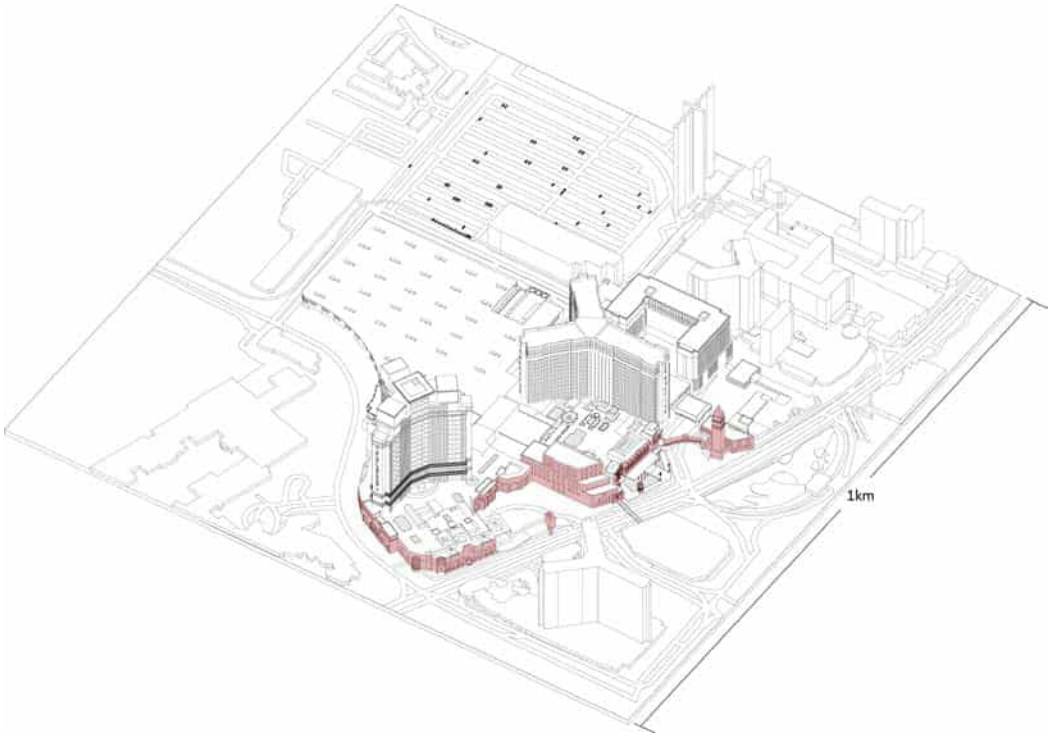

Figure 2 The Venetian – Las Vegas, street wall (in red)

The Venetian (Fig. 2), a mega-resort on the Las Vegas Strip owned by the Las Vegas Sands Corporation (LVS), was built in the late 1990s, its groundbreaking taking place in 1997 in conjunction with the Asian financial crisis. At the time of its opening to the public in 1999, it was the world's most expensive mega-resort, with a construction cost of $1.5 billion. Forming a large resort complex with The Palazzo, it held the record of the largest hotel (7,117 rooms) from 2008 to 2015. The complex constituted a turning point in the typological development of gambling resorts:

1. It used a worldwide known tourist destination as a consistent thematic *motif*, by reproducing its perceivable forms on a one-to-one scale;

2. Although maintaining the former separation between perceivable-forms and structural-forms, it produced a new alchemical combination by way of façadism;
3. It shifted the scale of urban intervention to an unprecedented size;
4. By doing so, it encompassed a miscellaneous series of functions, no longer just relying on gambling.

2.4 The Venetian Macao

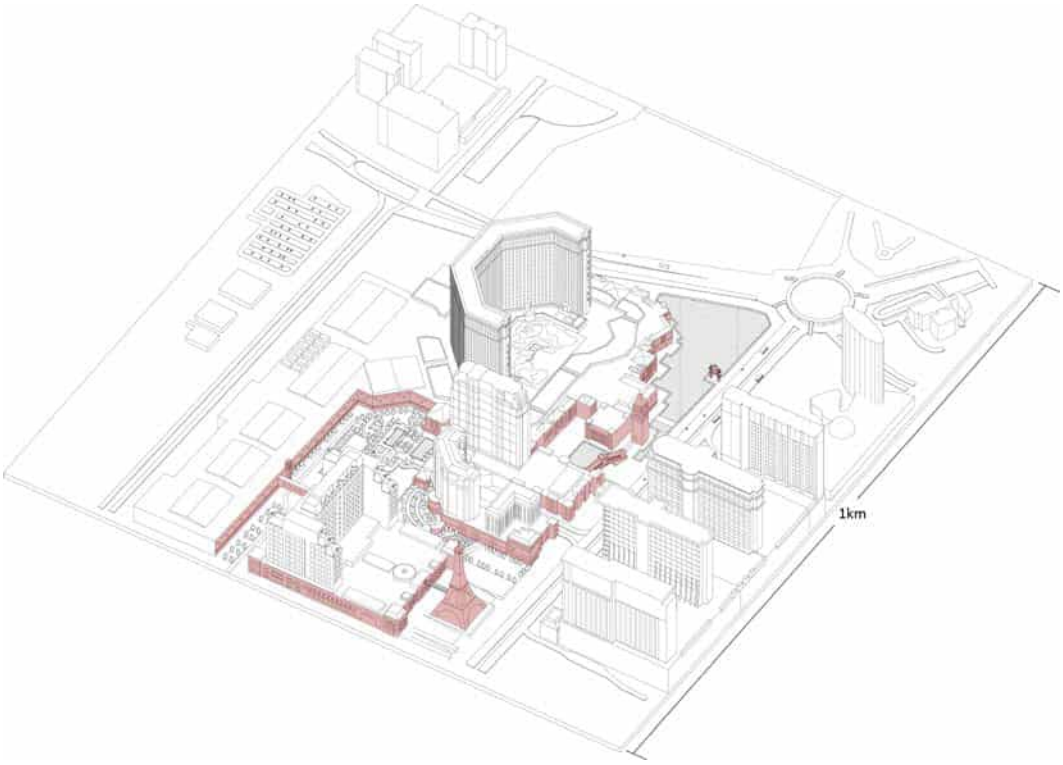

Figure 3 The Venetian Macao, street wall (in red)

LVS opened its first gambling resort in Macao in 2004. The Sands Macao, the first American casino to be opened in the Special Administrative Region of China, recouped its $265 million construction cost within nine months of operation [10]. LVS immediately reinvested the big profit gained into the construction of the Venetian Macao (Fig. 3), which opened in 2007, with a construction cost of $2.4 billion. The Venetian Macao stands as the largest hotel resort of Asia, and the second largest in the world. It extends over 980,000 square metres, comprising 300 shops, 30 restaurants, an arena of 15,000 seats, and an artificial water body of about 14,000 squared meters [17]. Designed on the model of the Venetian Las Vegas, the resort was the first to be opened in the land reclamation of Cotai. The complex represents a turning point in the development of Macao, determining the further direction of the entire city and possibly influencing the whole society at a regional, even international level [12]. The tactics of the American tycoon Sheldon Adelson, chairman and chief executive officer of LVC, and its competition with the local former gambling monopolist Stanley Ho, were among the most significant motives behind current planning and infrastructural development trajectories [10]. His uncontested economic power, thanks to some brave tactical moves, muted into a spatial hegemony. The first of Adelson's stepping stones into the Macao gambling market was the construction of the Sands casino. Its locational advantage, the casino being erected at the

entrance of Macao Peninsula, was one of the major reasons for the enormous profits gained after its opening [10]. Given that the tiny reclamation strip in front of the Macao Peninsula turned into a crowded battlefield in the competition among the three concessioners and their subcontractors, Adelson took the courageous decision of a pioneering intervention in Cotai investing in the construction of the Venetian. In order to reduce the locational disadvantage, Adelson invested in the infrastructural development of 5.2 km^2 of reclaimed land, for its connection to HK/Shenzhen with a new ferry terminal [10]. Moreover, he declared its intentions of a very large investment – up to $15 billion – in the Special Economic Zone of Hengqin, a 106.46 km^2 undeveloped land right on the other side of the border with the Mainland [10, 18]. The Venetian Macao recouped its initial investment in only four years, convincing all the other concessioners of the sustainability of large investments in Cotai [10]. Adelson's move was determinant both for the success of Cotai, as well as for the expansion of foreign investment into the Mainland, where gambling is still prohibited and where a new model of resort city – a hybrid of Orlando and Las Vegas, as described by GW Investment Consulting CEO Matthew Ossolinski [19] – is taking shape.

The Venetian Macao not only changed the urban ecology of Macao, it also contributed to the process of 'architectural mutation' [20] of the casino resort into:

1. A large, autonomous and thematic urban complex, which is no longer context dependent (strip dependent in the case of Las Vegas);
2. a mega-block in which the street wall is a continual element composed of one-to-one replicas of the city chosen as a thematic reference;
3. a new form of alchemy of perceivable forms and structural forms of the category of the 'decorated sheds', in which perceivable forms are a manifesto of the building function and programming;
4. a mega-structure in which the public open spaces of the traditional city are internalized and commodified;
5. a space in which consumers become extras, being part of the fictional representation of the reality they are turned into meta-tourists.

2.5 Disney in Macao

Gary Goddard is an American producer and director, best known for the design of several entertainment attractions around the world. During the 1970s he has been working for the Walt Disney Company and Walt Disney Imagineering, where he was involved in the design of various projects, and in the concept development of the Experimental Prototype Community of Tomorrow (EPCOT) – a visionary project of a city for 20 thousand people to be constructed within the Florida Project, and abandoned after the death of Walt Disney. Founded in 2002, the Goddard Group has designed several large-scale entertainment projects, comprising amusement parks, retail malls and resorts. The Galaxy Entertainment Group, controlled by the Hong Kong magnate Lui Chee Woo, commissioned Goddard Group to design the $1.9 billion resort Galaxy Macau, including concept development, master planning, schematic design and show design. In 2011 the Macao-based Melco Crown Entertainment Limited, controlled by the Ho family – Macao's gambling former monopolist –, impressed by the newly completed Galaxy, ask Gary Goddard to take charge of the design of their "Studio City" resort. "Ho wanted a new kind of casino hotel that was entertainment orientated and that would be a tribute to

and a celebration of cinema, the movies. When you say the cinema –he loves Batman– so you can definitely see traces of Gotham City in our design, but also of Metropolis, of Blade Runner – so we took those movies and some other ones as inspiration." [21]

Both Galaxy Macau and Studio City constitute steps forward in the process of definition of a new typological unit in urban design. In the Galaxy Macau perceivable forms are not any longer simply juxtaposed to the functional volumes by way of façadism, they are amalgamated in the process of massing, forming a consistent streetwall as in the European City of the XIX century. With the Golden Reel of the Studio City, function, symbolism and decoration reached a further synthesis: the building massing embodied a giant figure 8 (8 being an auspicious number in the Chinese tradition) fairground Ferris wheel, the first and highest of this kind. The Studio City also constitutes an important development in the process of mutation of the casino into a leisure resort; integrating for the first time gambling, retail, and hotels with facilities for television and film production, as well as a 3,700m^2 children's playground.

3 The synthetic city of the XXI century

As argued by Tim Simpson (2008), Macao is rising as a new urban model for a "reinvented and rejuvenated China" [10]. As the *belle époque* is coming to an end, the 'casino capitalism' [22] is supposed to slow down and give space to a different kind of entertainment, which accommodate the demand of the fast growing Chinese middle-class and the interest of the millennials no longer attracted by gambling. This trajectory is clear in the temporal passage from the old casino-resort, to a new type of colossal urban complex, as well as in the physical – the part of Hengqin leased to Macao – and ideological expansion of Macao into the Mainland.

Reclamation. The physical expansion of both Macao and Hengqin is progressively taking place through land reclamation. Two out of three parts of the 30.4 km² of Macao's territory are reclaimed lands. These new *tabulae rasae* are commodified [10] and become the physical support for the expansion of both foreign capital and consumeristic ideology within the territory of the People's Republic of China.

Mega grid. The first act of colonization of these virgin lands is the superimposition of a grid, which in the case of Cotai defines a block twenty times bigger than the standard block of Manhattan, or seven time bigger than the *superquadra* of Brasilia. The resulting urban structure, differing from the Las Vegas Strip, is developing along two orthogonal axes allowing an isotropic urban development. The changes that ensued from the addition of one dimension – in the passage from the strip to the grid – amply affect the urban design approach. The block no longer has one main façade overlooking the urban axis and large parking lots on the backyard as in Las Vegas; it is now encapsulated by four streetwalls, no longer has a hidden backyard and organizes the different functions vertically (Fig. 4).

Mass transit. The monorail promoted by Walt Disney in his parks since the 1950s was employed in Las Vegas in the 1990s with the construction of MGM Grand-Bally's Monorail, which is nowadays a portion of the Las Vegas Monorail. The elevated light rail system found in Macao's project is its ultimate interpretation (Fig. 1). The LTR, currently under construction, is a hybrid between the two systems proposed by Disney for EPCOT: light rail and people mover. The system will partially replace the feeder flews, which are currently offered free of charge by the casinos. A giant car park at the landing point of the Hong Kong–Zhuhai–Macao

Bridge (HKZMB) will be the main intermodal passenger transport hub together with the other main land connection with the Mainland and the ferry terminals. The LTR is planned to extend to Hengqin and to intersect the Hengqin Light Rail and the Guangzhou–Zhuhai Intercity Railway. Consequently, it will finally achieve full integration with the railway network of China, allowing visitors to reach Macao from Guangzhou in about one hour.

Thematic zooning. The mega-grid defines a blocks size of 0.5 km^2. The Venetian Macao together with its neighbouring Parisian covers a surface as big as the Vatican City State in Rome and twice the size of Burano island in (the authentic) Venice. Each of the mega-block can host an autonomous settlement that includes several functions ranging from production to consumption, from entertainment to hospitality, from residential to educational. An illustrative case is the University of Macao, which is going to relocate to Hengqin. The new planned campus for 15 thousand students will cover 1.09km^2. An other example in Hengqin is the Ocean Resort –partly opened and partly still under construction– which includes several attractions around the same *motif*, such as a theme park, an aquarium, a circus, a hotel, sport facilities, commercial and conference/exhibition centres and a so called Water City. It covers a total area of about 5km^2 (as a comparison, the Macao Peninsula extend over an area of 8.5km^2) and at its full operation is expected to attract 10 to 20 million tourists a year.

Colossal. “Here in Florida we have something special we never enjoyed at Disneyland: the blessing of size. There's enough land here to hold all the ideas and plans we could possibly imagine.” [23]

Lysippus did not only have a key role in the passage from the Classical era to the Hellenistic period, as previously described; he was also the mentor of Chares of Lindos, who produced another significant innovation in sculpture simply by reproducing a human body at a different scale. Chares was the sculptor of the Colossus of Rhodes, one of Seven Wonders of the Ancient World, a 32 metres high bronze statue, constructed between 292 BC and 280 BC, representing the god Helios and located at the maritime entrance of the city of Rhodes. The Colossus of Rhodes inspired the colossal statue of Nero (Rome, 1st century AD) whose adjacency to the Flavian Amphitheatre was probably the reason behind the name Colosseum. Similarly, the evolution of the classical from Ancient Greece to Ancient Rome happened by way of the colossal order. It comes with no surprise that the colossal order found widespread application during other classical periods such as the Renaissance and the Baroque. Since *Delirious New York*, the interest of Rem Koolhaas focused on a specific type of “architectural mutation” that is produced by way of “Bigness.” As the Colossus of Rhode was a fundamental step in the Hellenistic arts that open the way to the new classical, Bigness has been the stepping-stone in the production of the new giant urban unit, which as the Colossus of Rhode works as landmark in the cityscape, the skyscraper. The mutation described by Koolhaas, produced a new container unit in which, as a matter of scale, the “divorce between appearance and performance” [24] became effective. Thus, “the façade no longer reveals what happens inside […] – agent of disinformation – offering the city the apparent stability of an object” [25], while the “interiors accommodate compositions of program and activity that change constantly and independently of each other without affecting the envelope” [24]. The ‘architectural mutation’ produced by way of Bigness is no longer context dependent, containing “a promiscuous proliferation of events in a single container” it “generates a new king of city” [24] and empties the urban open spaces of their collective functions, turning them into residual spaces. The ultimate mutation, the one of Macao, engulfs both Bigness and the city, privatizing the urban open space, reprogramming and subjecting it to the logic of consumerism.

Conversely, its peripheral limits become spaces of propaganda, conveying phantasmagorical images, which function as advertisement boards to attract potential consumers – overturning the Bigness' motto "What you see is no longer what you get" [24]. The exterior limits completely enclose new colossal units (Fig. 3), disconnecting the city from the landscape as Bigness disconnected the building from the city. Thus, as the Ancient Greek semi-circular theatre, mutated into the circular Roman amphitheatre, the same process of disconnection from the natural environment and insertion in a full-surrounding urban context is at the base of the mutation of the Venetian Las Vegas to the Venetian Macao (Fig. 4).

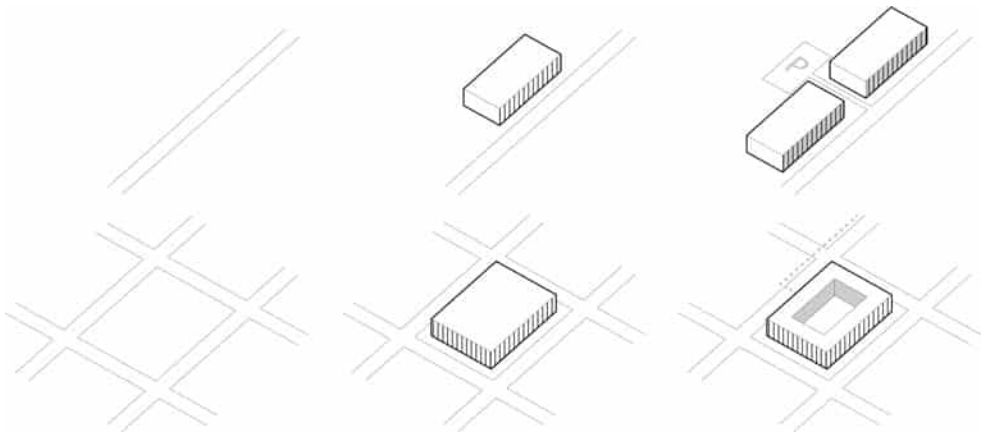

Figure 4 Strip-car development model (above – Las Vegas type) and Grid-LTR development model (below – Macao type)

Normalization. Las Vegas went through a progressive transformation from the 'city of sin', to a normal American urban conglomerate, while its most extreme image deeply influenced the rest of the country, both culturally and spatially. The same osmotic process is now happening between Macao and Mainland, with outcomes of cultural and political reach to go far beyond the aims of this paper. Nevertheless, what appear evident is a radical transformation of the territory by way of a new – no longer architectural – urban design mutation.

4 Conclusion

This paper has aimed to trace the connection between long economic cycles and architectural production by analysing how the establishment of a new systemic cycle of accumulation under the hegemonic role of China could to be associated with the emergence of a new urban formation. It has discussed the role of replicas in the process of separation of perceivable form and structural form, which is the theoretical ground of *Learning from Las Vegas*. It illustrates the establishment of a new architectural mutation as the outcome of a long-term typological transformation of the casino from the 1990s to the second decade of the 2000s, and from Las Vegas to Macao. Finally, this research has analysed this new urban formation by drawing inspiration from Rem Koolhaas' dialectical analysis of Bigness, and defining the six principles of this paradigmatic shift in urban design: reclamation, mega-grid, mass transit, thematic zooning, colossal and normalization.

Acknowledgements

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INHABIT! RECONSTRUCTING IDENTITY AND IDEOLOGY THROUGH LATE-SOVIET ARCHITECTURE IN THE REPUBLIC OF GEORGIA

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ABSTRACT

The existence and collapse of the Soviet Union has indelibly effected all republics from which the leviathan was comprised. In the case of post-Soviet Georgia, collapse was followed by over a decade of economic instability and ethnically prompted civil war which prevented the unification of the country under a national agenda. The Rose Revolution in 2003, marked the beginning of a series of rapid institutional reforms, beginning after the forced resignation of President Eduard Shevardnadze, by the Georgian people, and the inauguration of Mikheil Saakashvili. President Saakashvili was the first political leader able to successfully unify regions of Georgia which had continuously identified as Georgian (this excludes the disputed territories of Abkhazia and S. Ossetia), legitimize his regime through the collection of revenues through taxation, and attract the foreign investment that Georgia desperately needed.

Economic growth and stabilization in Georgia could not have come without promulgation of *so-called* pro-Western, democratic values. The national project of the Saakashvili government was the creation of the *image* of a westernized, contemporary republic: The *New Georgia*. However, this development was never substantiated beyond the *creation of an image*. Additionally, this was at the cost of establishing national identity, and was paradoxically implemented autocratically. The regime's approach to architecture and urbanism were gross adoptions of abstract European forms which were arbitrarily (in both senses of the word) deployed throughout the country via grandiose and poorly planned public and infrastructural projects, as well as through complete laissez-faire policy towards foreign investment and development. The inauthenticity of these constructions is the physical manifestation of the superficial adoption of western and democratic values, which served to further alienate Georgians while perpetuating longstanding issues inherited from the Soviet and early post-Soviet years.

Beneath the layer of "New Georgia" gilding, there are remains of ethnic conflict and large groups of internally displaced persons (IDPs) who are living in extreme poverty in former Soviet public buildings. In the Georgian capital, Tbilisi, this is evident in the former Industrial Pedagogical Technicum complex, which serves as a metaphor of true Georgian conditions; not as an isolated object, but within the context of the aforementioned rapid and inauthentic transformations to the country. The building is currently occupied by approximately sixty (60) refugee families from the Georgian-Abkhazian conflict in the 1990's and the Russo-Georgian war of 2008, who are living in separation because of ethnic friction. In order to authentically confront totalitarianism, accept diversity, institute democracy, and catalyze the reconstruction of Georgian identity, the ideologies of the Soviet period, and the tyranny which ensued, must be confronted. The appropriation, adaptation, and inhabitation of monumental structures of the Late-Soviet period by the public and for the public good, present the opportunity for change that could be foundational for Georgia and prevent further cultural erosion.

Keywords: Adaptation, Authenticity, Appropriation, Identity, Inhabitation

INTRODUCTION

Greatness stands upon a precipice, and if prosperity takes a man never so little beyond his poise, it overbears and dashes him to pieces.

-Seneca the Younger

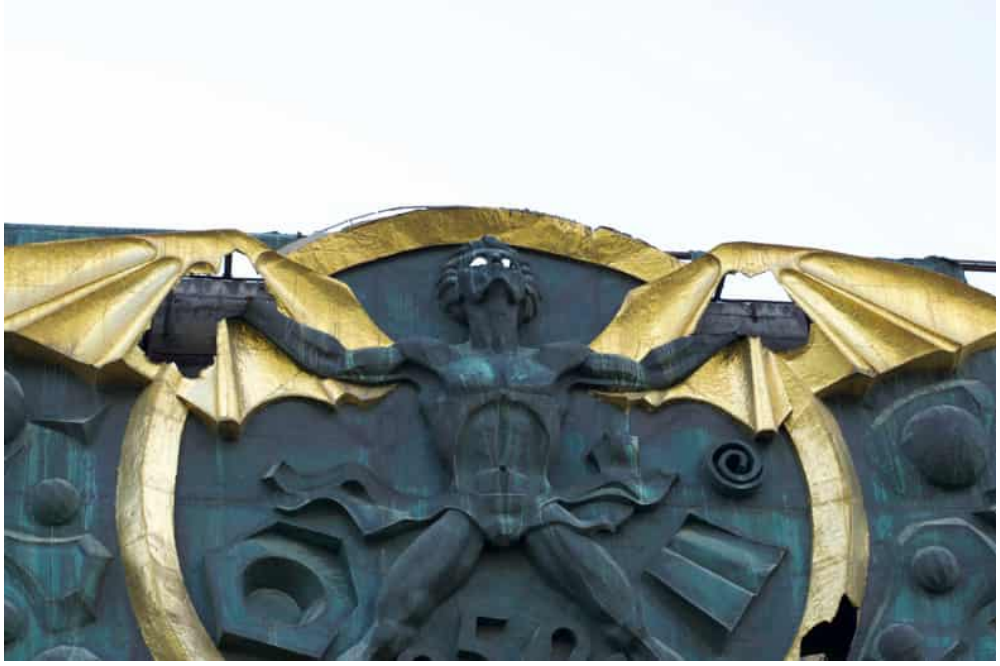

Figure 1: Sculpture on the façade of the former Industrial Pedagogical Technicum in 2017

According to the ancient myth, Icarus, a boy who escapes captivity through flight, is consumed by ambition, and despite warning to avoid the blazing sun, he ascends until the feather and wax wings created by his father are irreversibly damaged, plunging him to the depths of the sea. The myth of Icarus is somehow consonant not only with the story of the Soviet collapse, of the inevitable plunge following ambitious idealism but most recently, in Tbilisi, has been dramatically manifested in the late destruction of the relief sculpture affixed to the façade of the former Industrial Pedagogical Technicum. The dismantling of the *new Soviet man*[1]*,* a neo-Vitruvian figure with bat-like wings as the emerging archetype, irrespective of the country's cultural, ethnic, and linguistic diversity, embodies the fall of idealism, of Trotsky's hyper-ideological *superman*. This fateful fall may be a necessary step towards the acceptance, inhabitation, and humanization of former Soviet structures, a fruitful synergy between the dismantling, and potential re-appropriation of past identities.

PRE-SOVIET AND EARLY POST-SOVIET CONTEXT

The Republic of Georgia is located in the Caucuses region, east of Europe and west of Asia, and has long been considered the "crossroads of cultures and civilizations." Georgia's central geographic location has made it desirable territory for conquest by some of the largest empires in history (namely the Byzantine, Mongol, Persian, Ottoman, and Russian empires). Beyond the 12th Century, known as Georgia's golden age, the kingdom was unable to stay united because its territories were controlled

[1] Leon Trotsky wrote in 1924 in *Literature and Revolution* about the "Communist man," about a "man of the future," a "man [who] will make it his purpose to master his own feelings, to raise his instincts to the heights of consciousness, to make them transparent, to extend the wires of his will into hidden recesses, and thereby to raise himself to a new plane, to create a higher social biologic type, or, if you please, a superman."

by different empires simultaneously. Under the Russian empire, Georgian princedoms preserved a loose sense of unity because of the common ancient and medieval history, and cultural and linguistic similarities. [17] When the Russian empire fell to the Bolsheviks, Georgia seized the opportunity to declare independence in May of 1918, and attempted to *unify* with the regions of Abkhazia and South Ossetia. Before unification could be achieved, the fledgling nation was taken; the Democratic Republic of Georgia, was short-lived. On February 25, 1921, "'the red banner of the Soviet power [flew] above Tbilisi'… [marking] the beginning of the country's *revival*," despite Georgia's First Chairman Noe Zhordania's plea to the West for protection. [7]

Amidst the collapse of the Soviet Union, Georgia again declared independence in the March of 1990, but independence was again accompanied with challenges of unification, and establishing a secure state in a complex geo-political atmosphere. As was the case in several ex-communist countries, nationalism became "a way for the ex-communist *nomenklatura* to survive" (Žižek); Georgia's leadership attempted to maintain power via nationalism which served to marginalize minorities, and further alienate the regions of Abkhazia and South Ossetia. When the Georgian Supreme Soviet split from the Soviet Union with a declaration that Georgia was an annexed and occupied state, Abkhazia proceeded by declaring independence from Georgia and petitioning to Moscow to be incorporated within the Soviet Union. In the Autumn of the same year, the Democratic Soviet Republic of South Ossetia was excluded from participation in an election which would determine its autonomy. [27]

While Abkhazia and South Ossetia were suffering alienation, the already united parts of Georgia entered another ethnically backed conflict, beginning with the deposition of the nations first leader, Zviad Gamsakhurdia, in the January of 1992. Gamsakhurdia was forced to flee to Armenia, and Tbilisi fell under the control of Eduard Shevardnadze; however, Gamsakhurdia, who was of Megrelian (Megrelia is a region in the western part of Georgia) descent retained support from the people of his region, and was still recognized by some nations as the legitimate leader of Georgia. Amidst the power struggle between the two leaders, a nationalist paramilitary group known as the *Mkhedrioni* (meaning "horsemen" or "knights") began carrying out atrocities in Abkhazia under the orders of Shevardnadze. The *Mkhedrioni*, held onto the same "Georgia for Georgians," ethnically exclusivist attitude as Gamsakhurdia's supporters (though they were on opposing sides) to legitimize their looting, rape, and murder of ethnic Abkhazians. With Russian logistical support, Abkhazia managed to win the war against Georgia in the Autumn of 1993, resulting in the expulsion of approximately 200,000 ethnic Georgians [2], who mostly migrated to the adjacent Samegrelo-Zemo Svaneti region and Tbilisi. (Ministry of Internally Displaced Persons from the Occupied Territories) Since 1993, all diplomatic attempts to unify the two nations have failed, and the the regions are perpetually in "frozen conflict."

BUTZA: VISIONS OF NATIONAL UNITY

In simultaneity with the chaos which had consumed the Georgian state after the collapse of the Soviet Union, there was a voice among the artist intelligentsia which remained in the shadow of atrocity and ethno-nationalist extremism. Architect Victor Djorbenadze, known by his colleagues and friends by his nickname *Butza*, had been dealing with the issue of Georgian identity before the collapse of the Soviet Union. His most renowned architectural accomplishment, the Palace of Rituals,

[2] It was not only ethnic Georgians who were exiled from Abkhazia, several ethnic Abkhazians were also forcibly removed and migrated en masse across the country, and to Tbilisi. The subject of the status of Abkhazia is extremely controversial, and opinions vary among Georgians, Abkhazians and Russians about whether the territories are occupied, are independent, or are under Russian occupation. In the midst of chaos, the region continuous to suffer immensely, and has not economically development since the collapse of the Soviet Union.

in Tbilisi, is known to contain several allusions and symbols rooted in Georgian mythology, vernacular architecture, and ecclesiastical architectural tradition. Never before had Butza's work and ideals been as relevant as in the early post-Soviet years with the announcement of a competition for a new national cathedral for Tbilisi, The Cathedral of the Holy Trinity.

Figure 2: The Georgian Palace of Rituals by Architect Victor Djorbenadze

In the March of 1990, in a letter addressed to Georgian Patriarch Ilia II, written by Chair of the Union of Architects of Georgia, Nodar Mgaloblishvili, Butza's competition entry was described with the following text: "[the project] meets the spiritual demand of the present day Georgia and may become a symbol of *revival* and *unity* of the nation and country." [4] Regarding the project, Butza himself wrote:

> *While working on the Project we kept considering centuries old and rich ecclesiastical traditions of Georgia… In the process of designing the project we considered the existing situation in the country, great importance of consolidation of the Georgian nation, and the spirit of Georgians striving for restoration of integrity of the country. That is why the form of the Cathedral comprises the dominant element and its subordinate parts. That is why the main dome is the dominating part of our composition, comprising symbols of churches of all four parts of Georgia – four domes.*

The romantic version of national unity which Butza offers in this text is a testament to the still impending national disunity which would ensue. Nevertheless, for the first time after the collapse of the USSR, symbolism in architecture is offered as a solution, filling the inevitable ideological void in the post-Soviet space. The idea to adopt the dome structures from the cathedrals of each region and to make them "subordinate" to a larger central dome sends a symbolic message of precedence of national identity and interest over regional identities and interests. Needless to say, the project was never realized, and a very different Cathedral of the Holy Trinity, *Sameba Cathedral*, took shape during the Saakashvili period.

SAAKASHVILI AND POST-SAAKASHVILI: THE EXPERIMENT OF WESTERNIZATION

It is indisputable that under Mikheil Saakashvili, Georgia achieved a level of stability and national order that was unimaginable in the first decade of independence. First on his agenda was unification;

this began with the reassertion of Georgian control over the Adjara region, in 2004, which had existed in a state of semi-independence under Aslan Abashidze during the Shevardnadze regime. This move allowed for the collection of much-needed revenues via taxation from trade with Turkey, that had been flowing directly to Abashidze's government. Saakashvili would employ similar strategies in South Ossetia, tightening the Russian-Georgian border and closing a large "illicit free economic zone," while appealing to the local populations with aid and propaganda criticizing the brutalities of the last regime. [27] These efforts towards unification were fruitless. Furthermore, in order to solidify Tbilisi's relationship with Megrelia, and undermine his predecessor, Saakashvili symbolically returned the body of Zviad Gamsakhurdia from Chechnya (where it had been moved after his death in 1993) to the capital for a proper burial in 2007, claiming that he was a Georgian patriot and statesman, despite his controversial actions. [8] Though efforts of unification were not entirely successful, improved quality of life, stability, and public safety were major achievements of Saakashvili's regime.

Though Saakashvili's initial political actions were taken with obvious strategic deliberation, his national project as a whole was largely insufficient for sustained progress, and seemed to be ideologically incomplete. From the onset of his inauguration, members of the Georgian population viewed the West as a threat to Georgian identity, and the Georgian Orthodox Church also stated in official documents that "liberal ideology" is a threat to church tradition. [17] Saakashvili was faced with the difficult task of defining a new direction for Georgia and establishing a national ideology, with consideration for the nation's history, and cultural and religious traditions, while creating consensus and accommodating for diverse political attitudes, and quelling the ethno-nationalist sentiment. Progress however, came without regard for any of the aforementioned considerations, and the westernization agenda took full effect, subordinating Georgia to so-called western ideals, to prove to the West that Georgia could exist independently, without Russia. The failure to define Georgian values, and authentically adopt and synthesize them with western democratic values, has both tarnished democratic ideals in the mind of the general population, and provided fertile ground for radical right-wing dissidents to remain politically active. As recently as July of 2017, there was a protest in Tbilisi against immigrants from Iran, Africa, and the Middle East, who are seen as a threat to Georgian identity. [23]

The best way to understand the inauthenticity of the westernization agenda in Georgia is through its physical architectural manifestation across the country, which serves as a perfect metaphor for the attitude of the Saakashvili regime, with respect to national history. In a state and private sector jointly-funded publication titled *New Georgia: Georgian Architecture After the Rose Revolution 2004-2012*, the first spread in the book proudly displays the complete demolition and reconstruction of Davit Agmashenebeli Avenue. The result of the massive project was the replication of the existing buildings, which are very obviously a simulacrum of originals. Ironically, the back cover of the book bears the famous quote by Winston Churchill, "we shape our buildings, and afterwards our buildings shape us." [13] Furthermore, with regard to civic architecture, buildings such as Massimiliano Fuksas's Rikhe Park Theater, which has had its construction halted since 2012, were placed in Tbilisi's historic district without consideration for the unique urban and natural qualities of the city. The purpose of this out-of-scale, contemporary architectural landmark was with the two-fold intent of gaining European Union membership and reproducing the so-called *Bilbao effect*. [22]

The most insensitive project to be completed under the Saakashvili government is the Public Service Hall, also by Fuksas, that is colloquially known as "the mushroom building." Not only is the building's roof design inconsiderate of the concept of precipitation, and the building design completely unrelated to the adjacent Mtkvari River, but it was placed on the site of one of the few public parks in the city, eliminating much needed public recreational facilities. Additionally, the name of the park "Dedaena," which translates to "mother tongue," was inaugurated with that name after the famous

1978 Georgian riots against the Soviet regime's attempt to impose the Russian language as one of the Georgian SSR's official languages. The decision showed little regard for the symbolic implications of the building's placement, and the struggle of the previous generation to preserve the Georgian language, as well as the rebellious spirit which achieved Georgian independence in the first place.


Figures 3 and 4: The Public Service Hall by Fuksas completed in 2012

With regard to urban development policy, the westernization agenda is further evidenced through propaganda, like a banner appearing near the coastal town of Batumi in 2012 depicting real estate investor Donald Trump and President Saakashvili, bearing the claim by Mr. Trump that "in five years Batumi will be the best city in the World." Trump made this untenable claim, during his April 2012 visit to Georgia, on the basis of his so-called $250-million investments in Georgia with Silk Road Group to build a 47-storey Trump Tower. According to ex-partners, this deal was terminated in January of 2017 to avoid conflict-of-interest, as Trump began his term as the United States President. [2] It is clear here that Saakashvili was using Trump to legitimize his regime, and prove that the nation was taking progressive economic action, but this is obviously a complete fabrication.

With the insubstantial and insensitive transformations to the country, and the inability to catalyze a process for economic development beyond the tourism industry, Saakashvili both left himself open for intense criticism upon leaving office, and set the precedent for the further alienation of the Georgian people. He allowed the next political regime to take advantage of the people's anti-western, anti-liberal democratic sentiment, while making use of the Georgian Orthodox Church to appeal to nationalists. In a documentary produced after his term in office, titled *The Patriarch – The Most Trusted Man in the Caucuses*, Saakashvili is likened to Shevardnadze and Gamsakhurdia; paving the way for an even greater tyrant, Bidzina Ivanishvili. Bidzina Ivanishvili, an oligarch and the former Prime Minister of Georgia, has consumed the city's public land in the name of philanthropy via his Georgian Co-Investment Fund (GCF). He uses the Georgian Orthodox Church to further his political and economic agenda, and in the aforementioned documentary is quoted saying "we, the politicians, do not find it difficult, but rather easier to govern when our people have a spiritual mentor." With spiritual justification from the Georgian Orthodox Church, and complete control of the political elites, the ruling Georgian Dream Party is unstoppable in their ability to claim and develop any territories they wish. Most recently, the historic Pushkin Square, connected to the main Freedom Square, was gifted to the GCF for one Georgian Lari, or approximately $0.40. [21] In the environment of chaos, obvious corruption, and injustice it is not difficult to understand why members of the old generation hold onto memories from the Soviet years with nostalgia.

THE INDUSTRIAL PEDAGOGICAL TECHNICUM

Sitting in a marshrutka (mini bus) after a long journey from western Georgia, entering Tbilisi, travelers are met by a peculiar figure. Through the dense vegetation, a massive sculpture of a man with his arms and legs outstretched in liberation, head facing the heavens, and golden bat-like wings his most iconic feature. For nearly four decades the legendary neo-Vitruvian man stood in the midst of nude male and female figures, an allusion to the *new Soviet man* and a new Adam an Eve, and haunting children and adults alike with his intimidating aura. Scattered across the the massive sculpture, planetary bodies, numbers, a ladder, bolts, and gears – completely abstract, but obviously defining an epoch of industrialization that elevates the human spirit to heights never before reached. The relief sculpture affixed to the façade of the former Industrial Pedagogical Technicum theater, was rumored to have been created by the famous, and controversial, Georgian sculptor Zurab Tsereteli, but was likely completed by apprentices in his workshop because of its anonymity and the fact that Tsereteli does not have the sculpture listed in his publications or portfolio. Surprisingly, in February of 2018, the man's wings were taken, and then in March, nearly the rest of his body and other major components of the sculpture, as a consequence of an apparently irremediable process. How did this iconic copper sculpture survive the chaos of the Soviet collapse, while less precious wiring, steel railings, and rebar were stripped from its supporting building: why has the Tbilisi "batman" only suffered this humiliating disfiguration right now?

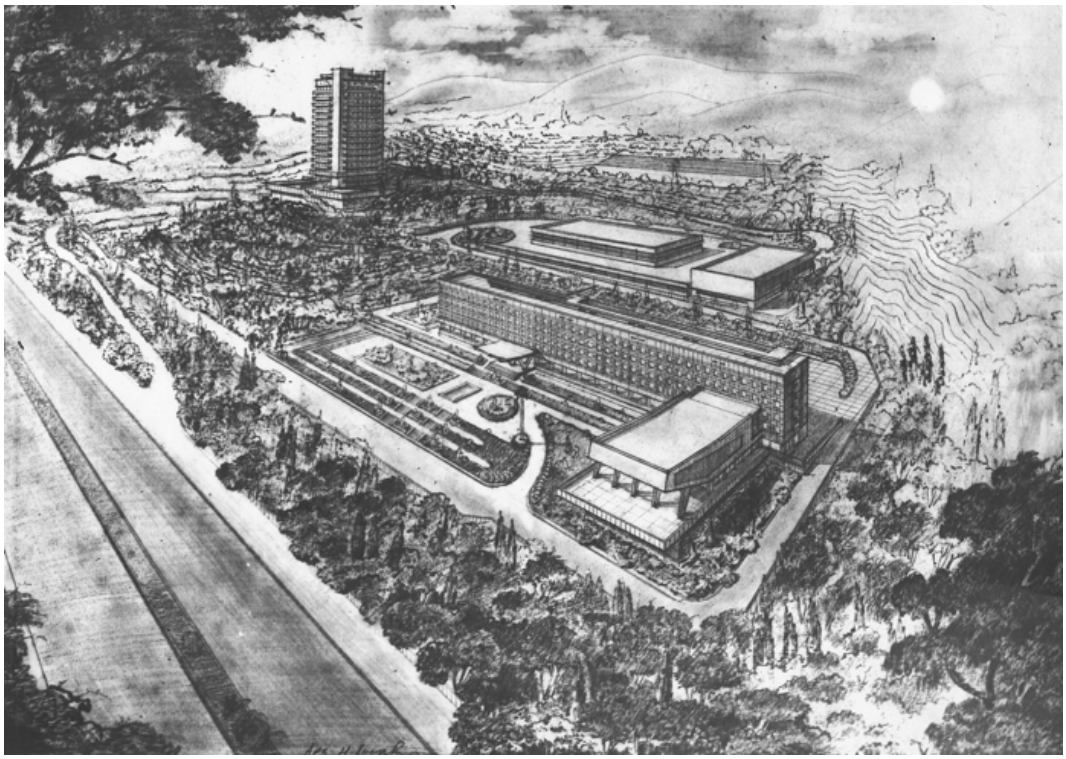

Figure 5: Industrial Pedagogical Technicum Final Perspective courtesy of Lasareishvili Family

The Technicum complex, part of an ensemble of monumental architecture, was completed in the same decade as the adjacent former Ministry of Transportation Building (now the Bank of Georgia Headquarters) and the current Fortuna FM Radio Building, in 1978. The building complex is massive, built on a mountain, and currently sheathed in dense vegetation. Before the Late-Soviet period, a public institutional construction of this magnitude would never have been built into a rugged landscape. The complex is comprised of a total of five buildings: 1) a main block that originally housed classrooms, a library, and the main entrance and lobby, 2) the theater/lecture hall building which has the sculpture attached to its cantilevered façade, and a large terrace, 3) an industrial teaching facility housing equipment, 4) a bridge that connects the main block to the industrial facilities, and finally 5)

a building that is separated from the others, father uphill, that was used as student dormitories. The building is site-specific; standing on the terrace, beneath the cantilevering theater, the adjacent hills are on the same level. The form, volumetric relationship of the exterior and interior, and fenestration of the theater are undoubtedly rooted in Russian Constructivism; it is inspired by The Rusakov Worker's Club by Konstantin Melnikov, but it has a unique character. The building also demonstrates an awareness of a breach in the so-called Iron Curtain. The typology of the project is reminiscent of projects by Le Corbusier and South American Modernists, like Affonso Reidy. What is the identity of the architect of a building of this scale in Tbilisi?

Figure 6: Industrial Pedagogical Technicum Theater Terrace

After visiting the Georgian National Archive, Tbilisi City Archive, Georgian Parliamentary Library, and Docomomo Georgia no information about the Technicum, sculpture, or architect could be found. Visiting the Tbilisi Architecture Union on Agmashenebeli Avenue also proved fruitless, because architecture drawings from the Soviet period had been discarded during the Saakashvili period, as a part of his agenda to eradicate the Soviet past. The faculty of the Georgian Technical University, however, exhausted an entire list of famous Georgian architects including modernists Shota Kachkachishvili and Zaur Beruashvili, and finally concluded that the architect was Nikolaz Lasareishvili. The family of the architect was the only resource which had possession of the perspective drawings and post-construction photographs of the Technicum, along with anecdotes from its construction. While speaking with the architect's grandson, Lasha Merdiashvili, I learned that his grandfather was struggling with the Technicum's foundations, until he was enlightened in a dream and told to move them back ten meters. And when the complex was completed, Lasareishvili's wife worked as a librarian there. The small anecdotes revealed the humanity behind the rigid structures - the people behind the monumentality.

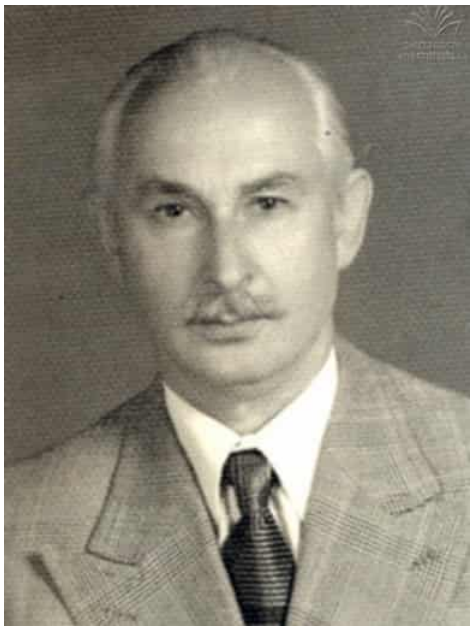

Figure 7: Architect Nikolaz Lasareishvili

SOVIET PUBLIC ARCHITECTURE POST-SOVIET COLLAPSE

After the Georgian-Abkhazian war, ethnic Georgians were expelled from Abkhazia and in need of refuge, tens of thousands of people traversed the entire country to arrive in Tbilisi. Without choice, these internally displaced persons (IDPs) occupied former Soviet public buildings, schools, and hotels. The most notable urban squat was in the center of the city in the iconic Iveria Hotel. Considering the building's location and the image that it presented, when Saakashvili was elected president, one of his first actions was to vacate the hotel, with the intention of its demolition to make way for a new *western* hotel. With a plea from the architect, Otar Kalandarishvili's, family the skeleton of the building was saved, but the balconies which originally wrapped the entire building were sheathed in a glass curtain wall: it was fated to become the Radisson Blu Iveria. [26] It was not only the Iveria Hotel that lost its original qualities, Saakashvili took initiative to remove several Soviet symbols across the city, including the famous Soviet monument known colloquially as Andropov's Ears, which existed in the former Republic Square, adjacent to the Iveria.

In the case of the Industrial Pedagogical Technicum, the Soviet run Industrial Ministry was defunct, and the building no longer had a purpose. IDPs began partitioning parts of the building and creating an informal living condition within. The site-specificity and monumentality which characterized the complex would become perfect conditions for their further alienation. Since the building is not centrally located, in a place where prospective tourists would not visit, accommodating for the Georgians living in the Technicum did not take precedence during the Saakashvili regime. Furthermore, the inhabitants were actually threatened with potential eviction since they have not been granted ownership of the building. The policy towards state property under Saakashvili's government, which was similar to Shevardnadze's, was "selling everything but our conscience." [17] The attitude of discarding and privatizing significant Soviet architectural landmarks across the city, began with the sale of the Palace of Rituals to the Georgian Oligarch Badri Patarkatsishvili. The Palace's muralist once stated in an interview, "it was a crime to sell this building, taking away the feeling of festivity from the youth and the public generally provided by the interior… [Patarkatsishvili] purchased whatever was offered for sale, but the one who sold it is a criminal." [4] At another moment of the interview, the muralist makes it apparent that the building was still in use by the public at the

time that it was sold. How could a building that is cherished in the public memory, and in immediate use be sold to become the residence, and burial site, of a single man?

After the Russo-Georgian War in 2008, there were more refugees seeking shelter who migrated to Tbilisi. They came to the Technicum, and began inhabiting the building alongside the Georgians from Abkhazia. The two parties built a partition along the fourth and fifth floors of the main block building, enter from opposite sides, and when interviewed, spoke ill of each other because of the aforementioned residual ethnic tension. The refugees displaced in 2008 maintain that the inhabitants from Abkhazia are more financially stable but are living in the building waiting to receive a government handout when the building is sold. After exiting, going up the stair to the other side, the same sentiments were shared, the Abkhazian-Georgian IDPs saying that they do not wish to be associated with their *neighbors*. On both sides of the border, inhabitants are burning wood for warmth, from the trees that they cut down on the premises. The wood is stored in the makeshift common areas and can be seen through the windows as soon as the Autumn cold covers Tbilisi. The inhabitants would prefer to run gas lines in the building, but have been forbidden from doing such by the government because the building is not privatized in their name. The original toilets from the Technicum are shared by entire floors of inhabitants, and some additional ones have been added in a few of the makeshift units – some toilets placed directly off the hallway. Wastewater is run through pipes that are punched out of the building's back façade. Altogether the building is inhabited by approximately 60 families, but some new units have appeared between the Summer of 2016 and the Summer of 2017. When we asked the them how they felt about living in the building, answers were mixed. One man made a remark in admiration of the integrity of the Soviet materials and construction, saying "it is much better than that cheap Turkish cement being used today." Certainly, everyone agreed that the conditions in the building were far below any acceptable standard, however, the communal qualities of living in the building are the little solace that come with immense hardship.

In addition to the building's inhabitants, there are an additional two parties occupying the main block building, an elementary school located on the first level of the building on the northern side, and Icarus Tourism College. The elementary school's premises are under the ownership of Tbilisi City Hall, and it was placed in the building to accommodate for the inhabitant's children, as well as children from the neighboring community in the Dighomi district. Icarus is leasing the southern side of the first through third floors of the same building from the Georgian Ministry of Economy, the organization which presides over all obsolete state property. All parts of the complex which are not owned by Tbilisi City Hall, are under ownership and control of the Georgian Ministry of Economy. In a meeting we organized between the directors of the Tourism College and representatives from the Ministry of Economy in November 2017, the School's directors expressed that if the building was ever privatized in their favor, they would not hesitate to evict the IDPs. The IDPs are subject to abuses by the College's leadership which on one occasion forbid a resident access to the roof to patch leaks that were directly effecting his family in their apartment. The former theater building is in ruin except for its primary structural elements, and is filled with several cubic meters of damp rubbish. On the roof of the theater, there are two cellular towers belonging to a local telecommunications company which is renting approximately nine square meters of the building from the Ministry. The industrial workshop building, made out of prefabricated elements, is intact and in fairly good condition, but the industrial equipment which has been in the building since the Technicum's foundation has been slowly disappearing since the Autumn of 2017. The bridge originally connecting the main block and workshops has been blocked off, the ghost of the doors appearing on the second floor of the main block, above the lobby.

CONTRIBUTORS TO DESTRUCTION: POLITICS OF THE SEEMINGLY OBSOLETE

Figure 8: Vandalism to the façade of the Industrial Technicum sculpture in April

There are several threats to the former Industrial Pedagogical Technicum complex, beginning with its Soviet-ness; Modern building's association with the imposed, foreign totalitarian regime is used as the main premise for sale and destruction. The second threat to the Technicum, is the complexity of the politics surrounding the ownership of the building, its inhabitants, and potential investors (both those wanting to capitalize on the Technicum's unique industrial history and those wanting to raze and redevelop the real estate). The final threat to the Technicum is scavengers who are still visiting the building and removing steel railings and industrial equipment to sell in the local market, under the watch of the administration of both schools, the inhabitants, and the ministry which owns the building.

In 2012, Tbilisi almost lost an immensely valuable institution because of anti-Soviet sentiment. The National Scientific Library of Georgia, boasts a collection of approximately 5 million books, and holds some of the earliest printed books in the Georgian language. In addition to the collection of Georgian books, the library also has a large collection of books in English, Portuguese, and German dating back as the 14th Century, that were said to have been brought by German soldiers during World War I. The library, one of three main libraries in Tbilisi, was going to be demolished to make way for new development, but the library's director, Irakli Garibashvili, and several urban protestors demonstrated to save the building. The anti-Soviet mechanism was used in the rhetoric of the Saakashvili period (and post-Saakashvili period), for the destruction of institutional buildings, which would result in the further alienation of Georgians. The library now makes use of its large interior expanses to host exhibitions by local organizations like Propaganda network, as well as public lectures and workshops. The library hosted a symposium organized by our team, UNDETERMINED, in November of 2017, discussing Soviet architecture within the context of the system, gentrification in post-Soviet space, and the uncertain future of Soviet architecture in Georgia.

Figure 9: Visiting the Technicum to better understand the living conditions

Much like the Scientific Library, the Technicum's inhabitants claim that the complex was nearly sold to investors twice during the Saakashvili regime. The fear of eviction without compensation would leave the inhabitants homeless, and is not unfounded. From my first few interactions with the Georgian Ministry of Economy via the National Agency of State Property, in June and July of 2017, I was asked multiple times, with excitement, if I was going to purchase the building. When I explained that I was interested in using the that there was no previous precedence for such a use of state property; it would have taken much less effort to purchase a public building than to use it for a cultural event. It was only after a series of meetings with the heads of the National Agency of State Property that we were granted the permissions to use the Technicum theater for our purposes. Though our initiative team was able to gain the trust of most of the building's inhabitants and mitigate the fears of our interest in purchasing the building, there was some skepticism among others about our frequent visits. This skepticism led to a renewed fear of eviction, resulting in damage to the building. On September 30, 2017, we noticed that some interior walls in the theater which were discontinuous with the inhabitants living quarters were demolished, and on November 4, we found that the cladding on the terrace of the same building was removed. The interest of the Georgian government to sell the building or real estate, Icarus Tourism School's interest in privatizing the building in their favor, and the interest of the IDP's to maintain shelter, and the failure of any of these parties to communicate, leads to further destruction of the Technicum. Additionally, in late October, during a visit to the building, we witnessed two men removing steel railings and window framing from the theater. When asked why they were removing the materials, and after expressing that they were stealing state property, they casually and indifferently replied that they were going to sell the materials and that the state did not care about the building any longer.

While working with the National Agency for Cultural Heritage Preservation of Georgia, former partners of our initiative team, we were trying to have the building or sculpture listed in the Georgian National Registry. This status would require the Georgian government protect the building from further damage. The Director of the Agency and the Head of the UNESCO Preservation Unit, who were originally very excited about the idea of preservation and adaptive reuse of Soviet architecture in Georgia, and were fully knowledgeable of the building, suddenly lost interest in the project. Members of our initiative team were invited by the Agency to attend a weekly Counsel Meeting to present a case for the Technicum's listing in the National Registry. Upon arriving to the office which we were told to attend the meeting, we were told that the meeting was moved to an office in a different district. We received a letter on November 20, 2017, that no part of the building was to be listed in the Registry, and the building was not designated by a narrow margin in the vote. We made the intention clear to the Agency for Cultural Heritage Preservation that we would make an attempt to again have the building and sculpture listed, to which we received no response. Ties between our team and the Agency were severed, and only a few months later, the sculpture began to disappear. In this complex political climate surrounding the building, it is uncertain who is behind the dismantling of the sculpture, or their reasoning; we will not speculate. On April 13, 2018, our team delivered a letter to the National Agency of State Property demanding that they begin an investigation into the issue. On April 23, 2018, we received a response that they have contacted the local police, and will be more earnest in their preservation of the remnants of the sculpture.

UNDETERMINED: THE FIRST INITIATIVE

Our initiative team failed to preserve the sculpture on the façade of the theater of the Industrial Pedagogical Technicum, and perhaps our intervention even unintentionally initiated or expedited the destruction, but the recent events have provided a clearer insight into the complex politics surrounding the building, the attitude towards state property, and the attitude towards preservation of Soviet public art. The different interest groups attempting to control the building, the people who rely on it for shelter, who use it for education, and who wish to exploit it for money, are the exposed foundation of a greater project, at the urban scale and national scale.

The Undetermined Initiative began with a meeting between the directors of Campus: Advocacy Center for the Arts and Art Education, Natalia Nebieridze and Mikheil Khundadze, the editors of Danarti Magazine, Elene Abashidze and Ana Chorgolashvili, and myself, an independent researcher. After finishing the initial research and investigation regarding the building, collecting information and images from the architect's family, initiating the dialogue with the building's inhabitants, and gaining the permissions to use the building for an exhibition (an idea that remained unrealized) and workshop in the Technicum, we gained momentum in organizing the event and working with the aforementioned government Agencies. The work which we had done in the following months culminated in the organization of a symposium we called UNDETERMINED, held at the National Scientific Library for both symbolic and public purposes, given the building's previously mentioned pardon from demolition. The symposium was aimed at addressing the pertinent urban issues in Tbilisi – the post-Soviet reality, outstanding issues from the Soviet years, and the future visions of the city. The general topics of discussion were cultural heritage preservation and urban development and their symbiosis, gentrification, the historical context of Soviet architecture, the value of renewal of Modern structures, and the movement away from monumentality through inhabitation of monuments.


Figure 10 and 11: UNDETERMINED Symposium at the in November of 2017

The conclusions of the dialogue at the Scientific Library began with a discussion of foundations and partnerships for a new organization with the objective of adaptively reusing Soviet public buildings, while considering the complexities, values, and the local dissention. The final opened with a discussion about what our task would be (a reference to the lecture given by David Bostanashvili about Soviet architects and their concept of task). Our tasks were to 1) imagine the potential futures of the building, 2) create a strategy to engage the interest groups in the building and the public, 3) document the buildings inhabitants in a census, and to 4) make a focal intervention in the building that would reintegrate it into the city. We then discussed the buildings positive values: 1) aesthetic value because of the industrial nature, monumentality, and vast public space, 2) historical value as a "morpho- political" object because of its presence in the city, 4) potential institutional value, 5) practical value as a built structure, and 6) potential economic value because of tourism. We then discussed the negative connotations and discussed issues of 1) negative memories because of the association with the last regime, 2) the horrific living standards for the inhabitants, 3) the monstrous presence (that is the other side of iconic presence), 4) accessibility, 5) low aesthetic quality to ordinary people, and 6) institutional materiality associated with the past regime. We then further discussed the Technicum's current value beginning with the fact that it is 1) not abandoned, 2) the informal occupation by the inhabitants, 3) lost functionality, 4) economic deficiencies, and 5) the potential future appropriation or inhabitation. We then discussed the future value; the building could be used by public institutions while maintaining the current inhabitants. The conclusion of this discourse was that 1) the society which built the building no longer existed, 2) that there was a risk of corporate gentrification, 3) that because it exists as a part of the past, it should be saved, 4) there is a need for technical education, the original purpose of the Technicum, 5) there is a need to resolve the urban issues in Tbilisi, 6) the existing conditions ought to be closely considered with any intervention that is made, and 7) the functions need to be added for the building to be integrated in the city.

A NEW ATTITUDE: IDENTITY, IDEOLOGY, *INHABIT*!

The present circumstances surrounding the former Industrial Pedagogical Technicum within the historical and present context can be portrayed as follows. While the city disavows the existence of the building because of its location on the periphery, distanced by its monumental placement and concealed in dense vegetation, the building simultaneously negates to identify with the city, given its foreign communist origins, which reject the local identity through ideological symbolism, causing the building to fall under the present conditions of dilapidation and neglect. Furthermore, the building is

occupied by two ethnic identities that refuse each other, while the government ignores them both, because of ethnicity in one case, but more generally out of mere dereliction. The Technicum negates itself currently because it no longer holds its original identity, which was lost with the collapse of the Soviet Union, and furthered recently with the loss of the relief sculpture on its facade, the last trace of its cultural and ideological identity. The situation is excessively chaotic – nearly void. The question then becomes how identity can arise from almost completely depleted conditions? Identity is typically concerned with itself, and this is seen in Georgia immediately following the Soviet collapse, through the actions of the ethno-nationalists, in the attempted elimination of an abstract "other." Another way to find identity, in void, is to adopt a new identity, which was the established national agenda during the Saakashvili regime. The first way that it ought to happen is more Hegelian, that is surpassing the contradiction: instead of simply "I am Georgian, but not Soviet," then "I am Georgian while also something else," identity should not be exclusive. That is to say, Georgian identity is not contingent on the Soviet, but that because Georgia was Soviet, *Soviet-ness* remains a part of the Georgian identity, heritage, and history, resulting in an identity that is neither Georgian nor Soviet. Meaning that Georgian identity, like any other identity can not be a *pure identity*, purity being the mere reflection of self, but rather a complex mixture of historical and cultural elements compounded over millennia. The history of Georgia after the 12th Century is that of a country and people who were conquered and fragmented because of the control of several empires until the annexation by Russia and incorporation into the Soviet Union, and that complex history cannot be eradicated. And the presence of the *other*, the *foreign,* allows for an awareness of self, which is the foundation of identity. When history is erased, autocracy, exploitation of the Georgian people by tyrants, and even an ironic nostalgia for the Soviet regime is perpetuated, as has been the case since the inception of Georgian independence.

Figure 12: School children climbing on the terrace of the former theater during a school break

Our response to the current situation surrounding the former Technicum is that of a *critical realism*, an attitude that accepts the situation as it is, but is not passive, and better prepares to act and address

it accordingly, with positive pragmatism. It is not merely the use of common sense to inhabit, or adaptively reuse buildings because they exist or because of their present occupation. To further "*Inhabit!*" the building is not merely a pragmatic solution, it is a critical ambition to challenge the present conditions; it is a big positive step through negating the previously mentioned denials – to challenge and contest the existing reality. The rebuilding and westernization which took place under Saakashvili, is not Georgian in nature *per se*, despite the fact that it is now a part of Georgian contemporary history and the urban environment. It can be simply described as *neoliberal* [9] or abstractly *western* – an attempt to erase the Soviet identity without critically negating (or addressing) it, and without offering any alternative or authentic way to Georgian identity. While blindly erasing Soviet identity, the Georgian is also abstractly eliminated, perpetuating the extreme conservative and fundamentalist ideologies. Furthermore, ideological symbolism does not supersede reality, if that approach was feasible then the Soviet Union would have never dissolved. Thus the previously mentioned cathedral designed by Butza in the early years of Georgian independence, which was designed to ideologically reunify the country, results indeed in a veiled continuation of Soviet symbolism and monumentality in its counter tactics.

Perhaps the initial fascination to the former Technicum stemmed from the lure of the relief sculpture on theater façade – as the bewitching songs of the Sirens in Homer's *Odyssey* attracted Ulysses (Odysseus) and his ship's crew; ideology manifested in art led to an unveiling of a dismal situation. The sudden and shameful disappearance of the sculpture strips the scene of beauty, but confronts us with the cruelty of love at its core. It may well illustrate, in this case, a first act in a movement towards something more substantive than the placement of ideological symbols by a distant authority – the *act* of ironically unintended deconstruction of illusory identities and ideologies.

The first step of inhabitation is dismantling – a necessary act of appropriation. To *inhabit!* means more than coming in and re-using a building, it is also the reimagining of its identity; the fall of the relief sculpture is not the fall of the building, but the fall of outstanding aesthetic idealism. We are not suggesting that the immediate reuse of this building (or others) will resolve the national issues in Georgia or other ex-communist states, but that it is a necessary step in confronting past idealism with new ingenuous idealizations. If the building is finally demolished, if existing symbols are replaced with more contemporary ones, or only the monumental skeleton is what will be reused, it would not be truly critical to the identity. The phenomenal icons from the past regime, which we certainly would love to be protected (for artistic, historical or museological reasons), should not, however, necessarily be left untouched as they somehow legitimize the idealism they audaciously represented, stigmatizing them and even preventing definite inhabitation. In its present condition, with the sculpture being crudely dismantled and sold for its rough material and weight, the building has lost its aura and authority, but simultaneously its distance (meaning its unapproachable monumentality, its presence as "the house of the people" to be seen by the masses from afar).

A new *Inhabit!* attitude will be fulfilled when these structures finally become simultaneously public and intimate, and when they truly live up to the ideals of the past without pretension. In the case of the Industrial Pedagogical Technicum, built with noble public intention and predicated on artistic but monumental and ideological expression, the observed fall of Icarus and its wretched end, may allow Georgians to deem, acknowledge and dignify the current organically occurring inhabitation of the building, further strengthening its dwelling potential, while reconciling the Technicum with Tbilisi's urban fabric, embedding it in the local communities to house a genuine renewal of social spirit.

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ADAPTABILITY AND APPROPRIATION WITHIN DWELLINGS: ADAPTATION POTENTIAL IN APARTMENTS FROM THE 1960s; THE CASE OF HUKUKÇULAR RESIDENTIAL COMPLEX IN ISTANBUL

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Abstract:

Along with modernity, the concept of dwelling which has been transformed into a meta should be re-questioned considering the consequences and problems occur today. With modernism, the state of being detached from "the place" and confined into closed boxes have resulted in the loss of identity and individuality thus came out the problems of losing sense of belonging and alienation. Home in its essence is related to concepts such as 'settle', 'permanence', 'continuity' beyond physical being, it exists with a body and its experiences.
Transformation of "dwelling" as a physical meta into a "home" again can only be possible by reconsidering individual and life. Considering the changes in individual, family structure and lifestyle or social, economic, environmental changes in general, home should be able to adapt to such changes. Especially nowadays, the age of movement that every condition has been changing rapidly, how do we perceive 'home'? Is it possible to feel belong to 'place' ? What should we do to feel such belonging? Asking such questions brings us to the concept of "adaptable" which means "the potential of being able to change" and transformation according to the user and its changing needs brings us to the concept of "appropriation".
This study intends to interpret the concept of adaptability, which is formed as a result of the analysis of the concepts aiming to provide solutions to present-day problems, with Unite d'Habitation which presents a different approach to the concept of collective housing in the socio-economic conditions of the 1940s, but still bears an 'individual as a fixed input' and mass production logic of standardization. The aim of this study is, to evaluate adaptability in the case of Hukukçular Residential Complex, one of the remaining structures of the period which can be read as re-interpretation of Unite d'Habitation within the socio-economical frame of Turkey in 1960s, and aims to open a discussion on how to move adaptability forward, considering the technological and constructional advancements of today, from where it stays in the 1960s.

Keywords: Adaptability, Appropriation, Open Plan, Transforming, Re-Using

1.Introduction

Main focus of this study is to examine the disconnection between inhabitants and their spaces of living. This problem of disconnection originates in the era of industrialization. In that era, production is rendered as a ready-to-consume object (product) that is produced for a prototypical, standardized subject. This accelerated standardization in every area eventually effected the architectural production. The early 20th century marks the period that problems of the standardization started to be realized and consequently first solutions were produced. Le Corbusier created a flexible interior area with detaching structure from other building elements in Maison Dom-Ino, Mies established the theory of 'open plan' based on it. However, these early initiatives were left aside following the post-war social and economic problems such as population growth, or inadequate housing means; and the idea of standardized mass production was reestablished. In this standardized system of production, user is perceived just as a physical object, or a norm. The standardization, which is vital considering the conditions of the period, presented a distant perspective from humanism and disregarded the user as a subject. Then the user became alienated to the product that is presented. Social transformations of 1960s paved the way for the reconsideration of problems related to standardization, and from the humanist point of view, individual regained importance. Reactions towards mass produced housing projects brought forward the pursuit of alternatives. Although these discussions lost acceleration in 1980s, it seems that there is a rising interest again. At this point, it is fundamental to scrutinize the historical perspectives about the problems and then move forward in the light of the obtained arguments and potentials of present day.

2.Research Method

In this article, the problems that leads to concepts of 'adaptability' and 'appropriation' will be explained, and to propose a base point for solution, certain other concepts will be introduced and discussed. First of all, how the term 'Adaptability' is perceived, how it is different from the term 'Flexibility' will be discussed in line with the studies conducted before. In a historical perspective, various perspectives will be presented regarding this matter in conventional, modern and post-modern architecture. After forming an etymological and historical background*, open building, appropriation, transforming, reusing* concepts will be further clarified around this subject with the question of how a system that

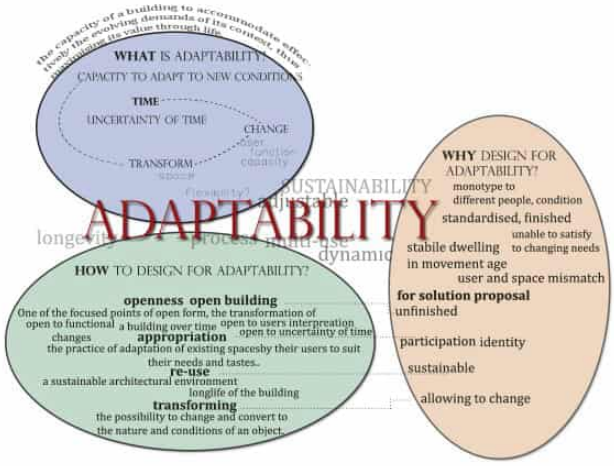


Figure 1. Conceptual Boundaries

is incomplete, provides participation to user, allows change and sustainable as opposed to today's standard, finished, rigid forms can be developed.

This study will focus on Hukukçular Residential Complex, built in 1967, and reexamine above concepts. Not only similarities and contrasts between Hukukçular Residential Complex and Unite d'Habitation by Le Corbusier will be established, but also both structures will be examined considering the concept of 'adaptability'. Consequently, adaptability conditions of these two structures, which were built in different periods, under different social conditions while sharing a similar design approach, will be presented. The concept of 'appropriation' will be discussed in a broad framework in the case of Hukukçular Residential Complex, moreover, its present condition and its potential of appropriation according to inhabitants, considering the transformations it had, will be studied.

3.What is adaptability?

In the transition process of a static product to a dynamic, vital flow, and an existential continuum, there occurs the element of 'time'. Then, time brings forth the 'uncertainty' for the very conditions of future. Parameters of design such as user, function, and capacity might subject to change in time, and this possibility of change requires a potential of adaptability of a space. At this point, we encounter different concepts and comments about the space being subject to change. The concepts of 'adaptability' and 'flexibility' are frequently confused. Besides there are different opinions, they are used interchangeably. As defined by Stewen Groak, 'adaptability' is the potential of being adaptive to different social uses, and 'flexibility' is the potential of being adaptive to physical arrangements. Assuming that adaptability concerns utilization, then flexibility includes mostly formal and technical issues.

As 'adaptability' is interpreted as an inclusive element of resident and residence relationship, and as carrying the potential to response temporary needs of inhabitants; use of the word 'adaptability' is preferred in this article.

4.Historical Backround

4.1. Pre-modern Era

If we define adaptability as a potential, that gives the resident a chance to create his/her own residence according to his/her needs and to adapt it to the new conditions of time, then it is possible to link the beginning of this argument to the beginning of building construction. Examining the first primitive structural formations of nomadic societies, they can be interpreted as temporary and instant structures of reactions which are built to meet various needs of that society in conditions of the time. They built a single, wide open space that could bear variety of functions for various activities, and by using independent structural and

envelope systems they created a convertible structure for any condition or function. If the process of construction is scrutinized from primitive period to modern era, it is possible to acquire various data on adaptability from different geographies, construction methods and architectural approaches. The Renaissance architecture, for example, has been able to serve variety of functions, using the advantage of its glorious dimensions. In the traditional Japanese system of construction, free spaces are offered to be shaped according to the needs of residents. The fact that Dutch Canal Houses were not planned according to a functional arrangement gave the user the freedom to transform them according to their own needs.

What makes the old canal houses so livable is that you can work, relax or sleep in every room. (Hertzberger, 2005) (1)

Figure 2. Viollet-le-Duc, First Hut

Figure 3. Traditional Japanese Home

In Turkey, there is a pre-modern, traditional construction system in which residents form the space according to their own way of life and then participate in the construction process. The space which is formed as 'Sofa' might serve to different functions. Moreover, extensions and changes according to needs were performed by the residents, using local materials in most cases. In the traditional period, it is possible to talk about the architecture developed in a process in which the users establish a direct relationship with the space they live in, participates directly in its construction, add their identity and culture to the structure and shape it with their own materials compatible to different conditions.

4.2. Modern Era- Open Plan

Both new materials and construction systems following the Industrialization period in mid-19th century, and new lifestyle following modernity in early 20th century were related to adaptive system. Approaches encouraging adaptive system with using lightweight materials, or structures supporting open plan were on the table. Still, with the social and economic forces became dominant after the post-war housing crisis and accelerated demands of population, interest in standardization of housing production is increased, therefore quantity of property became more important than quality, and in the end, home was industrialized. In this manner, examination of positive approaches will be more suitable to understand the concept of adaptability in this process.

Open Plan: In 1914, Le Corbusier created Maison Dom-Ino, the first example of the open-plan idea, by detaching the structure from other building elements. As partition walls are freed from load-bearing properties, the flexibility of interior space is achieved. Then, Rohe proposed a residential building pattern that can offer twelve different plan alternatives using open plan system. Archetypes of patterns concerning adaptability were produced with the use of mobile partition walls and its independent facade from the structural system.

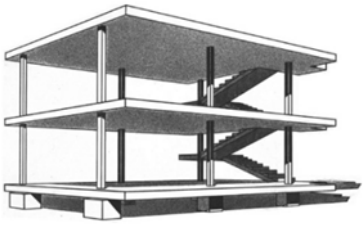


Figure 5. Maison Domino, 1914

Figure 6. Weisenhoff, 1927

4.3.Post-Modern Era- Open Building

In the light of social transformations, 1960s marked the period that the protests towards mass production of housing projects is increased and the search for new approaches were begun to discussed.

Open Building: In his book 'Supports, an Alternative to Mass Housing' published in 1962, Habraken materialized the Open Building approach. In the book, Habraken proposes a model based on supports / infills and explains further as "A support structure is a structure that allows the provision of houses (infills) that can be built, modified and disassembled independently from each other." Since the system of infills is easy to modify according to the needs of the residents, many different conditions could be accommodated and resident is given the possibility to adapt the house according to the changing needs.

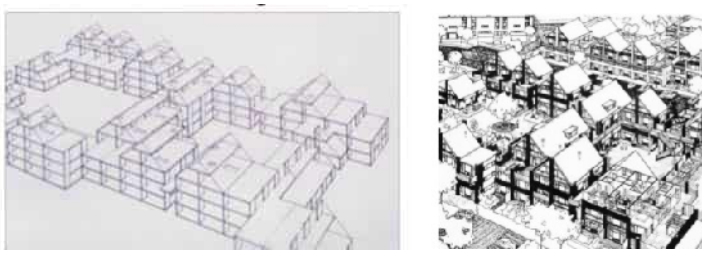


Figure 7. Molenvliet, Frans van der Werf, 1974

Although the arguments made in the spirit of humanism have lost its momentum around 1980s, it becomes influencing again in 1990s and still remains its place in frequently discussed issues of present architectural sphere.

5.Problems- Why Design For Adaptability?

5.1.1. Problem: COMPLETED DESIGN EXCLUDING THE USER

The main source of the problems discussed is the presentation of a finished, ready-to-use product that does not give the resident a chance to intervene. As a consequence of the economic pressures, housing production has been reduced to the point of producing a fixed form as an object that has been designed and finished in the industrial production logic, up to its furniture layouts, in which houses are defined with the number of rooms, and independent from all conditions and residents. This physical image of the 'house' is only one of the characteristics of home, beyond that 'home' is intertwined with many cultural, economic, social, and psychological conditions and is also subject to uncertainty of time. However, in present situation, 'house' stands as a finished and fixed object, which neglects the changing conditions of time, and shuts itself permanently for the possibilities and user comments.

The user, who is considered together with other physical objects, is an "apparent" input for the product-oriented approach that architect planned since the beginning of project. In this sense, it can be said that one of the most important reasons for the user to fade into background, in the relationship between the architect and the product, is the "finished" status of the product. (Atay, Güldehan, 2011) (2)

5.1.2. Anti-Thesis: UNFINISHED, INCOMPLETED DESIGN

In order to propose a solution to the problems identified in the completed product, the condition of being incomplete or being left unfinished should be examined as an anti-thesis. Space should be perceived as a constantly developing organism, and an extension of body. At the point where the space changes according to different processes, incompleteness can be seen as a power that provides the natural flow of life. Incompleteness creates a motive to complete. The object that left unfinished will be finished by its subject considering the necessities of the time, and the bond between the object and the subject will be re-established.

We should see buildings not as finished, stationary works but imperfect objects whose forms are in flux, evolving to fit functional, technological and aesthetic transformations in society. (Schmidt III, Robert; Simon, Austin; 2016) (3)

In relation to the 'unfinished design' syntax, 'space is an abstract entity that lacks certain aspects until it is experienced and stimulated by its users.

5.1.3. Reflection on Architectural Space:OPENNESS,OPEN PLAN,OPEN BUILDING

Discussions against the problem of being static and fixated brought about by modernism have focused on a less-defined design approach that allows for user interpretation and change. The uncertainty and unpredictability of time requires an openness in which space can be constructed in different ways. The simple ambiguity of the space provides protection against functional constructions, accommodates adaptations to different uses, and allows for user interpretation. 'Open plan' and 'Open building' approaches are developed following that understanding.

The most fundamental feature of the incomplete and unfinished "open end" product is that the user has the chance to complete and "interpret" it by himself/herself. (Eco, Umberto, 2001) (4)

5.2.1. Problem: THE TRANSFORMATION OF THE HOUSE INTO DWELLING AS A COMMODITY, THE DECOUPLING OF BODY

This problem can be read as the result of the problem discussed above, and as its continuation. The concept of mass production of ready-to-use items was also applicable for 'home', and the standard plans produced according to an idealized family structure were replicated on top of each other to form present concept of dwelling. Accordingly, users who do not have any interaction in the process of planning, production and even use, and who only exist with sizes, dimensions and numbers, are fail to feel sense of belonging to space. This resulted in the loss of 'home' feeling.

"*It can be said that the 'modernist processes of production,' on the other hand, put the architect as a 'one and only power' in the center of architectural production and made the relations between the architect and the product strictly interdependent. Within this "dependency" relationship, the user does not go beyond being the "whole body of physical data'' (2) Being an observer clearly reveals the profile that follows the production of the subject transformed into user. (Atay, Güldehan, 2012) (5)*

"We can say that man is not seen as a point of action in the modernist processes of production. Objects are also designed independently from the people. According to this, man does not go beyond being a subject who witnesses this kind of evolution and yet remains in discourse, a subject who follows the end but does not 'participate in the cycle.'" (Eisenman, Peter,1976; Hays, Michael,2002) (6)

5.2.2. Anti-Thesis: IDENTITY, PARTICIPATION

The transition from the traditional housing scheme to the standard uniform housing scheme of the same size resulted in the disappearance of the identity. Turning back from this point is possible in the continuation of the previous solution proposal, users should fill the gaps that are intentionally left incomplete and comment on the shortcomings, according to their temporary conditions and needs. In a system that has been left incomplete, there is a state of mutuality between the individual and the place that redefines and completes the space in every action, the individual becomes unique, acquires character and self-identifies himself/herself and participates in the space as opposed to the individual who feels alienated in standardized, closed systems of today, and feels belong the space. This kind of interaction between individuals and their spaces of living will bring back the 'identity.' In the flux of life and in the dynamic process, only the organism-like growing built environment as an extension of the body, can protect its identity.

5.2.3. Reflection on Architectural Space: APPROPRIATION

The fundamental concept in the transformation of perceived space to a lived space, or specifically in the transformation of 'house' to 'home' is appropriation. Appropriation in architecture is the ability of existing spaces to be adapted by the users according to their own conditions and necessities while being able to add their own identity to space.

To have an appropriated space means filling it with personal and social meanings. (Kösten, Elif) (7)

At the Conference 'Building, Living, Thinking,' while mentioning about the house where man contributed to the construction process and thus felt connected and belonging, Heidegger said that only in such a situation man can become part of the community.

If the space of living allows appropriation, it may respond to different requirements and functions over time, which enhances the sense of belonging by the transformations of the users who can transform it concerning their cultural identity, alongside with the increasing continuity and lifetime of the building.

Figure 8. Open plan and facade that enable for appropriation (Nid d'abeilles/ Carriere Centrale housing / 1953 – 2003)

'The principals at the foundation of open form is that no artistic expression is completer until it has been appropriated by its user or beholders ' (Hansen, Oskar,1959) (8)

'Architects such as Herman Hertzberger and the late Otto Steidle welcome this revised value system through working with the principle of 'incomplete' space — a space and/or structure that anticipates change through infill or other appropriation.' (9)

5.3.1. Problem: RIGID FORMS THAT FAIL TO RESPOND CHANGING NECESSITIES

At this point, there is a single-typified construction system, which is considered as a commodity and produced in a standardized approach, from its plan to its furniture layout. As a commodity, ready-to-use product is designed to respond to instant needs, and considering the sustainability of the construction sector, it is targeted to change with a new housing form at the point where it cannot respond to change.

5.3.2. Anti-Thesis: ADAPTATION TO CHANGE

In today's age of movement, speed and accordingly change is very effective. Various impacts in the life cycle of an individual, such as the needs, the family structure, environmental influences, social and economic factors, change rapidly in time. The influences of this change is reflecting on the space that individual lives. The problem of static and rigid constructions today is to obscure this vital flow and to serve a single part of life, and shortly thereafter to cause inconsistency between the user and the space. In the perception of space as a living and dynamic organisms in the extension of the body, the space must be adaptable to the needs of the user.

Miller describes the house as a process in which we are in, beyond being a physical form. Therefore, the uncertainty brought by the phenomenon of time requires adaptation to all possible circumstances and change.

Venturi and Scott Brown switch the architectural adage of 'form follows function' to 'form accommodates functions' to be more appropriate to a dynamic World.. (2004)(10)

5.3.3. Reflection on Architectural Space: TRANSFORMATION

Following the questioning of the static space brought by modernism, a dynamic and transforming idea of production has begun to be discussed. In this period, when the phenomenon of individuality and identity are on the foreground within the perspective of humanism, an open system setup that can be changed by the user when necessary, should be constructed instead of trying to foresee the best considering the heterogeneous structure and the unpredictability of time.

While defending the production of an architecture that can be changed by 'instant effects', Colquhoun argues that it can only be possible if strict boundaries and static understanding of forms are abandoned.

'The user plays an active role in the structure. The architect's role is to provide the user with a 'cage' in which he can choose his own behavior. The comfort of the user is not the result of any form forced into the environment by the architect, but the result of his own momentary activity.' (Colquhoun, Alan,1985)(11)

In 'New Babylon' project, in Amsterdam, in 1960, Constant Nieuwenhuys has created flexible and transforming spaces instead of stable and static spaces. This structure, which is left unfinished, allows users to form their own environment. Spaces that everyone can transform according to their immediate needs encourage different life styles and experiences.

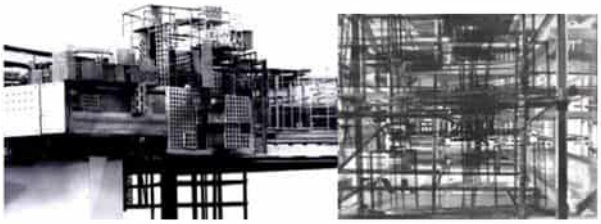


Figure 9. Constant Niuwenhuys "New Babylon"

5.4.1. Problem: OBSOLESCENCE

The intended result of all the problems mentioned above, a finished, static design that disregards the user, is to make the space unusable by not meeting the needs and then that space become obsolete. The housing, which is shaped on a physical stability, will be inadequate when it is unable to respond to the changing structure of life. In this way, the search for a new housing will start and the construction sector will survive. The developing world based on the aging of consumer goods. The same strategy also presents itself in the field of architecture, and the housing, which is produced as a commodity as intended, fails to meet the need after a while and becomes obsolete.

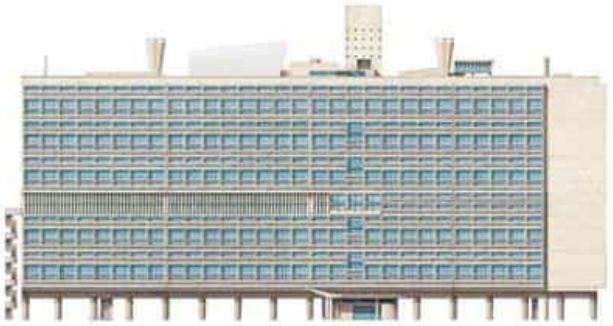
5.4.2. Anti-Thesis: CONTINUITY IN USE, SUSTAINABLE DESIGN

As a result of the suggestions presented to the above mentioned problems, when the user can be involved at all stages and the building has openness to encourage this, the building remains operational and is therefore sustainable. The structures whose functions are not fully defined considering the uncertainty of the time, may react to social or economic demands and pressures that may arise, allow different uses and thus prevent aging. Considering the argued concepts, and the proposition of adaptability as its responsiveness to change, the purpose of adaptive design is continuity in use.

5.4.3. Reflection on Architectural Space: RE-USE

In the light of all the problems and solutions discussed until this point, the goal is to reach an adaptive system that can respond to all the possibilities that may arise and to ensure continuity of use through reuse and then to maintain sustainability.

Being adaptive in the short and long term is important not only for the people living in the space, but also for the lifetime of the physical structure of the building.

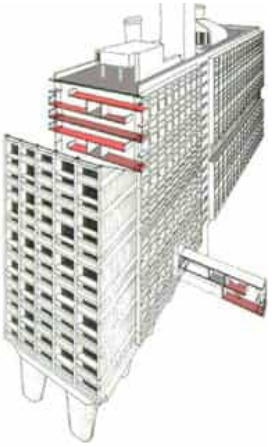


Figures 10. Unite d'Habitation at Marseilles

6. INTERPRETATION OF CONCEPTUAL DISCUSSIONS THROUGH THE UNITE D'HABITATION AND HUKUKÇULAR RESIDENTIAL COMPLEX

6.1.1. UNITE d'HABITATION

Le Corbusier designed this project in 1945 as a building group of three blocks to provide a solution to the post-war housing needs. In 1952, it was completed just as a single block of 337 apartments for 1600 residents. The complex is designed to accommodate various functions to create a small-scale, city-like environment. It is different from the housing approach of the period via a three-dimensional reinforced concrete cage which can allow different constructions of residential units to be placed independently, and via its different plan variations to offer a life of up to ten people or just a single person.



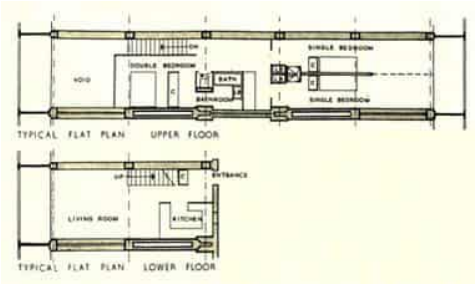
Figures 11. Bottle rack principle

6.1.2. READING UNITE d'HABITATION WITHIN THE CONCEPTUAL FRAME

INCOMPLETENESS, OPENNESS

In the Unite d'Habitation, each dwelling unit is interpreted as a 'cell' that is independent from the main structural grid. In this context, this complex may be seen as the first multistory building embodying Open Building approach after Maison Dom-Ino. The support and infill systems work separately, providing an openness to enable various types of infills over time. At this point, although the building is not completed as a whole, the standardized modular layout provided for infill-units limits the openness. Yet, when it is compared to the public housing approach of the period, the plan scheme can be read as an open plan that allows for transformations over time or even an open volume layout in three-dimensional space. By leaving a share of flexibility in the internal circulation area of the complex, additional areas have been provided

to serve different functions for the user's changing social needs over time.



Figures 12. Open plan and Open volume in Unite d'Habitation at Marseilles

USER, IDENTITY

Although this structure has designed to take the individual into consideration, diverging from the mass housing concept of the period, the concept of individual has been reduced to "Modulor", a single user and resulted in the logic of a modular housing unit which has been industrialized with standard dimensions of the user. This standardized individual and that limiting modular plan layout resulted in the monotony of the facade. This ordinary was later tried to be altered through colored panels, but it remained a rather shallow approach at the point of providing an identity. We can also say that the users cannot feel belonging to the structure, and the idea of appropriation is applicable only at the level of the interior organizations. The fact that present inhabitants of the houses are not the initial also supports this inference. However, the fact that there were 23 different typologies that could provide a life between one to ten individuals, the open building approach and the open plan could be interpreted as an important breakpoint in the housing approaches at the time.

TRANSFORMATION

The design approach of the structure is the bottle rack principle derived from Le Corbusier. According to this system, housing units are placed in an existing skeleton system, like placing a bottle on the shelf. In this sense, housing units are designed as a module and can be changed independently of the skeletal system over time. Although the basic idea was based on the standardization of housing units, the fact that the units were considered as bearing concepts of open plan and even open volume, allowed changes at the plan level. Partitioning elements have been limited to less and it is intended that the user can convert this open layout. The partitioning wall between the children's rooms is mobile to allow construction of one or two rooms according to the needs.

Figures 13.Moving wall

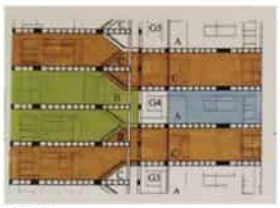
REUSE

As a result of all these features, the open building and open volume layout of the building, Unite d'Habitation has been able to transform over time according to changing needs, and thus continues to be used. Although the complex was built to provide social housing for low-income individuals in post-war period, with an idea of establishing an independent new city outside the city, it still has a different use today, but that use has also been adapted. The ground floor, which is originally arranged as a garden by uplifting the building with pilotis, is now used as a motorcycle track. Architecture Offices are located at ground floor. At present, the area being designed as a social facility and a regular floor serve as a hotel. The penthouse, which is planned as a sports facility, is used as an art center.



Figures 14. Transformation of the dwelling into a hotel

6.2.1.HUKUKÇULAR RESIDENTIAL COMPLEX

Figures 15. Hukukçular Building

Although its construction was started in 1950s, Hukukçular Residential Complex, which was completed in 1967 after the military coup in Turkey, was one of the first high-rise apartments in Turkey. Located on Büyükdere Street, one of the important transportation axes of Istanbul, the building has a prismatic mass with a T-shaped plan. The intention to combine housing, social facilities, commercial units and technical service programs and the conditions of a gated community in a single mass is seen first time with this project in Turkey. Commercial units are located on the ground floor and the social facilities, located on the terrace, are designed as meeting and entertainment halls, youth clubs, pools, indoor and outdoor terraces that in whole meet the social needs of users and guests. The 12-story residential block is considered as a total of 66 apartments in 3 different typologies: simplex, duplex and semi-duplex. A-type apartments arranged on the same elevation are 117 m2 in size, and 12 in number. B-type apartments arranged on three different elevations are 147 m2 in size, and 30 in number. In the transverse use of the block, there are C-type apartments which are 151

m2 in size, and 24 in number, facing both the Southwest and northeastern sides, passing over and under the A type apartments in section.

Especially among housing and apartment buildings, Hukukçular Residential Complex is one of the most distinctive and prominent examples in Turkey. The apartments seen in Turkey since the 1930s have been shaped as a monotonous mass by the repetition of same plan-layout on top of the other. In general, housing construction has continued through the standardization and universal values of modernization, and this form of mass building has been carried to present day with social and economic pressures; and as a result, the problems discussed in the previous section have emerged inevitably. Hukukçular Residential Complex distinguishes from the others because by reconsidering the individual and the experiences, instead of offering a uniform product, adaptive fiction that can be differentiated in different typologies and over time was tried. It is one of the few examples in Turkey that can be examined in this sense, and continues to be an experimental and brave example that has not yet overpassed.

In order to make a brief assessment of the period in which the structure emerged considering the perspective of the architects; the period between 1950 and 1960 was a breaking point in various respects. It is a period in which rational thought is settled in Turkish architecture, where the effects of modern thought are observed but the standardization and the concept of universality are questioned, and the individual and its experience begin to gain importance again in the framework of the humanist perspective. At the same time, this period has marked the modernization and transformation in construction technologies. The architects became defenders of rationalism, influenced by Le Corbusier's early architectural style, and reinterpreted this idea with the humanistic point of view and new construction possibilities of the period. They also consider the needs that may occur over time on the structures they designed, instead of stressing the architectural dominance and imposing the mono-type spaces to the residents, or controlling the daily activity of individuals; architects embodied the idea of incomplete spaces that can be arranged according to the user and time, and tried an architecture where the individual could be liberated. The understanding that liberates the building with the individual living in it is a universal critique of International Style both in Turkey and in global at the end of the 1950s and also a contribution to local modernism.’ (Kaçel, Ela, 2007) (12)

Figures 16. Le Corbusier effects

6.2.2.READING HUKUKÇULAR RESIDENTIAL COMPLEX WITHIN THE CONCEPTUAL FRAME

INCOMPLETENESS, OPENNESS

Instead of a single-type of plan imposed on its user, it has an open plan layout that allows conversions. In all three plan typologies, the kitchen, living room and dining room carry the opportunity to be organized in an open layout. Children's rooms may be combined to a single space or can be used as two separate rooms. Instead of proposing a finished structure, considering the uncertainty of time, the architects of the building have designed an open structure that would allow different interventions.Apart from the plan layouts, additional undefined spaces were left between the floors to provide the opportunity enabling different functions and the needs that may occur over time.

Figures 17. Spacious communal area

USER, IDENTITY

A system, in which users can change according to necessities that may be observed in a day or in a long time period, has been set up with an approach that avoids imposing a life on the individual and consequently liberates them.

Figures 18. Different entrance doors

The user can prefer to use the kitchen, living room, dining room together as a single space, or can customize the guest room when a guest arrives, or the kitchen can be enclosed during cooking. The mobile partition wall in the children's rooms can be opened to allow coexistence of two children, but it can be closed when it becomes necessary to provide private space for each child. From the facade of the building to the different entrance doors and interior adaptations, it can be observed that the users feel belonging to the building, express their own identities and spontaneity. This issue will be discussed in detail in the following section.

Figures 19. Hukukçular Building / 1970- 2000-2006-2018

TRANSFORMATION

Instead of proposing a rigid system with load-bearing partitions, the structure is designed as an open plan layout which is convertible with mobile partitions and furnitures. It is designed as a flexible system that can be opened and closed when needed, with the mobile partition in children's rooms, and same between the living room and the dining room, with a dining island and window between the kitchen and the living room, and with a closet between master bedroom and bathroom.Owing to the open system, it is observed that the spaces can be arranged in different settings, so they can also respond to different functions.

Figures 20. Moving Wall and furniture

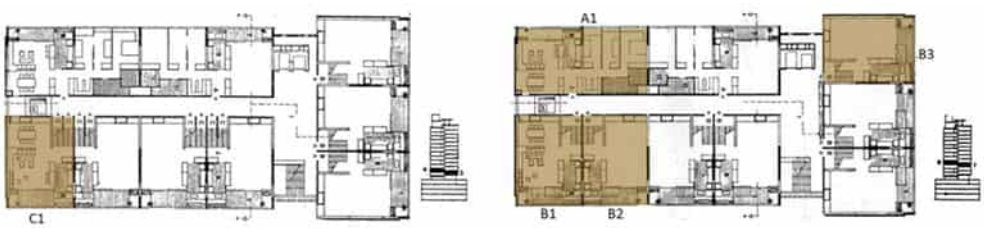
REUSE

As a result of all these features of design, an open system allowing the user to participate in the conversion of the structure was provided, encouraging the reuse of the structure according to different necessities and functions.

The housing units have been converted according to the different necessities and the continuity of use has been established. In time, as the environment became a commercially favorable, the structure became influenced and functionally transformed. The garden on the ground floor, which is created by elevating the structures on the pilotis, has been transformed into commercial units. The penthouse, which is originally used as a social facility area on the roof, serves as an architecture office. According to the records of 2014, 24 of the 66 housing units had been used as offices, and at present this number is elevated to 32. The additional space left inside the apartment has served for different functions over time, and today it responds to new needs such as laundry room, or the room of building manager.

Figures 21. Free spaces that enable for different uses

6.2.3. APPROPRIATION WITHIN DWELLINGS



Figures 22. Apartments that received information

Dwelling (B1) : The first apartment visited has a Type B duplex plan layout. It was originally designed as a residence, but now it serves as an office. Due to the fact that the office layout necessitates open space, the users only enclosed the kitchen completely, but all the other compartments were left open. The living room and the dining room are combined and serve together within the main office space as meeting area. Children's rooms are combined and used as a private study area. The other room planned as a bedroom is also another private study area. The section under the stairs is used as a storage area for office supplies.


Figures 23. Rooms used as offices

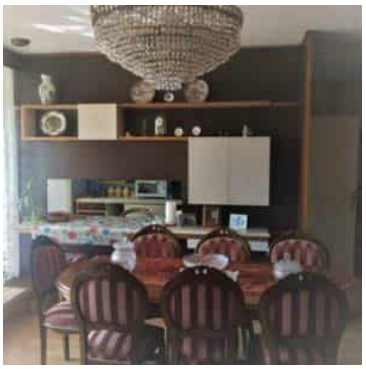
Figures 24. Usage as storage


Figures 25. Transformation of living space into office

Dwelling (B2): The second apartment visited has a Type B duplex layout and continues to function as a residence. Residents in present are the first owners. A single old man, who is in need of care, and his caregiver lives in the residence. The children and grandchildren come to visit.

On the day of the visit, the window between the kitchen and living space was left open. The table under the window serves both to the living space and the kitchen. The living room and dining room are used as a whole, and the dining table is located closer to the kitchen.

Figures 26.Usage of living space



Figures 27. Usage of semi-open kitchen

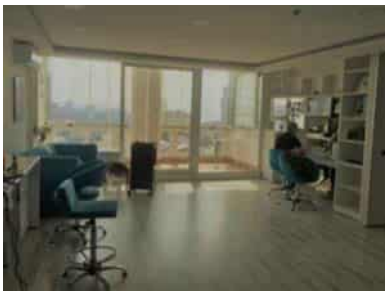
The rooms, planned originally for children, are arranged in a semi-open layout composed of a bed for the elderly user and a seating area for those coming to visit. The other bedroom is organized for children and grandchildren who come to stay.

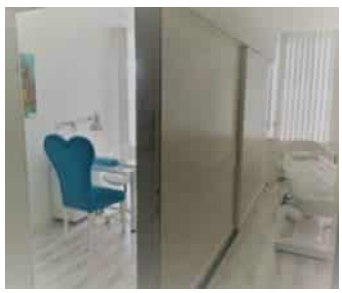
Figures 28.Semi open arrangement of rooms

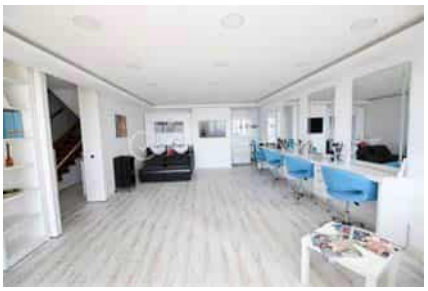
Figures 29. Usage of bedroom

Dwelling (B3) : The third apartment visited has a Type B duplex plan layout and a sea view. It was originally designed as a residence, but now it serves as a beauty salon.

The first floor is used as a completely open space to meet the requirements of the business. The space between the kitchen and the living room have been divided by cabinets. The mobile partition between children's rooms is closed on the day of visit. All three rooms were converted to serve different functions.

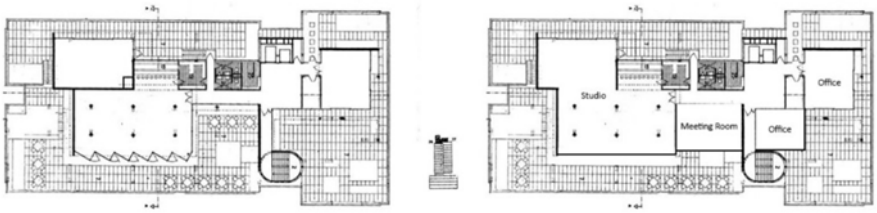






Figures 30. Transformation of the house into a beauty salon

SOCIAL FACILITY: The space where architects design to embody social facilities on the roof top serves as an architecture office in present.



Figures 31. Transformation of the roof terrace plan

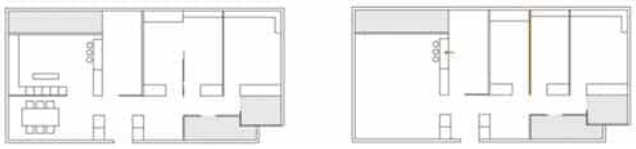
The main office space is arranged in an open-plan layout, the walls are removed and the space is divided by a level difference. A meeting room and few private study rooms separated by glass were added to the semi-open space left as terraces.

Figures 32. Transformation of the social facility into the architectural office

Dwelling (C1) : This apartment has not been visited and photographed, but has been interviewed with its user. The user is the first owner of the apartment.

The kitchen, living room and dining room are arranged in an open-plan. Since they are a family with two children when they first moved in, the partition between the children's rooms is used and the space is arranged as two private rooms. After the first child left the house, the partition between rooms has been removed and the space is used as a single room.

Figures 33. Transformation of dwelling C1



Figures 34. Transformation of dwelling A1

Dwelling (A1) : This apartment could not be photographed either. When the resident was interviewed, it was found out that the living space and dining space were used together, and the kitchen is left semi-open using the window as a partition. As a family with two children, the partition between the children's rooms is used to get two private rooms.

7. CONCLUSION:FROM THE UNITE D'HABITATION TO HUKUKÇULAR RESIDENTIAL COMPLEX

A criticism on Hukukçular Residential Complex focuses on its similarities with Unite d'habitation. The idea of unity, which is achieved by thinking a single complex of multiple dwellings and social areas of different types, is the starting point of design. Architecture always gives references to the previous spatial approaches. The cumulative knowledge of architecture that is not self-enclosed paves the way for the redefinition and reinterpretation of architecture under new conditions. Although Marseilles housings have been a reference for this structure, it is necessary to read this system, by including the existence of individual in a humanistic perspective, as a re-interpretation of the contextual conditions and construction systems in specific to the local.

ADAPTABILITY / BUILDING		UNITE d'HABITATION Marseilles,1947-1952	HUKUKÇULAR SİTESİ Istanbul, 1959-1967
OPENNESS, OPEN PLAN, OPEN BUILDING	systems in which the elements are independent of each other	+	-
	modular system which allowing different fiction	+	-
	open plan system	++	++
	excess space for different functions that can occur over time	+	++
	possibility dividing up or joining for children rooms	+	+
	possibility dividing up or joining for kitchen, living room and dining room	-	+
	having prefabricated separating elements	+	+
	modify the size of rooms	-	-
	different plan variations	+	++
USERS AND IDENTITY	users is the first owners	-	+
	users is detected different from standart data	-	+
	interaction between individual and living spaces	+	++
	appropriated by the users and have identity	-	++
	respond to the needs of the individual	+	++
	APPROPRIATION LEVEL	LOW /MEDIUM/ HIGH	LOW /MEDIUM/ HIGH
TRANSFORMING	possibility of spatial change	++	++
	possibility of functional change	++	+
RE-USING	used for multiple uses	+	+
	durability / long life	+	+
	continues to use	+	+
ADAPTABILITY LEVEL		LOW /MEDIUM/ HIGH	LOW /MEDIUM/ HIGH

Table 1: Adaptability and Appropriation Level of Unite d'Habitation and Hukukçular Building

On the axis of adaptability, Unite d'Habitation with its open plan approach, which allows different plan variations, and with its mobile partitioning system that allows rooms to be transformed according to different functions, is a pioneer of Hukukçular Residential Complex. It is seen that the open plan approach continues in Hukukçular Residential Complex, and consequently convertibility can be achieved according to different structures and functions leading to the continuity of use. With the open spaces left intentionally in the building, different needs and functions that occur over time could be met. However, in addition to all these, it is observed that in Hukukçular Residential Complex, instead of using the uniform plan typology of minimum sizes in Marseilles houses, which is accepted according to the standard body scales, these dimensions were enlarged and three different typologies were presented considering different family structures. It is seen that when the individual and his/her life is taken into account during design process, users tend to feel

belonging to the space they live in, to represent their identity, and to appropriate dwellings for themselves. This is confirmed by the fact that at present the majority of the inhabitants were the first owners of these houses. The purpose of the table in this study, which is prepared based on the levels of adaptability, by examining the concepts of openness, identity, convertibility and reuse, is not to compare these two structures. In terms of being products of two different social understandings, although there is not much difference between the years of construction, the goal is to be able to make a conclusion about what experiences and interpretations are transferred to Hukukçular Residential Complex from Unite d'Habitation and how the differences in social point of view affect the adaptation.

In this context, it seems to be possible to say that the level of adaptability, which is interpreted as a user-space relationship with the experience and ideas that can be transferred from the period Hukukçular Residential Complex was built, will be further enhanced in the atmosphere of today's architecture in favor of the new building systems and technologies.

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CHARACTERISING DESIGN FEATURES AND COMPONENTS IN QAJAR DYNASTY

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Abstract

Over the centuries, Iranian interior design and architecture have been developed as a unique, coherent design in one building. Each architectural development and evolution is followed by previous practices. With the advent of modernity in Iran which coincided with the beginning of the Qajar era, this coherence gradually changes from the perspective of the concepts and configuration, and withdraw from its previous continuation. Despite the criticism about designs developments of this era, it contains messages on the creativity of the architectural space. This is especially evident in the interior and exterior of residential houses of the period. Qajar House has various style of interior design, each of which displays the effects of tradition and modernity or a combination of them. The purpose of the paper is to survey the components of this period with the qualitative approach. The study is expected to describe the interior design features of the house design in Qajar dynasty with a holistic approach. The outcomes of the study indicate that among the identified components related to the interior design of Qajar houses, there are valuable features and spatial concepts which have the great impact on improving the quality of design in the internal architecture.

Keywords

Interior Design, Architecture, Components, Features, Qajar Dynasty

1 Introduction

Modernity has had distinct effects on different societies and has led to distinct outcomes. The arrival of modernity in Iran coincides with the beginning of Qajar Dynasty. In this dynasty, modernity has gradually pervaded various fields and dimensions. This was due to the expansion of cognition in social, cultural, educational, political and commercial fields and the developing relations between Iran and Western countries. So, during Qajar dynasty, there have been a lot of attitudes towards architecture. Specific buildings like palaces, gardens and aristocrats' houses are the first architectural issues which influenced by Modernism. Subsequently, public spaces are the second group of buildings which influenced by the movement and residential buildings are the last ones. In another way, Iranian architecture and design is influenced by the West and gradually diverged from its original essence. A number of Western architectural elements and features are applied in Iranian architecture and integrated with indigenous architecture or introduced a new style. Despite being part of a historical period, the inner and outer spaces of residential houses have diverse spatial spirits and styles. Some experts believe that the variety of motifs and decorations give a heterogeneous appearance and a conflict character to Qajar houses while others describe that this period reflects a diversity of duality, complexity, and contrast in the architectural values, ideas, tendencies, and practices. The latter point out that the Qajar design has upgraded the principles, procedures, and patterns of Iranian architecture and created space-based innovations. Anyway, it seems that when the context (socio-cultural, political) changes, it affects the meaning; so influences the art and architecture. In order to answer the question about the characters of architectural and interior design of Qajar era, it is necessary to survey about houses, as the aristocrat residential houses are the most remain monuments of the era. This research aims to classify the common characters of Qajar architecture and interior design with the holistic approach. It is good to mention that there is no comprehensive architectural information about this area for correct interpretation of the formal, shape, and historical aspects.

2 Qajar Dynasty and the factors impacts architectural space, meaning and principles

In the formation of Qajar architecture, there are several factors which can be categorized into two mainstream groups: internal and external. The effect of Qajar architecture can be seen in residential houses and different types of buildings.

1) Internal factors. These are factors that rooted in culture and Iran traditional - endogenous architecture, especially the Safavid era (Isfahan Style).

2) External factors. The main factors influences on forming Qajar design and architecture are external ones. They are factors which are derived from foreign countries (Europe and Russia). A number of them are mentioned in Fig.1.

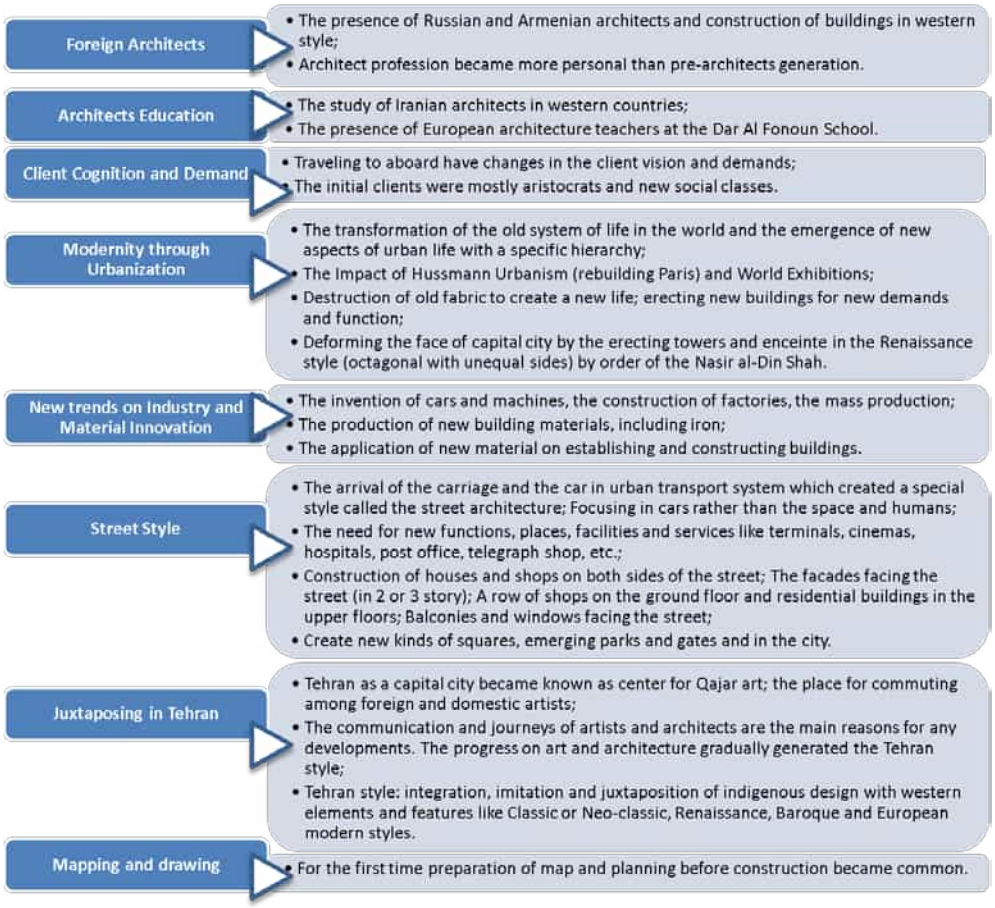


Fig.1. A classification for external factors which has impacts on Qajar design

New technical, technological and cultural phenomena have led to the emergence of this trend in Iran, and the Qajar period faced with wave of widespread changes from within and outside the country. Qajar dynasty is the beginning of juxtaposition of tradition with modernity. A progressive model (in Fig.2) may use for summarizing the impacts of modernity on context and art (like painting, decoration, literature and design).

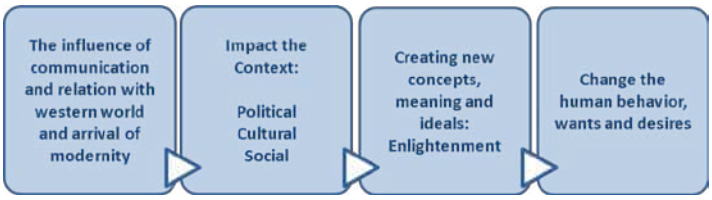


Fig.2. Qajar impact Process Model

While these developments in Europe arise from the needs and changes bring about by the Industrial Revolution and the tendencies of production, and they are completely endogenous respond to the changes; in Iran however, these changes are due to the superficiality, imitation and fascination of the king and rulers, the nobility and the society (internal factors) as well as the pressures of the western countries (external factors) and are imposed exogenous and imposed. So the apparent shape of the city is changed without the necessarily infrastructures. Anyway, this trend emerges in erecting the palaces of king and royal family. So, the dual lifestyle between aristocrat and people appears in the image of city and create a gap, so the city finds an inhomogeneous picture.

3 Towards Modernity in Architecture

Modernity brought major changes in the design. The words modernity and tradition are often considered as being in fundamental opposition to each other. This kind of thinking about modern tradition has common place among specialist. According to Pirnia, the Isfahan style was the last Iranian endogenous style which conforms to unity, identity and endogenous developments of Iran. He do not agree that Qajar dynasty could have Tehran style as it is not grew inside, not completed or continued the pre-styles. Etessam and Hillenbrand also, mention about conflict and impacts of modernity which can't have a good dialogue and communication with tradition. Many others believe that modernity has halt creation not in Iran but in any traditional undeveloped society. Consequently, if looking at architecture is from physiological points of view (form and content) such as dimensions, proportions, shapes and decorations, the architecture of the Qajar period shows a lower status than its past periods; especially the Safavid period. Shapes do not have the firmness of the past, and the new forms come into the design is superficial.

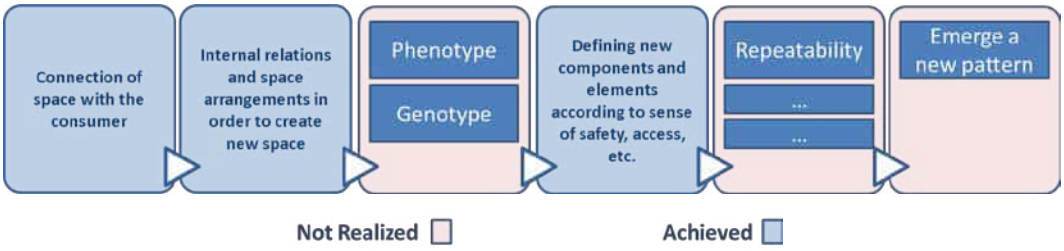


Fig.3. Qajar Changing Process as a Model

Within other points of view, Qajar architecture was one of the outcomes of idealistic approach at that time which has a close and adjacent relationship between form, function, decoration and structure. By considering design effects and space creativity in architecture, the architecture of this period will be valuable and be more advanced than pre-styles.

4 Qajar Dynasty (1781-1925) and architectural time classifications in 19th century Iran

Qajar architecture can be classified in three main different trends. It is necessary to say that, there are disagreements over the number of classification. Bani Masoud is refers to the two stages of the architectural changes in Tabriz during this dynasty. Memarian believes in three different classifications of architectural changes in Isfahan. Mirmiran and Sultanzade mention about three different styles in Tehran. According to this research and field survey, the division of the three periods seems more accurate, although this classification may be more obvious in a city than other one.

4.1 First period: From the beginning of the Agha Muhammad Khan reign till the end of the Mohammad Shah reign (1781-1848).

In this period, the dominant architecture is still Iranian indigenous and traditional design which is based on the Isfahan style from Safavid Dynasty –an evolutionary and perfectionism Iranian style of that time. The houses of this period couldn't develop architectural elements, motifs and components any further according to disorderly conditions. The majority of

ordinary peoples' houses in the first period build by continuation of traditional space and architecture. However, in the last years of this period, some traditional architects (Memar Bashi) construct buildings by using postcards and photographs of European architecture. Although architecture in the first period of the Qajar is not the main concern of government, the customers of western styles are nobles and aristocratic. In this way, some ornaments and motifs are imitated by traditional architects and this is the beginning of using Western elements as a source for inspiration. Perhaps the reliance of traditional architects on second-hand evidence such as postcards and paintings, and the lack of any kind of formal education, led to the creation of new forms that are inspired the mainstream and looked like distant ones. The shape and form of columns are a two-dimensional details in capitals (instead of 3-d), with new impressions of classic ones (Ionic order), and foliated bell of Corinthian style. Hence, the ornament decoration pattern is in accordance with Iran design and architecture. Some remarkable houses in different cities can be mentioned as, Salmasi House in Tabriz, Vosouq House in Tehran, Heshmat ol-lah Khan and Aameriha House in Kashan.

4.2 Second period: From the beginning of the reign of Nasir al-Din Shah to the Persian Constitutional Revolution (Mashruteh) (1848-1906).

During this period, the buildings manifest the contrast with traditional architectural values and thoughts. Nasir al-Din Shah travelled to Europe and saw the modern manifestation and ordered to build the same. So, the influence of abroad architecture is diversed in Tehran by direct order. The foreign architects (France, Germany, Russia and etc.) and the first educated architects have faced with divergent design for work and the outcomes of such conditions represents variety of architectural trends in practices.

Buildings still have to be constructed in accordance with traditional designs, but European elements and ornaments found the way through the architecture of houses in frontispiece and front facades, stairs, motifs, decorations and etc. Part of these elements and motifs is borrowed from the Classical and Neoclassical architecture of Europe (especially France), and the other part is influenced by Russian style. However, the organization of the spaces is still in accordance with the Iranian architectural pattern and the plan is introspective architecture. The design style of this period is eclecticism; the integration of Isfahan style with European architecture (Classic, Neo-Classic) and Russia. This is the incorporation of tradition and modernity. In the middle of this era, while the traditional housing is still continued, the neighbourhood fabric is gradually transforming. Two types of construction became common, erecting in traditional urban context or housing on both sides of streets (street style in Tehran).

Some of houses which can be mentioned are: Constitution (Mashruteh) House in Tabriz, Amir Nezam Garousi House in Tabriz, Masoudieh House in Tehran, and Borujerdi House in Kashan. The majority of buildings with public, private and religious application were built in this period. Unfortunately, the majority of the Qajar houses in Tehran have been destroyed due to urban development efforts in the next reign after Qajar dynasty, for developing city outer than Naseri-walls (which were built in this period accordance with Paris and western style); also, many more of these houses in cities are neglected and abandoned.

4.3 Third period: From Persian Constitutional Revolution the Mashruteh up to the end of the Qajar dynasty (1906-1925).

At the end of the Qajar era, the effects of European architecture is covered all sectors and buildings. The European and western architecture is influenced traditional spaces and the modern styles with exact imitation of them are emerged. European architects among Iranians' construct buildings which differ in their outward appearance and architecture with the original buildings built in Iran.

Other kind of house is the home garden or suburban home which is the exact imitation of Baroque style, with high decoration and ornaments. There is a progressive at this style, ornaments and design of the plan, which can be named as Iranian Baroque. Nearly all of the villas and splendid palaces of the aristocrat and nouveau riche are built with imitation or adaptions of Baroque style specially French Baroque.

The different components, motifs and elements of Renaissance, Baroque and Rococo styles beside Achaemenid, Sassanian and Parthian style is covered the urban text and city face. This period does not have similar effect in cities. Most of trends are not followed by the other city governors; so this attitude is mostly remains in Tehran. Some notable houses can be named as, Sarraflar House in Tabriz, Sorkhei House in Tabriz, Hariri House in Tabriz, Amin Ol-Zarb Mansion in Tehran, and Dastmlchi House in Kashan.

5 Housing Architecture and Interior Design in Qajar Dynasty

The Qajar architecture includes a number of unique and specific features; although, it may has similarities and differences with the preceding and subsequent quarters of Iranian traditional design or intimation of European and western designs. These attributes are only specific to this era, which distinguishes it from others.

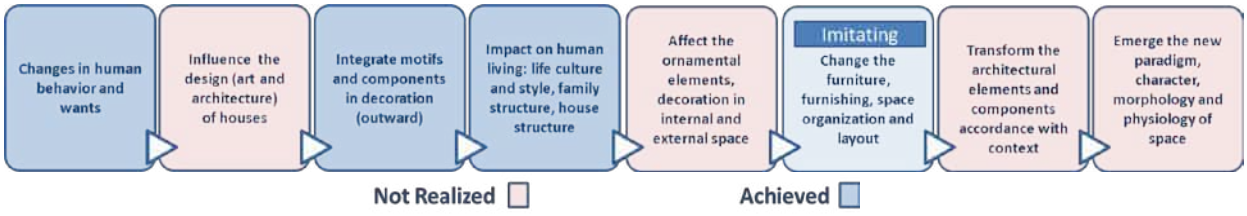


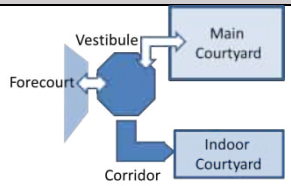
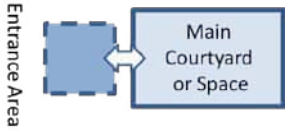
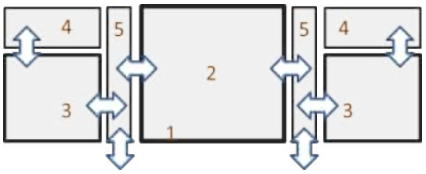
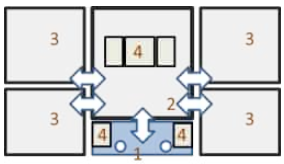
Fig.4. Qajar design space in modernity era as a process model

Among other characters, the architecture of the Qajar period is called housing architecture or residential houses architecture. During this period, due to increasing the urban population, the focus is mainly on erecting homes for the immigrant and new populations. Also, the design features of the housing interior design reflect the varied, distinctive and sometimes indigenous values in contrast with western style.

The western themes superimposed the design values of this era in the whole parts. In order to outline the impacts and attitudes towards housing design, and characterize the design language of this dynasty, the changes in the elements and components are classified. The architecture and interior design overlaps in form, organization and content. Concepts are correlated in the design of architecture and interior such as the essence and type of space; the form and function; materials, elements and components; the type of activities and adjacent spaces; the separation or adaptation of space; proportions and axis; decoration and

orientation; spatial hierarchy; surfaces (floor, roof, ceiling and walls); light and colour; furniture; and etc. The classification of this study looks forward to entrance area, inner spaces, main façade (Iwan, column, window, and stair), ornaments and furniture.

Table 1. Main Characteristics in Procedure of House Design at Qajar era

Elements	First Period	Second Period	Third Period
Entrance Portal			
	Between the outdoors and the central courtyard, there are mass and thick shells to create distance; an intermediate space like corridor and the vestibule. This part has features includes: Defines as one of the main parts and elements of the house; Locates near one of the corners of the house; Consist of identical components; Composes with various components in specific character; Observes the hierarchy; Contains quite simplicity in front door and walls, little adornment of brickworks, plastering or combination of both in the over door above the doorway.	Between the outdoors and the central courtyard, there is a light shell or surface to create distance. The main features includes: Presents of Modernity adjacent with Tradition; Has decreased traditional elements and increased ornaments and decoration; Occasionally uses half-columns, engaged columns and blind arch for decorating doorway; Arranges by the crescent (arc) or triangular-shaped (pediment) over front door; Has adornment of brickworks, plaster works, tile work or combination of them in the over door; Rarely has small windows beside the door.	There is a no distance between the outdoors and the central courtyard. The exterior and entrance space are mostly open to the main road. The main features includes: Presents foreign front doors with new materials and elements (window, fan light, cornice, string course); Portal is accordance with western styles (Neoclassic, Baroque, etc.) and concealed from traditional elements; Forming and decorating the door by Arch, Pediment or Palladian style; Has windows on door.
		 	
Front view	 1. Orsi; Sash Window; 2. 5-Door Room 3. 3-Door Room 4. Back Room; Closet; Alcove 5. Corridor	 1. Portico 2. Lobby 3. Room 4. Stairs	 1. Porch; Loggia 2. Lobby 3. Room 4. Stairs 5. Corridor

Elements	First Period	Second Period	Third Period
			 
Space Configuration	Common house is constructed with the modules and standard patterns of the Iranian indigenous house (S, M, and L the three modules) which can be applied in any place in accordance with its climate. They also have three famous orientations. The geometry represented everywhere; Plan and spatial orientation of houses are influenced by the four elements of nature. Introspective architecture is dominant in house design. The main spaces of the house are included a central courtyard; three-door rooms; five-door room (with Shah Neshin or Talar); Iwan (from Parthian dynasty). The three-door rooms could have multi-activities according to the needs and main spaces (five-door room) designed as summer and winter activity in different parts. As there are varieties of activities so, other kinds of spaces are adjacent, too (indoor courtyard or cortile, hall, guest room, crew quarters, facility area etc.). The arrangement of the spaces is accordance with main courtyard; so the main spaces are expanded around it, in one up to four sides of the central courtyard (in the form of L, I, U). The roof form is followed climate condition and different vault structure. Stairs are not very important or apparent component in Iranian architecture.	The construction unit system and modules inside the house is converted. For instance, three-door rooms reduced into two-door room which changed the meaning and measure of space. The elongation of houses is almost East-West (not necessarily according to the climate). In housing design both introspective and extrovert architecture observed. The outcomes of extrovert architecture can be mentioned as, omitting cortile and some of internal and private quarters, and solely using main courtyard for any activity. The house main spaces included a portico; central lobby; main hall (with decoration of mirror, plastering etc.).The pediment is decorated and the portico is in the form of western distyle (or other type of) entrances. The small rooms are gathered around the main hall. Staircase is located in the middle of the lobby and axis (which derived from Russian style). New spaces are adjacent to new desires and activities or in progress followed by past, which named as Wind Catcher Room for cooling space Houz Khane (or Basin Room with special design and decoration, consist of a shallow pool of water and fountain for summer season); Korsi Room (Kotatsu, a room for applying during cold winter); and Sofre Khane or dining room. The roof is flat and different kinds of indirect lighting elements from roof or wall became common. The order and proportions between the plan and the façade in traditional design is still operative.	Housing construction followed by foreign architecture styles and patterns: more freedom from traditional design and indigenous spaces. The diversity, lightness and more space opening can be seen in plan and façade of buildings. Extrovert architecture is dominant in housing style. The plans are mostly in the form of Renaissance and Baroque style: stretched pivotal plans with turrets, main halls inside the house, hall of mirror, harmony and norm among elements, Porch with high height which exhibits a magnificent and ambitious atmosphere, embedded the overall space in the centre and arranging other spaces towards it. The house is built above the platform with stairs. The name of rooms and spaces converts according to new functions and furniture occupation. The roof follows hipped or pitched roof figures or flat roof with wooden plinth. Organizing the European furniture and appliances including dining tables, beds, sofas, etc. New elements is used like in main spaces like Fireplace and sculpture.

Elements	First Period	Second Period	Third Period
Ornaments and Decoration	The royalty and rich people gave postcards to traditional architects for erecting exact buildings. The traditional architects establish buildings with indigenous figure and foreign decoration as it shown in postcards.	The ornaments' application and design is important in the main spaces. The decoration motifs and materials are varied and consist of: Tile work in small glazed bricks, Mirror work in the main hall, Stucco decoration, Muqarnas, Lattice wooden work, Colourful glasses, Girih or strap works, Graffiti or Mural, Arabesque, Painting motifs of Zand dynasty, and other decorative ornaments	The decoration with different style spread in any spaces (main hall and other rooms) and elements (the ornament in wall, ceiling, façade, column); The effect of Rococo is flourished; the variety material, varied arch and motifs for decoration; wall painting, wall paper, mirror wok with plastering in panels, stucco decoration, using foreign painting motifs, painting European realistic images, Abstract motifs of plants and arabesque designs.
Front Façade	There is symmetry and harmony in front façade of house. Usually, the main front of the building is located in the northern part of the land. The façade has many important elements including Iwan. The diversity of Iwan is due to form, space, proportions, dimensions, place and function. Iwan has usually the highest elevation in the main yard. This space is interconnection between the main hall and room to the courtyard, and has beautiful decorations. The portions and proportions of the Iwan and the space behind it match together. Sash windows are another important element which covers main spaces of the house. The sash window of this period has elegant ornaments and beautiful decorative motifs. The dimension and measurement of the room subordinate with the number of window openings in sash window.	The main facade is integrated with Iranian decorations such as, brickworks and stucco decoration integrated with western style. The façade elements gradually deforms in to European style. This transition can be seen in changing Iwan to portico (Iwan with columns); applying western style in front view such as Semi-circular arch and pediment and distyle columns in the front façade; capital decoration (from two-dimensional inspiration form of helix and foliated capitals in classic orders to new motifs of Eclecticism); form and figures of doors and windows (detailed design at door and sash window, using fanlight, colourful glasses, Girih or strap works, and other decorative ornaments); and emerging stairs (locating in the main axis). Iwan and windows are important in terms of applying the diverse range of geometry, methods of construction and components. There is a harmony between portico and the whole front façade; it represents the glory and authority of Classical- Iranian architecture.	The lavish ornaments are applied in façade and interior design, richness in decorative elements and colour. Besides having loggia and porch, the façade elements may include Belvedere and veranda. The porch of houses faces with different styles and decoration, with Tetrastyle, or more columns. The main facade is integration of different elements, such as decorative tiles (glazed bricks), Aina-kari (mirror work), Stucco decoration, cornice, plinth, cover flashing, marble columns; different styles (like Parthian, Achaemenid and Sassanian motifs adjacent to Renaissance, Baroque and Rococo) and new materials; Porch is an independent space as it has not conjunction with other spaces like Iwan; Decoration like Fronton on above the windows Elaborative columns, round arches; marble Pillars and capitals; Double-return stair Staircase like rococo style.

6 Conclusion

Ghobalian and Mirmiran state that, Qajar design has the features of transitional era; a transition from the old habits, interests, design and construction, to the new realm. It has the identity of both tradition and modernity, and displays with the contrast and superimposition of design characters of each context and idea. This challenge has variety of attempts and could be especially investigated in living houses, as the house confronts

directly with needs, believes and desires of human in space. Transformation of parts and spaces is listed in Table 2.

Table 2. Characterizing Qajar Design Elements Transformation

Creativity in Space, Elements and Decoration		
Conceptual Changes in the Configuration	From introspective to extrovert architecture Variation and spreading the space	Evolution in Space
Layout Plan Shape	From non-geometry to rectangular shape	Growth in Space
Appearance and Facade	From Simplicity to Luxuries	Diversity in Space
The Impression of Traditional and Contemporary Western Architecture	Shape and form rather than pattern and principles	Diversity in Space
Entrance Area	From being communicational and semi-public space to a separation boundary of public space from the private space	Openness in Skin
Ornament accumulation in Front Façade and Interior Spaces	Representing variation and spreading the space, Extending and opening the space and, lightning and transparency through space	Openness and Transparency in Space and Skin
Space and Function Relation	Transforming space-orientation to function-orientation	Growth in space
Main Elements in Design	Subtracting or concealing some of the main elements of Iranian homes and superimposing many Western elements	Transition in Skin

The new need and desire of this dynasty spreads variety of spaces in the living houses. The change through proportion and application of space gradually creates a new language of space. The Windows cover almost whole of façade skins; so, the surfaces become more transparent and lightened. According to Mirmiran and Memarian, this era prepares fundamentals of creative level for the next era. Evolution on spreading, openness and expansion of spaces; growth of varied spaces, elements and decoration; celebration of colour; and emergent the lightweight and transparent skin has improved the pre-endogenous styles but didn't have enough strength to create a new paradigm of space. There are many parameters in design of spaces at this era. So, this study could be followed by more specific and detailed researches in cities in order to draw comprehensive transforming elements of this dynasty.

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LIVING 'HETEROTOPIAS': THE GOJIKARA MURA© SETTINGS

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Abstract

People are living longer and being old is becoming the norm but the potential of acquiring a long-term condition such as dementia is increasing. The societal viewpoint has started to conceptualise the aging population phenomenon as an impending social and economic burden due to a growing demand for high dependency and high cost services. To challenge this concept there is a necessity for a care model change focusing on the older adult's mental and physical well-being. Architecturally this type of change requires a shift in the way care provision is designed.

An exemplar is the Gojikara Mura setting in Nagakute (Japan). This multigenerational community not only accommodates older adults but also their families and visitors. The analysis of this approach is based on a one-time post-occupancy evaluation framework: the 'thinking, making and living' method reveals the urban typology of this setting capable to generate "heterotopias." Diversity becomes the main medium for the production of the system's relationships and interactions. In addition, new patterns of an inclusive care emerge through the participatory and seamless collaboration of residents, their families, volunteers, and healthcare providers. Consequently, these together with a new design model are having the effect of normalising ageing while at the same time reducing personal and social stigma.

Keywords

Intergenerational Living Environment, Combining Health and Social Care, Architectural Typology, Heterotopia, Ageing.

1 Introduction

One of the major concerns of the postmodern economic model was a necessity for efficiency and performance. Consequently, the 20th century urban and architectural design was characterised by a spatial separation [1, 2] according to functional labels [3]. This has been emphasizing a distinction between social groups by supporting the "healthy," and limiting the "sick" [4].

It is now well established from a variety of studies that better healthcare systems, a reduction in infant mortality, a longer life expectancy and improved economies have determined a growing number of older adults. Besides healthy older adults, the number of people with mental and physical impairments such as dementia, their related high dependency services, and related expenditures are expected to increase [5]. In a society driven by efficiency and performance, older adults represent a passive beneficiary, which has been segregated [6]. Therefore, such spatial specification is nowadays unsatisfactory [1].

The article attempts to critically evaluate the Gojikara Mura© settings (case study). This initiative, a care village situated in Nagakute in Japan, embodies a unique response in older adults' care provision. The Gojikara Mura© is a multi-generational community able to accommodate not only older adults but also their families and visitors. This Japanese architecture so the Gojikara Mura© embodies several cultural principles and norms, which also affects its possible inhabitation of it [7]. Yet, some of these issues are inevitably illustrated in this article thereby clarifying the diverse Japanese contexts. However, outstanding are the socio-economic challenges posed by the contemporaneity, as well as peculiar are the adopted answers.

Moving on from the cultural and contextual focus, the article empirically investigates and discusses the possible impact of the environment of the care model upon the quality of care grounded on the interaction between residents, volunteers, families and staff. From this, the Gojikara Mura© is described as "Heterotopia – the real place" [8] where relationships are a direct consequence of differences (i.e. diverse activities, diverse population, etc.) [9]. Building upon the lessons learnt, my conclusions promote recommendations for an architectural frame beyond the requirements and standards of an ageing population. This is an architectural theory that supports a "social model of ageing" [10] and the shift from the idea of cure to the idea of care [11].

2 The Japanese Society Ahead

By 2050, the total Japanese dependent population (older adults and children) will represent 66.5% of the totality [12]. In particular, the percentage of over 65 years old will rise from the 21% (2012) to 40% (2050) of the total population. [13 - 19]. Furthermore, the number of older adults suffering from dementia will relatively increase. In 2002, it was 1.49 million, while the actual number counts 4.6 million people [18, 20, 21], projected to reach 7 million by 2025 [21, 16]. The following session is organised into four paragraphs that take up key domains tangent to the new demographic structure and related economic threats. These are: (a) beyond the family system and the group formation; (b) a Japanese senility, (c) a housing and care model review; and (d) what is heterotopia? The emerging differences as well similarities with other socioeconomic contexts constitute a robust background supporting my discussion.

Beyond the Family System and the Groups' Formation

Fukutake's critique of the modern Japanese society formation [22] reveals the centrality of the groups' formation in the Japanese social organisation. In particular, the group formation has revolved around the "IE" and the "MURA" notions. Historically, the Japanese term "IE" refers to the idea of "family system" [22] as a collective group considering also a family's properties (i.e. inhabited house). This is a familiar group with a strong collective sense in which any one of the members could be excluded for its protection [23]. The term "MURA" instead identifies the "village system" [22]. This is not only a geographical location of a housing group, but also its complex substratum of political, governmental organizations (i.e. tax system) [22 - 24]. Over time, these terms have acquired different meanings and roles but are still constantly present [23, 25, 26]. Nowadays, the "MURA" and "IE" often address group organisation in relevant economic activities [22]. These cultural norms and values, with a sense of aesthetics based on simplicity and ornament [27] have permeated through the architectural and urban landscape [7, 28, 29]. Therefore, they are also determinant in the comprehension of the proposed case study.

Alongside the new demographic structure and social organisation, the Japanese population is also undergoing through a parallel shrinking process. It raised rapidly during the 20th century, by tripling its number. In 2010, the population peaked at just over 128 million before starting a rapid and increasing steep decline. The government expects a decrease of the 23 -24% by 2050, ¼ of the current value [12, 15]. Unequivocally, these together with a succession of diverse economic models have been redefining the household structure [30]. Between the 16th and 18th century, the Japanese household composed of two or more married couples and their related offspring (20 -30 members) was replaced by a household of only one married couple and their children (3.5 – 5.5 members) [31]. Successively, it dramatically fell to 4.97 in 1955, 4.05 in 1965, and 3.23 in 1975 [23]. Nowadays, the household counts only 2.71 people [32 - 34]. This has determined its segmentation in which an increasing number of older adults live alone and in isolation [33, 34].

Consequently, the redefinition of these sociocultural and demographic parameters will have substantial spatial implications, both at the architectural and urban scale [12, 15]. These have implications that create a trans-institutional fear [15].

A Japanese Senility

In 2004, the Japanese word for dementia "CHIHO" which carried a negative meaning [35] was changed into "NINCHISHO" (cognitive disorder) with the target of raising awareness and understanding [36 - 38]. The Japanese link this word with three different categories of functional decline usually connected to older adulthood. This classification is mainly referring to the different possibilities in facing the functional decline. These three different categories are Alzheimer disease; All the other forms of dementia occurring in older age; and "BOKE," a word with multiple meanings that can be literally translated as "being out of it." On the one side, the first two categories are identified as clinical senility [35]. This expression refers to a condition, which goes beyond the human

control. On the other, “BOKE” is more identified as a social category of physical and mental impairments on which older adults might have some factors of control [39].

Government propaganda and more general publications have emphasized the moral perspective and self-cultivation connected to older age. The engagement in suggested activities would mean the fulfilment of social duties by a moral and responsible older adult, a responsible “ROJIN.” In fact, the manifestation of the “BOKE” would be instead a failure of an older adult. [35, 36, 39]. These have contributed to creating healthy communities, not only in terms of the built environment but also in terms of people’s well-being and societal roles [39, 40]. These are supportive communities rooted in the principle of subsidiarity in which older adults progressively find the aid of informal networks before, and professional after. Central in this shift was the introduction of the Long-Term Care Insurance scheme (LTCI) since 2000 [41, 42]. Examples of the adopted measures are the “micro-functional community care facilities, dementia friends, IBASHO, etc.” [20, 36, 38]. Nevertheless, families are still main figures in the care provision [19].

All of these measures have allowed Japan to adopt a pioneering community-focused approach which is widely accredited [38, 43, 44]. However, it may have a downside. Japan is a country in which also simple everyday relationships are regulated by rigid social rules and behaviours. For example, the word “AMAE” identifies adults’ dependence on the public and expectations for being cared by them as a right [45]. Therefore, preserving people's social network also at a later age may be physically and mentally exhausting [42].

A Housing and Care Models Review

Japanese cultural assumptions have significantly influenced the care provision and housing for the aged [46]. Historically, the Confucian ethic and the familiar piety demanded the family as the central source of support for older adults. [33, 34, 47]. However, the long-term persistent care for very sick or disabled older adults was not frequently happening due to a shorter life expectancy [47]. Inevitably, social and economic achievements gained during the centuries (i.e. social and health care policies, technological innovation, longer life perspective, etc.) redefined the family role. For example, the “Poor Relief Legislation” introduced essential help (i.e. food) for people lacking familiar support. In 1929, the Japanese Government approved the “Public Relief Act” which provided a basic form of assistance to the same social group. For the first time, public Alms-Houses appeared in Japan [22, 47]. Only in 1938, a National Health Insurance scheme was started and accessible to industry workers [14, 22]. In 1950, the “National Assistance Act” appointed local institutions as responsible for providing facilities in which not independent old people could live [14, 47]. Nursing Homes arrived into the Japanese scene only in 1963 with the “Elderly Welfare Act” [22, 41, 47]. In the 1960s, the Japanese government also ratified the “Universal Health Care Insurance” and “Citizens’ Pension Law.” Japan entered in the list of countries with a universal pension scheme [22, 41, 47]. Nevertheless, institutional facilities were stigmatized by the cultural notion of “OBASUTEYAMA.” This is a legendary mountain on which older adults as an economic and social load were abandoned by the eldest sons. [22, 47].

Besides this elderly care institutionalisation process, families were still the core of the care provision. Therefore, the Japan Housing Corporation, which is now known as Housing Urban Development (HUDC), were supporting families with Multi-Family Dwellings to rent or to purchase [48]. In the 1970s, the real alternative to nursing homes and alms-houses were Public Hospitals, no geriatric or psycho-geriatric facilities. At first, they were free, because advanced medical treatments do not have a gatekeeping system in Japan. Successively, the free hospitalization was abolished for people over 70 years old in 1982. In Public Hospitals, the 'hospitalized old' were not perceived as a socioeconomic burden [14, 25, 41, 47, 49]. In those same years, Japan faced the advent of Retirement Villages (RV). A striking example is the Huis Ten Bosch, a Japanese Retirement Village that emulates a Dutch city [50]. In 2000, LTCI targeted the provision of social care to older adults [25]. The promoting slogan was "from care by a family to care by society" [21, 33, 36, 41]. Therefore, Group Homes were introduced. They became the physical settings of this community-centered care model for physically or mentally impaired older adults [36, 37]. Nowadays, all of these initiatives are managed at the urban-ward level. These areas are identified as "Town Units System" [42] – Figure 1.

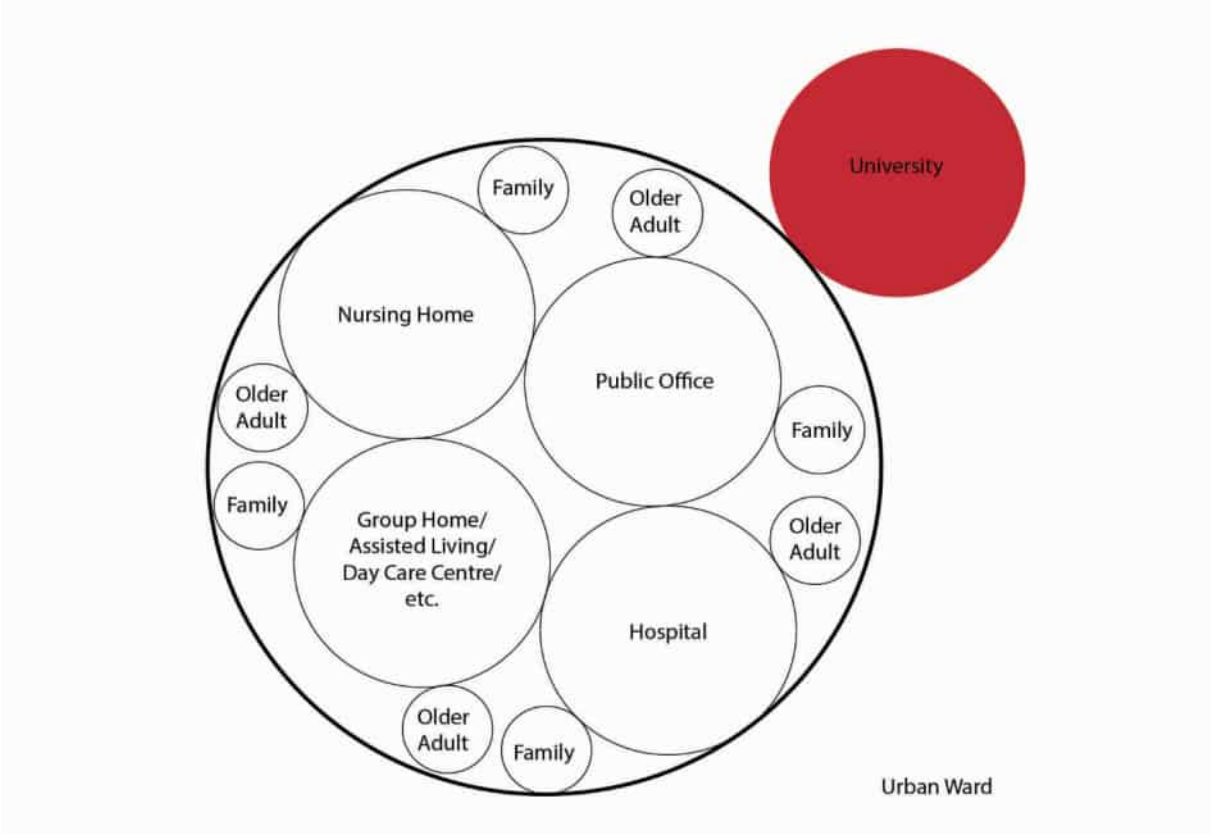

Figure 1. Town Units System Diagram, Source: Davide Landi

However, the rapid pace of the ageing population, the inadequacy of the existing facilities and policies, older adults' social isolation both in urbanized and rural areas [51, 52] confirm the substantial demand for diverse and feasible architectural and care models [33].

What is Heterotopia?

The notion of "heterotopia" is distilled from a critical exploration of two French philosophers' contribution to this theme and its parallels with the built environment. It was coined by Michel Foucault in 1967 [8] and in the 1970s adopted by Henri Lefebvre [9]. However, the context then was quite different from the contemporaneous. Therefore, it is useful to return to the original conception of the term in order to reveal the possible meaning for today's architecture.

Foucault's [8, p.24] concept of the "heterotopia" is based on his investigation of the obsession and anxiety associated with the notion of space during the 1960s. For Foucault, the process of appropriation and dwelling space by the contemporary society was the cause of this anxiety. It was a space container of "our time, our history," so people's lives. This was the departure point for the definition of the "heterotopia - a real place" and its six principles in contraposition to the "utopia – a no real place." The six principle are summarised as follows:

- Heterotopias appear in diverse forms.
- Heterotopias accommodate different functions according to the society in which they exist. This reveals similarities with Lefebvre idea of "space of enjoyment." The attributed function to a space of participation varies over time [53, p.151].
- Heterotopias host apparently diverse and incompatible spaces in a single "real place."
- In Heterotopias, time is a factor for accumulation or temporariness.
- Heterotopias, different from conventional public space, are simultaneously detached and permeable.
- Heterotopias have functions which are informed by the socioeconomic and cultural complexity of the context [8].

A decade after, Henri Lefebvre [9, p.37] redefined the three concepts: "utopia, isotropy and heterotopy," while concerning about a paradoxical relationship between "differentiation – each place and each moment exist only within a whole," and "homogenizations – industrial rationality" characterizing urban spaces. In particular, the "utopia" is the "no – place, a place does not occur," as in Foucault's definition. The "isotropy - the identical place," and produces homogeneity. The "heterotopy - the place of the other, simultaneously excluded and interwoven," is instead capable to generate diversity as an active element. The juxtaposition of different places and differences (also in terms of their inhabitants) is a medium for the creation of relationships [9, 54].

Consequently, heterotopias may be identified with the idea of "spatial practice;" physical environments that can be experienced with the five senses and not just a projection of an ideal one [53]. In this article, the notion of heterotopia constitutes an analytical tool for the case study. In contrast to ordinary specialized and uniform older adults care facilities, the Gojikara Mura© is a container of real diversity (i.e. diverse population, diverse activities, diverse relationships, etc.). It reveals the urgency of

promoting participation and diversity in terms of inhabitants and built environment by opening up functionalist and specialized settings [55, 56].

3 From a Post Occupancy Evaluation Framework (POE) to the Thinking, Making and Living.

The Post Occupancy Evaluation Framework

The major advantage of the Post Occupancy Evaluation (POE) framework is the insight on a specific aspect of a building physical setting. In detail, the POE allows a deeper insight into the case study performance on users' activities and goals (professional caregivers and residents) [57]. One of the most well-known POE for assessing buildings performance was introduced in 1963 by the Royal Institute of the British Architects (RIBA) [58]. Over time, a number of techniques have been developed to assess age and dementia friendly environments [57]. Examples are: a 2002 POE investigating the bathroom in dementia facilities [59]; a POE focusing on dementia cottages in dementia [60]; and a cross-national investigation of older adults care environments (26 case studies from Australia, Japan, Sweden, Denmark, the Netherlands, The United States and the United Kingdom) [61]. According to Zimring and Reizenstein, [62] three are the common aspects of a POE method. The first is the intended "generality" of the results, which are usually defined by a facility's physical settings. The second is the "breadth of focus" where physical settings are analysed by their specificity or in a wider and more complete context. The last is the "time of application." Some studies immediately provide data that can be used by professionals; others develop long-time compilations of information which can be used in the future. Furthermore, the adopted method produces an "investigative review", which is an in depth-assessment of the building's performance based on more rigorous research tools such as staff and residents' interviews [63].

Thinking, Making and Living

The analysis is based on the conceptual POE framework proposed while preserving parallels with the architectural profession. Consequently, it is fragmented into three parts: "thinking, making and living" [64].

1. Thinking phase – determines the case study care model and the conceptual design process chosen by the designer.
   - A systematic literature review was conducted of publications about the Gojikara Mura©.
   - Qualitative interviews and semi-structured questionnaires to managers and architects (1 manager and 1 architect) support the literature review. They examine the building as a whole, such as its legibility and its use.
2. Making phase – generates a fresh insight into the actual physical setting of the Gojikara Mura©.
   - The case study visit reveals the proposed care activities, programmes and their spatial implications (i.e. distances, natural light, "privacy gradient" [65] vegetation, etc.) Furthermore, the visit contributes to the development of a photo archive. It puts attention on the relationship between the people (residents, professional

caregivers and volunteers), the built (indoor and outdoor space), and the surrounding context.

- Post-fieldwork evaluates the case study through the available design outcomes produced by the design office (i.e. schemes configurations, plans, sections, etc.) This evaluation is broadened through the realisation of analytical drawings, conceptual schemes, and infographic representations of knowledge or data.

3. Living phase - reports the totality of interactions between the Gojikara Mura©, its inhabitants, and the wider community through:

- Behavioural mappings. Residents' daily activities occurring in a specific period of four hours are documented.
- Qualitative interviews and semi-structured questionnaires to residents (four older adults and four families), and caregivers (four professional caregivers). They analyse residents and caregivers' perception of the architectural settings and the case study's effects on their wellbeing (care model).

4 Against a programme: The Gojikara mura© test site

This section attempts to illustrate the results according to the "thinking, making and living" method [64] and the previously provided notion of "heterotopia."

Embodied Heterotopias: A Model for Meaningful Lived Experience

The Gojikara Mura© rises up on the southeast corner of the Ryokuchi Greens Prefectural Park (Natural Reserve) in Nagakute. It is a care village with a peculiar incremental development started in 1981. The case study adopts a radically innovative care model far from the ideas of convenience and efficiency [66 - 68]. It is a care model based on the contribution of many actors such as the forest, the animals, families, nursing students, etc. In fact, the settings offers a wide spectrum of services such as child day-care, kindergarten (200 children between 3 – 5 years old), adult day-care, assisted living (50 older adults residents with different level of physical and mental impairments), nursery school (300 enrolled students between 6 to 12, and 18 to 22 years old), and nursing home (48 older adults residents with different level of physical and mental impairments). It is totally different from what proposed by the Japanese government. Other models focusing on the management instead of users [68]. The architectural settings with their Japanese domestic "small" scale and spatial "ambiguity" embody these ideas [66, 67, 69]. Therefore, the Children's Day-Care centre was the first facility built which was extended with a nursing home six years after [66]. Over time, these initial facilities have been integrated with other older adults' care and community services, such as an assisted living unit, a community centre, a secondary school, nursing school, café/restaurant, art and craft shop/workshop, and a kindergarten. This created a "MURA" with a strong sense of "normal community" fundamental in residents' daily practice [66, 70] – Table 1.

Table 1: Gojikara Mura© Constitution

Population (person)		**Areas (m2)**	
Older adults	80 (Nursing Home - short and long stay); 50 (Assisted Living)	Communal (i.e. community center, multipurpose room, etc.)	1,941.8 (336.5 – Ground Floor)
Professional Caregivers	220	Entrepreneurs' Hub	0
Volunteers	200	Shopping (i.e. shop; café; bookshop; restaurant)	360.2
Students	300 (Enrolled – Nursing and Vocational school)	Educational (i.e. kindergarten, nursing and vocational school and children day care center)	2,250.2
Children	200 (Kindergarten); 15 (Daycare Centre)	Green	29,971.8
Total	1,050	Total	50,000

Source: Data Adapted from Interview Landi 2017, and Anderzhon et al., 2012

Even if the Gojikara Mura© was designed according to the "Building Standards law" and the "Elderly Welfare Law" [67, 71], there is no urban or architectural logic behind the village. In fact, it often does not "consciously satisfy accessibility requirements" with some "deliberately inconvenient" areas nestled on a slope with a difference in height of 10 m [67, 68, 70]. However, the only mandatory rule was the preservation of the place's identity [66]. A pre-existing forest loomed by a rapid urban development - "to remove the building's eaves rather than cutting off a single branch" was the building motto [67, 68, 71]. On the one hand, the existing trees addressed the layout and volumetric composition of the buildings, which are not perceived as institutional care facilities [68, 70]. "The different volumes fit in the land, in between the trees, it looks like a labyrinth" [71]. However, this also negatively affected the construction process. The construction company could neither lay the ground nor cut the trees' roots [68]. Additionally, the incremental development of the diverse care village was also characterised by the relocation of two farmhouses from the surrounding areas. This showed coherence with the idea of preservation [67]. On the other, the existing trees act as a connecting tissue between an eclectic architectural landscape [66]. Interestingly, Oi Koji, the architect, lived in the care village while working on the design [67, 71]. Furthermore, the project also exemplifies a series of cultural notions, such as "GATA-GATA" (Zigzag, or a very complex shape) or "GOCHA-GOCHA" (Imperfection). These are 'Complex and Imperfect buildings' that imply an active cooperation and participation by all of their users. These settings definitely do not fall within a conventional scheme [67, 68]. The Gojikara Mura© promotes, therefore, a complete mixture of sociodemographic groups and services/facilities - "GOCIAMAZE" (Mix) [67].

Further analysis showed that the case study falls within Foucault's "heterotopia" principles. In detail, the Gojikara Mura© occurs in diverse forms and hosts different functions. The three-storey Nursing Home, for instance, is composed of two detached buildings connected by a floating bridge. The four-storey assisted living unit is made of several scattered buildings connected by enclosed passageways. Both of the facilities have reinforced concrete structures. The others such as the community centre, the art and craft shop, the kindergarten, the café/restaurant, the secondary/vocational school and nursing school are single or groups of one-storey wooden pavilions [68, 71]. This diversity in terms of form and use is also reflected in the collective spaces. On one side, there are informal collective spaces such as the corridors presenting chairs, benches, bookshelves. On the other, there are formal collective spaces such as a multifunctional room, a small bookshop, a recreational/restaurant room, and an 'entrance café' [67, 72]. Inevitably, the Gojikara Mura© accommodates diverse and incompatible spaces so occupants reside in a single "real place"- a powerful forest. Consequently, time contributes to the accumulation of narratives in which multiple informal interactions occur. For example, older residents converse about possible bedrooms' spatial layout with mothers who take their children to the kindergarten [66, 70]. Cultural notions embedded in the project's physical setting also drive the interaction of different groups of people. "GATA-GATA" corridors provide public spaces as well more private – "hiding spaces" which restrict the sight; so different occupants are forced to move along them and interact [67, 72]. The nursing home's central courtyard, the "GATA–GATA garden" instead, is the place for the physical and visual encounters between the nursing home and the Children Day Care Centre populations - "Listening to the children and see their face every day" [67, 70]. Additionally, the notion of "imperfection" ("GOCHA–GOCHA") emphasizes the sense of belonging and participation. Thereby, volunteers and older residents are involved in several activities such as community patrol, restaurant support and buildings maintenance besides any professional skills or capability. Occupants are committed to the Gojikara Mura© improvement while their care and accommodation fees are reduced - "Mess is something comfortable. Perfection stops participation. Visitors conventionally experience untidy private and communal spaces, but they also see older residents sitting next to children or students, playing with them, talking to them or just simply looking at them" [67, 70]. In this scenario, the robust natural environment is a stage for confrontations between different groups inhabiting the village (i.e. human beings and animals) as well as spaces for "interiority" [70, 73]. The nursing home, for instance, has a rooftop vegetable garden managed volunteers and students/children. The generous openings onto the interior spaces allow natural light to enter. This facilitates older residents to perceive the passage of time, and to preserve a sensorial connection (i.e. sight, smell, and sound) with the outdoors in case they cannot physically experience it [67, 72]. Furthermore, the community centre can host seminars, children's education programmes, or weddings, possibly to increase in numbers [70]. The organic restaurants located in the assisted living and nursing home can welcome customers from the whole community such as the vocational school students and teachers. Together with the café/restaurant, the secondary/vocational school, the art and craft shop (local artists exhibit and sell their works in the village) the kindergarten, and nursing school emphasize a significant pattern of encounters coherent to the care model [67, 72].

Turning now to the fifth Foucault's principle, the case study as an institutional setting proposes a secure environment while its informal and consistent interrelation pattern confirms its openness towards a wider public. In particular, the Gojikara Mura© does not have an entrance gate as well as reception desks. 'Entrance cafes' instead welcome visitors. The case study is a "simultaneously detached and permeable" [8] container, in which professional caregivers, volunteers, families, and students behave, as noted by Jacobs [74, p.36], as "the eyes on the street."

The Gojikara Mura©, therefore, inevitably becomes a possible response to the new demographic structure and some of the segmentation patterns characterising the contemporary Japanese society. The mixture of users, a spatial ambiguity within its boundaries is coherent with the Japanese idea of inhabiting [66, 67, 75, 76]. This ambiguity also peculiar to everyday environments but not institutional ones [77] maximises spontaneous so "meaningful" relationships [78]. Thereby, the Gojikara Mura© is a real place – a heterotopia [8, 9, 54] – Figure 2.

Figure 2. The Gojikara Mura© Axonometric View, Source: Davide Landi

5 Connecting People: New Interdependencies between Users, the Care Model and the Built Environment

Individualistic and segregation patterns define the built environment of our contemporary society. The stagnant political and economic situation have brought difficulties in merging social and health care. People are anxious about ageing and its medicalisation [79]. Older adults, in particular, ask for a leap in the quality and effectiveness of the provided care [80]. This has direct implications on care models and its physical settings. A new paradigm is required [81]. Questionable is also the dignity of an old person who is not anymore an active part of the socioeconomic framework. It is a dignity impossible to measure through design standards [82, 83]. Consequently, Japanese health and social care system, as in many of the developed countries, is strongly under pressure.

In all this, my paper roughly investigates only one of the facets of the subject so the generalisability of these results is subject to certain limitations. For instance, the geographical area. Additionally, the scope of this study was limited in terms of time. The chosen methodology is a one-time Post Occupancy Evaluation framework so the data were collected at only one time. Thereby, longitudinal studies may reveal new insights of the case study. Another weakness of this study may be the paucity of objectivity. In fact, the main body of data was obtained from interviews and semi-structured questionnaires (self-reports measures).

Furthermore, the Gojikara Mura© clearly does not adhere to some of the standards typical of aged people and dementia friendly environments. For example, the abundant natural lighting and the outdoor natural environment contribute to reducing distress and distraction [84 - 89]. However, the big collective spaces, such as the multifunctional room and restaurants, generate distracting and disorientating confusion [70]. The spatially and visually uninterrupted "GATA-GATA" corridors and the use of way-findings, simplicity, and generous dimensions support occupants' navigation [90 – 92, 89]. However, professional caregivers frequently face exhausting long walks. Talking about this issue interviewees confirmed that working, managing and maintaining the Gojikara Mura© is very tiring, a "satisfying tiredness" [67, 93]. Nevertheless, the mixture of services, of age/social groups creates a multigenerational environment grounded on the idea of interdependency. "Embracing diversity" constitutes the possibility to build genuine relationships through which people are "happy" and their "hearts move/beat" [66, 67, 70, 72, 93]. This may imply some lifestyle changes but surprising are the benefits on occupants' well-being [70]. Older adults' vulnerability, for instance, as well as the ageing process and related functional and cognitive decline slow down [94 - 96]. The built environment and care model, therefore, not only has direct physical, emotional and psychological repercussions on older adults, but also affects the provision of care, and professional caregivers [97].

The Gojikara Mura© as "heterotopia" [8, 9, 54] is an outstanding architectural alternative latent in contemporaneity. This may represent the basis for a new critical architectural theory central also in Brenner, Marcuse and Mayer's [98] original critique of urban theory where practice addresses the work of theorists. This is a critical theory, which takes into consideration not only of the architectural object but also, in this specific case, of the care model. It is tailored to multiple layers of care providers and individuals [99]. It offers a new way of sharing responsibilities while combining together the diversity [100, 101]. Therefore, the critical architectural theory becomes a "social act" that rejects disciplinary division, but creates new cross-fields synergies [4, 98 p.57] and architectural types.

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CONSIDERING GREAT WORKS OF CINEMA AS A BASIS FOR EDUCATION IN ARCHITECTURE AND DESIGN

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Abstract

This file provides a template Architecture is the most important among multidisciplinary professions. In order to creat qualitative architecture one needs to master mathematics, statics, physics, geography, sociology, psychology, ergonomics etc. As well comprehend aesthetics and develop artistical maturity and proficiency. Viewed in this context the art of cinema, which puts forth stunning ideas, unique Technologies, exciting visions and aesthetic impressions,is the first to come to minde to draw on for inspirations of architecture. The main aim of this Project: Analyzing the input of cinema's special design, fiction, vision and aesthetics to the architectural profession and education in the context of the interaction between architecture an cinema.

In this Project we aim to crear aquailitative source for architectural culture by analyzing the interaction between architecture and cinema professions through articles to be written by expert academician, writers, artists and intellectuals on the subject. The articles will discuss the design of space on the white screen through architectural techniques. Even though almost hundred masterpieces of cinema emphasizing architecture have been included in this project, six of these have been selected fort this paper.

This study is aimed to promote, in architectural education, the skill to approach the profession, occurrences and projects with an advanced, sophisticated and easthetic view is nourished by cinema resource of great essence.

for writing papers for the conference. The conference proceedings will be published in an electronic format. The manuscript shall be written in compliance with these instructions.

Keywords

Architecture and Cinema Interaction, Cinema in Architecture, Architectural Education, Representation of Architecture Language.

1 Introduction

Architecture has always been interacting with other art forms. In the architecture-cinema relationship, it benefits from cinema's visual power, its ability to render a sense of place very close to reality and its creation of spatial alternatives. The methods and the distinct perspectives of the two art forms foster each other.

Architecture has always been interacting with other art forms. In the architecture-cinema relationship, it benefits from cinema's visual power, its ability to render a sense of place very close to reality and its creation of spatial alternatives. The methods and the distinct perspectives of the two art forms foster each other.

According to Bernard Tschumi, architecture emphasizes the importance of mental interpretation beyond time and space dimensions in cinema, so much so that the structures in films can shape the architecture of our future. Places and events experienced through the way the images created in our memory complete the scenes on the curtain, gain their particular meaning through those images [1].

The presented paper is based on our research on "architecture in cinema". The aim of the research is to examine, via the interaction of architecture and cinema, the contribution of cinema to design, construction, vision of space and its aesthetic contributions. In our study, we will explain the content of this research.

2 Method of Research

In accordance with the research theme and purpose stated above, "-Roughly- 100 Masterpieces That Touch Upon Architecture" has been selected from a collection of works in a wide variety of topics covering utopia, dystopia, fantasy, sci-fi, avant-garde cinema and auteur cinema.

In this context, the analyses and interpretations conducted by expert authors, philosophers, academicians, architects and artists about the hundred important works were collected, evaluated and classified.

Research methods specific to architecture were used in the study. Interaction of architecture and cinema was realized through cinema's design, construction and vision of space and its aesthetic contributions, along with films and texts that touch upon architecture. The following elements were investigated in the selected films:

1. Construction of space / 2. Creative innovations and inventions / 3. Inspiration on real life / 4. Technological novelties / 5. Spatial Avant-gardism (pioneering idea) / 6. Resourcefulness in Dream-like Fiction / 7. Spatial Vision / 8. Design Knowledge Elevated Through Fantasy / 9. Diverse Ideas on New, Different Lives and Worlds / 10. Aesthetic and artistic ideas, insights and innovations regarding spatial editing

These criteria were investigated and analyzed in the selected films, for which the essays were produced. These articles are the written input in the research. Starting from these products, cinema's design, construction and vision of space and its aesthetic contributions were evaluated.

3 Evaluation Criteria

The 100 films we have dealt with for the project were chosen from masterpieces that emphasize architecture and provide a combinatory force. The following criteria have been previously reported to the authors in articles based on architectural analyses and interpretations of the world's most important artists, writers, screenwriters and curators, and occasionally the works of their architects. Analyses and evaluations were made by architects, experts, authors, and academics, as noted in the introduction to the declaration, through the following criteria:

3.1. Construction of Space

Cinema takes its course from the construction of space. When considered in this sense, its starting point is the same as architecture. When the architectural space is integrated with our minds, the images that appear in our memory are embodied in the same manner as in the film space and in the viewer's mind. With these aspects of film images, we actually have the power to expand the boundaries of our relationship with the world. While the mental images create a construct with the help of new images, different visions and vital images appear in our minds. Furthermore, the images used in the cinema are not limited to architectural spaces. By using all kinds of visual arts and applications, cinema displays a free creative process. In this sense, it has possibilities that are not available to the architect. Because while architecture can move under the means of the employer or the user, cinema has the freedom to use all the images in an imaginative unlimited world. This aspect of cinema presents a possibility that initiates innovative, avant-garde, extraordinary, competent and striking inventions for the construction of space. This practice is of the same kind that the architect seeks in reality.

3.2 creative Innovations and Inventions

Cinema, besides giving designers the opportunity to create unusual space representations, being a testing ground for architecture and creating spatial experience memories, provides the spatial designer with its methods and technique. These cinematographic techniques have been adopted by spatial designers following the discovery and expansion of the cinemas, and they have begun to be used as design input. Another contribution to the design process of space is the potential to foresee future spaces that cannot be built as of yet. Subsequently, designers can turn spaces that are not created as of yet into real, partially or wholly realized spaces when appropriate conditions are created, or they can use inspiration as design input. For example, utopian, dystopian films reveal the constructions of places of the future. Such films are not only unusual experiences, but they also give innovative design ideas to architects. Moreover, if you look at architectural design, applications in cinema space can be revolutionary; they can be sources for future real applications. All of these features make it possible to look at cinema as a laboratory and a

fictional plateau that produces experimental products and to relocate the design innovations and inventions there to the architectural scene over time.

3.3. Inspiration on Real life

Cinema gives a chance to experience places that have yet to be visited and creates a wealth of spatial experience. Memories about places that have never been visited contribute to the architectural experience of the individual by placing them in memory. In this respect architectural culture and education contribute and create a wealth of spatial experience. Through the efficiency of the art of cinema, it is possible to share and witness the unique, different, contrary, unusual and surprising vital universes in the regions, countries and cities where the world can never reach. This brings, with the most extraordinary forms, the elements of knowledge and experience to the architect. In this way, it is possible to reach concrete ideas about how different life forms can be maintained in different situations and how they will be applied in architecture.

3.4. Technological Novelties

Both disciplines have gained references to each other through cinematic and architectural techniques that they commonly use. Cinema's new possibilities, especially in terms of space experience, using camera techniques, technological simplicity and visual illusions, can sometimes be mind-opening and functional in architecture applications. For example, architectural animations that are easy to do with developing and expanding computer technologies can finally become functional for architectural spaces that are still in the idea and design stage - thanks to the nature of the animation and its motion parameters. Consideration of the potentiality of technological applications in the field of architectural education is thought to be useful for architectural education and representation. Another technique that architecture can take advantage of is architects' use cinematography techniques such as framing, assembly, arrangement and light as design input.

3.5. Spatial Avant-gardism (Innovative idea)

Cinema is not only rendering the inexperience of future spaces, it also features the characteristics of spatial avant-gardism by presenting new horizons to the concepts of architecture that have distorted the human perception or with images that go beyond the limits of human perception of space. Cinema comprises an unlimited free creative universe that is the most essential element for an artist. With the possibilities film-makers have arrives the opportunity to investigate the most daring innovative ideas in the most riskless way, so they can go to extreme ends, the "*terranova*"s of the spatial conception and they can come back from there with the results we never knew. The "*terranovas*" (unexplored lands) of the world of art and imagination contain the most essential elements for architecture that is the area of creation. That is why watching the adventure of a film-maker is a real educational factor for architecture.

3.6. Resourcefulness of Dream-like fiction

Cinema takes advantage of architecture by defining virtual spaces, rebuilding real spaces and taking subject of architects or architectural products. While cinema uses architecture as a tool, architecture uses cinema as a catalyzer to reach the depths of the human mind. The

cinematic products that rebuild real spaces are to produce different places by reinterpreting or referring to the actual spaces in the eye of the director, or to produce future predictions by reference to these spaces. But what is more important than all is the imagination and imaginative power that the pioneering directors have, in order to enable the art of cinema to be successful. In cinema, a director who does not have a superior imagination and imaginative power is immediately eliminated. It is natural that the imaginative power is incredibly high in a creative world where such a ruthless selection is made. The products of imaginative power that have been mentioned contain valuable ideas for architects' design universes.

3.7. Spatial Vision

The moment we feel interaction between architecture and cinema in the strongest way is when the images of the moments of life come into being. Directors such as Antonioni, Tarkovsky, Godard, Truffaut, Bergman, Vigo, Fellini, Renoir and Bunuel gracefully observe life situations to reveal the search of the individual and the individual's relations with the environment. Cinema has become an art form that presents the interpretation of the use of architecture with interior and exterior spaces over and over again. The spaces where the events of film narration take place sometimes become remanufactured places, transforming into a component of narrative interacting with events. In such a case, the interpretation of the space concerns the mental communication of the director and the audience.

Apart from the imaginary productions of space coming from the nature of expressionism, this category also includes science fiction films. Today, spaces that are technologically impossible to produce can be produced through these films, and when circumstances permit, these imaginary spatial products can be turned into reality or partly be a source of inspiration.

These spaces also provide predictions about the future situation of today's structures. The potentials of the films as the infrastructure for the future architecture have been noticed in the early years of cinema's existence. After Luis Bunuel watched "*Metropolis*" in 1927, he said: "Films will turn architect's most impossible dreams into reality." (Bunuel, 1927) (p.15)

As can be seen from the descriptions and analyzes referenced above, the future of architectural space that will be redesigned and subsequently built and serviced by cinema will have qualified and experimental proposals about the future, the future positions of the community, and the future prospects for society and people. Along this vein, it is possible to draw functional and rational inferences on the future vision or mission of a particular space or structure. This is one of architecture's main preoccupations.

3.8. Design Knowledge Elevated through Fantasy

Cinema, a test field for architecture, gives designer of space the opportunity to create extraordinary spaces, creates memory for architectural experiences, provides spatial awareness by allowing spatial images to be experienced on different scales, and presents potentials for architectural design knowledge by using the techniques and methods of cinema as design input.

Cinematic spaces include reality and beyond, and in essence makes the subject experience the space with their whole body, even when they experience it only through the sense of sight. The ability to create fantastic architectural spaces that can appeal not only to the functions but also to the emotions of the subject, and to establish these delicate architectural patterns in a qualified manner in the architectural space provides new and competent opportunities for the designer. The film space provides architectural imagination, design knowledge and ideas for practice with a sense of reality, which can sometimes be fantastic and surreal.

3.9. Diverse Ideas on New, Different Lives and Worlds

Cinema traditionally carries the original, the different, the exciting, the inspiring and the extraordinary. Even in when it depicts the ordinary, it reveals to us the habitats of other people, other places, countries, cities and lives. Almost all of these lives are outside of our tiny, personal universes. But through cinema, we share this vitality, design of space, emotion and dreams with the universe, and there is a great need for the contemporary architect, who designs for others but not for themselves, to know and experience the life outside of this self-perception. Cinema places our lives in a world of vigor, fantasy, dream and observation, manifesting before our eyes secondary and even tertiary lives. The exhibited works are filled with valuable data, information and elements for the architect.

3.10. Aesthetic and Artistic Ideas, Insights and Innovations Regarding Spatial Editing

Art of film can transform a run-down and unseemly space into impressive images through stylization. This transformation can also be defined as the transition from a passive space to a more dynamic space. When in connection with the narrative, space in film can also transmit to the audience the symbolic meaning of the structures at display. While constructing the background for a narrative, the director sheds light on the inner world of the individuals and the structures in order to fully reflect the characters and the story. To achive this goal, the director tries to create a dynamic space using rhythm, color, sound, shadow, texture and light, as they are utlilized in architecture. The film aspires to a high acclaim through the highly aesthetic elements it has acquired from other art forms (music, painting, sculpture, architecture, literature etc.). Totality of these elements regarding spatial editing distinguishes a film while presenting architects with aestheticly creative ideas.

4 Results and Evaluations

As a result of this research, an analysis/article on the masterpieces of cinema that presents a vision with an emphasis on architecture was commissioned from academics, writers, artists and thinkers with expertise. These articles made it possible to analyze the design process of the spaces observed in film and present how film and architecture influence and borrow from each other. The resulting publication is a valuable addition to the architecture culture.

The final observations regarding this study are as below;

- A more mature understanding of aesthetics and culture was achieved through a higher understanding of the films analyzed for this study, which led to valuable publications to place more emphasis on aesthetics, theory and art in the architectural education. The final aim of this project is to bring the profession and projects a sophisticated and aesthetically concerned point of view through architects who are exposed to such insightful works. The results of this research are in line with this aim.
- This project aims to initiate a transformation on the understanding of architecture. It is essential to analyze, understand and internalize film masterpieces with an emphasis on architecture to build more aesthetically pleasing and livable cities for tomorrow.
- Our final object in conducting such a research is to support architectural design education on a theoretical, philosophical and artistic level. This research will help students and architects to improve their artistic background. It is undeniable that such a collection will help to form a more qualified design expertise.
- Another priority of this research was to enrich the interdisciplinary approaches to architecture education. This research creates opportunities to form new perspectives on education and research programs including new courses, masters and doctorate subjects and research fields.

- This research on architecture in film also made it possible to prepare an insightful and comprehensive publication which is to be published on a respectable and useful manner. Such a publication will be used to draw the attention of designers to the creators of such visually and aesthetically pleasing spaces.

Current developments in technology made the former approaches on architecture, urban development and interior architecture education mostly redundant. The issues on technical drawing, static calculation, planning, material requirements, work flow etc. are mostly dealt with computer technology. In contrast, theories on aesthetics, an artistic foundation, creative ideas, a wider understanding of the global culture and decision making skills became the focal point of architectural design. Relevance of such concepts is yet to be fully comprehended in architecture education. Therefore architecture programs create designers who lack aesthetical, philosophical, artistic and cultural notions which lead to the current architectural environments without any qualifications.

As per the issues raised above, study, analysis, understanding and internalization of relevant artistic and philosophical works is imperative for an indepth and comprehensive education in architecture, urban development and design. However, resources available to emphasize the importance of theoretical issues and to improve the intellectual understanding of architecture students and the society is not adequate.

Certain studies on the interaction between film and architecture prioritized the design aspect and focused on the definition of space in film and methods used in design. However, the number of studies on the contribution of film to architecture education regarding spatial editing and aesthetic vision is lacking. Although such publications aiming to support architectural design on an intellectual level exists, they are not inclusive enough. It is evaluated that the outputs of this research will be qualified to inspire the works of all architects and architecture students.

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THE PERSISTENCE OF TECHNICAL FORMS. TYPOLOGICAL TRANSFERENCES IN ALBERT KAHN'S WORK.

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1 Abstract

Form, its generation, transference, and transformation have been historically one of the central themes of architecture. The influence of texts from diverse disciplines such as "Eupalinos or The Architect" by Paul Valery, "On Growth and Form" by D'Arcy Thompson or "The Fractal Geometry of Nature" by Benoît Mandelbrot on the architectural discipline tells of this intense interest on forms transmission modes and on the adequate means for their generation and mutation. This paper uses the concept of "Type" to study the transmission of form's cycle between three fields: industrial architecture, railway engineering, and the aeronautical industry.

This document establishes a specific North American reference frame and uses as a central core two Albert Kahn's factories for the aeronautical industry. These are the successive additions (1937-1939) to the assembly building of the Glenn L. Martin Company in Baltimore. They serve as a link to establish a typological lineage between the structures of truss bridges of the American railroad tradition and the structures of airplanes. The direct transfer of forms between disciplines responds to completely different functional and structural needs. The graphic reconstruction of the factories and their study from a mechanical point of view is the basis for this analysis.

2 Keywords

Technical Object, Typology, Albert Kahn, Railroad, Airplanes.

3 Introduction

Form has always been one of the main concerns of architects. A number of them expressed their predilection for texts as those of Valery, Mandelbrot, or Thompson. Through these texts, coming from such different disciplines as mathematics, biology, or poetry, architects have implemented several theories about architectural form. Most of these theoretical constructs rely, in one way or another, on in the idea of evolution or the idea of one forms deriving from others. These three texts represent specifically the beginnings of three main streams in the theory of creation and evolution of form in architecture.

D'Arcy Thompson's geometric exploration of the dynamics of growth in living organisms has been in the origin of the so-called organic architecture. Le Corbusier is the best representative

of the postulate of architectural forms deriving from nature, or from mathematical laws consistent with the mechanics of the living organisms. Le Corbusier's "Modulor", based on the Fibonacci succession is a good example of this attitude [1]. Other architects guided by this book range from Wright and Louis Kahn to contemporary authors as Greg Lynn. In the theoretical field, Thompson's influence has been even wider, yielding an important number of relevant texts [2].

Paul Valery's book initiated a theoretical line that considers architectural form as the result of a previously determined performance. This text is the precursor of what might be called Functional Formalism. The idea developed by this kind of functionalism is that architectural form, as it happens in a technical object (planes, weapons, machines), derives directly from a determinate function. For these architects, the establishment of the functional needs of the building solves the problem of form. For instance, Gropius demands in a text of 1924:

"*The (architectural) object is conditioned by its function. Therefore, to give its particular form to an object in a way that a precise functionality is achieved, we must have previously established clearly what the function to accomplish is*" [3].

Form follows function is not only the motto of the functionalist European Avant-garde; it is also the main postulate of Lamarck's zoological philosophy [4]. This kind of functionalism traces a straight line between necessity, function, and form. It moves away from architecture design and is more similar to the optimization method used in engineering [5]. Engineering tries to look for the optimal solution to a reduced number of well-defined problems. Architecture, without exception, begins with a complex and necessarily ill-defined problem that is solved using criteria not of optimization but of 'satisfiction' [6]. The problems put forward by architecture are always resolved in a mediated way, not a direct one.

Lastly, Benoit Mandelbrot's book is the theoretical precursor of the contemporary generative architectures with forms generated by algorithms. This kind of design process creates a form using software that delivers an architectural system as an automatic and optimal response to a series of pre-established parameters.

The explanation of these three theoretical frames tries to state the intense interest within architecture as a discipline on form-transmission modes and on the adequate means for their generation and mutation. This text will define another mode of architectonic form genesis, mutation, and hybridization. This mode relies on two main conceptual foundations: Gilbert Simondon's theory about Technical Objects, and Carlos Martin-Aris' concept of Type.

4 The typology of technical objects. Structure of mutation and mutation of structure.

This paper extracts from Simondon's theory the idea of the non-linearity of the technical evolution. Simondon explains that there are two kinds of technical evolution. The first one follows a continuous path based on the refinement of unessential characteristic. It follows a process called abstraction that tries to solve compatibility issues among different systems integrated into the whole object. This process leads to the establishment of a stable form until an essential evolution occurs [7].

The second way of evolution called concretization process follows a discontinuous path. This mode of essential evolution tries to establish new synergies within the object and is due to

new technical discoveries and advances. That way follows the creation of new forms for the technical objects.

The first mode of formal change leads to unessential evolution and even to involution of the form. The second mode leads to essential changes and explains the formal confluence of different objects, designed for very different functions, but sharing a common general functional principle.

The concept of type is therefore completely independent of programmatic characteristics of the buildings. There are many examples of this kind of formal convergence of objects designed for very different functional performances (hospitals and monasteries, Richardson's branch libraries and churches, prisons and offices, and so on). The next step in this research must be to illustrate that this typological transmission can also happen within structural systems. We will use for this purpose the structures designed by Albert Kahn, but there are several other examples that can be listed.

For instance, the structure of the Jefferson Pools in Warm Springs, Virginia (1761), and some structure of round barns sited in the American North West, like the Pete French Round Barn (around 1880), both depicted in figure 1.

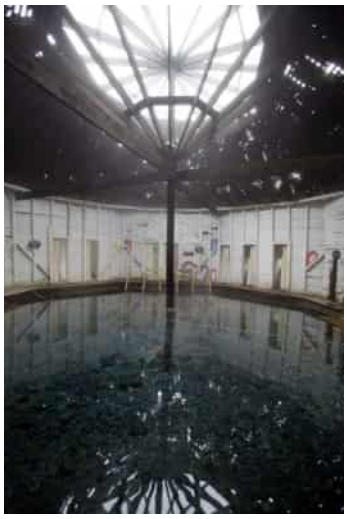

Figure 1a. Pete French Round Barn.
https://oregonencyclopedia.org/articles/peter_french_round_barn/#.WrfVOC7wapo

Figure 1b. Jefferson Pools. http://www.roanoke.com

This formal coincidence cannot be explained in terms of functionality or program, but only in terms of a more abstract structural principle related with the centralized form and with the need for proper ventilation of the inner spaces. The formal convergence is due to the coincidence of the structuring features of the form. This second thought connects with the other key concept of this text: the concept of type as explained by Carlos Marti Aris [8].

To define what this typological method of transfer of forms consists of, we will say that typology is understood in this context as a process associated with the linear and chronological temporality of history and it is based on the search for similarities to obtain the common root of disparate phenomena. Type is for Marti Aris: "*A concept that describes a formal structure*".

Deriving from this primary definition three implications: "*Type has a conceptual, not-objectual character, encompasses a family of objects"; it involves a "logical statement that is identified with the general form of these objects or integrating phenomena, and refers to the formal*

structure, without caring about the external appearance of the phenomena, its physiognomy" [9]. The typology is based on the evolutionary and selective character of the tradition considered as a system; it is not based on an imitation of particular models or objects or on the forms themselves, but on an imitation of the ideal.

The operations of transformation of the type have an infinity of modalities: juxtaposition, addition, subtraction, combination, change of scale, superposition, investment, symmetry are some of the basic tools of the project based on the typological method, and produces variation, hybridization, and mutation of the primitive type or elementary structure. It is also necessary to highlight the importance of the friction that occurs between the notion of type and that of place, of which architecture is a product as a material phenomenon inevitably and permanently located in a specific geographical location. The type refers to the generic, to the universal and abstract, while the place is singular, concrete and particular. This duality can be studied optimally in Kahn in the case of the whole of its production, in which the same program is adapted to several different places by means of typological manipulation, evolution, and hybridization from the same type. In other cases, as in the industrial architecture after Highland Park New Shop, it can be stated the separation of the buildings from the concept of place and its alignment with the concept of "technical object" of Gilbert Simondon. That allows us to assess the idea of type, as not only a procedure of analysis of the essence of architectural works, but as an operative method, as a strategic tool of the design act, and as such it will be studied based on the industrial work of Kahn.

Once the two initial hypotheses that establish the connection of Kahn with the railway tradition and the mode of operation of this connection is established, we will analyze the presence of the types coming from this tradition in the work of Kahn. We will try as well to reveal in what way the use of the typological method allowed the transformation of these primitive types into new ones.

The connection of Kahn's industrial architecture with types coming from the tradition of the American railway engineering, starts with the passenger stations and extends to other fundamental types of this tradition, such as, on the one hand, the railway bridges, and on the other, the "depots", "trainsheds", "engine-houses" and "freight houses" of the 19th century. In this paper, we will analyze only the case of the railway bridges. [10]

5 The American Railway Engineering as a tradition.

We state here the main working hypothesis of the article: the tradition in which Albert Kahn should be registered and where his industrial works come from, is not the tradition of American factory engineering where authors such as Banham [11] place it, but rather the tradition of American railway engineering. By reviewing the characteristic features of Kahn's buildings and formulating this hypothesis about the use of railway types in the genesis of this industrial architecture, two main considerations appear.

The industrial buildings of the first period of Kahn, in which the drift from the architectural project to the project of a pure technical object, come directly from the conditions of the production that they host. These buildings enter into a synergistic process with the assembly line. They become the spatial and material part of a global machine composed of machines, workers, and architecture. Thus, they are buildings that depend more and more on the form adopted by the Fordist assembly line. This form of production is, in any case, similar in its

linear motricity, to that of a train. An assembly line could well be called "assembly train" without losing an iota of significance and specificity. The assembly line, according to the authors who have dedicated themselves to its study, comes from the synthesis of numerous previous practices of other industries such as the manufacture of firearms and their interchangeable parts, the production of bicycles, meatpacking, and steel fabrication. Sigfried Giedion relates the assembly line and the railroad in an explicit and detailed manner. Giedion locates the origin of the assembly line, with the pioneering experiences of the Oliver Evans mechanical mills, and connects it directly with rail technology, using suspended rails and carts that slide over them at the Cincinnati slaughterhouses [12].

"The overhead rail system in the great slaughterhouses ultimately led to the conveyor system, which did not reach full development until the following century. The track, high above head level, carries small wheeled trolleys which are either drawn by chains or rolled by their own weight down an incline. Invented by a Cincinnatian in 1869, a hog-weighing device for pork-packing houses shows how overhead rails –as had appeared in J.G. Bodmer's traveling cranes by about 1830- have now developed into whole railways". [13]

Giedion reviews, as intermediate stages of this technological evolutionary line, some cases of special relevance for their connection with Kahn's factories, such as the invention by Bodmer (1786-1864) of the bridge crane, or the use of an elevated railway on Broadway with a suspended passenger compartment with a similar operation. In all these examples, the functional connection between the railroad and the group of mechanical inventions that later would constitute the total Fordist machine of Highland Park is obvious.

We will conclude that there is a total functional synergy between all the elements that make up the Fordist machine: the assembly line, the overhead crane, the elevated transport lines, the slides, the hoppers, and the railroad. This functional analogy, which establishes a technical lineage based on what we might call the "railway principle", is also present in the other inventions that transformed Western culture and thought in the early twentieth century, the cinema and the airplane.

On the other hand, a superficial glance at any set of factory plants designed by Kahn is enough to extract from all of them a common and evident characteristic. All of Kahn's industrial buildings are connected, in one way or another, to a railway. The numerous factories for the assembly of vehicles for Ford or Packard are, in all cases, industrial production buildings, and at the same time, railway loading and unloading terminals. The Fordist process of assembly line, had the necessity of a total continuity in the flow, in the rhythm of arrival of raw materials and in the distribution of finished products, for which the railway connection was essential in all cases, as that the connection to other transport routes of material such as fluvial or maritime. It is not strange that many of the factories that are explored subsequently have a plant organization similar to that of a station.

6 Railway Bridges. The cantilever as a structural type.

To highlight the relevance, importance and enormous popularity of the railway bridge as a constructive type in all its variants, it would suffice to say that, in the century that goes from the year 1790 to 1890, the Patent Office of the United States of America registered more than 600 patents of different bridge structures.

The explosion in the design of bridges occurred to meet the demands of the pioneering railway companies, which needed a faster and cheaper way to build than the old stone arch bridges. The first material used to replace the stone was wood, an abundant, cheap and easy-to-work material in nineteenth-century North America.

The design of arched bridges was soon abandoned in favor of the single-supported truss, which offered greater constructive ease, greater regularity of the pieces, a flat and horizontal platform for the train and vertical thrust in the supports, avoiding the horizontal thrust. These characteristics- the box-like bridge, open on top, and with two lateral lattice girders, became the standard of the railway industry.

Of all the lattices used in bridges, we are particularly interested in the Pratt beam. Albert Kahn will use this type of truss for the first extension of the aircraft assembly building of Glenn L. Martin. Pratt took the Howe beam and replaced the wooden diagonal elements in compression by two iron bars with threads and nuts in traction (changing the direction of the bars), and kept the vertical uprights to compression of wood. The other most popular truss of the time in the railway industry was the Warren beam (1846), without verticals and with alternate diagonals to compression and traction. This is the other truss used by Kahn at the Glenn L. Martin factory.

All these trusses had the need for wooden scaffolding under the bridge during the construction process. Normally these forms could be placed on temporary foundations or on floating platforms. Once built the bridge, it was allowed to come into charge and these auxiliary means were removed. However, there were numerous topographical situations, which made impossible the construction of these scaffolds or made it so costly that it was better to convert these scaffolds into the proper structure of the tracks [14].

The solution of the American engineers to this problem was the cantilevered bridge. The first example of this type is the Bridge over the Kentucky River, 1877, in Highbridge, Kentucky. Nevertheless, the cantilevered bridge that marked that time is the Bridge over the Niagara River (figure 2).

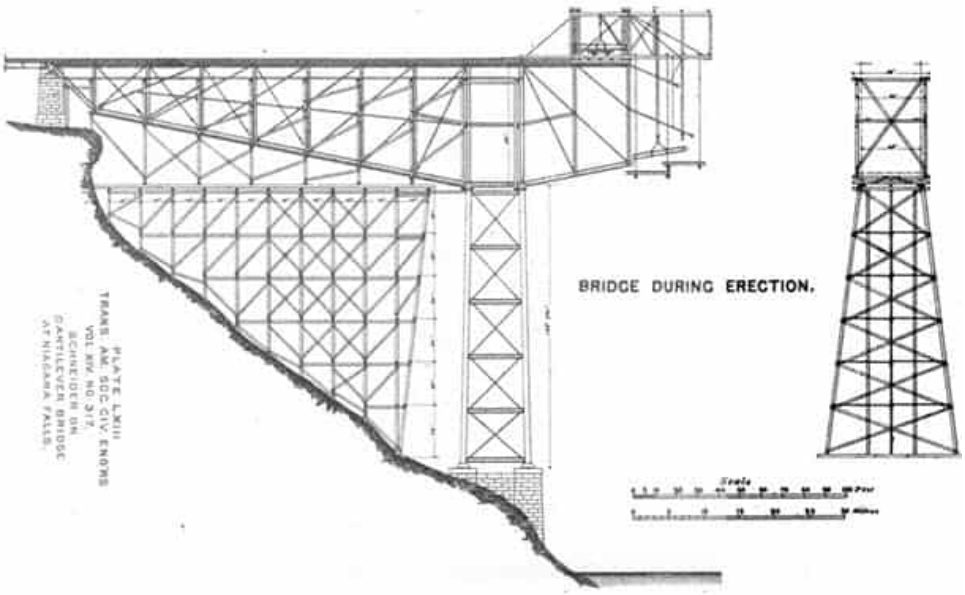

Fig 2. Niagara Cantilever Bridge. Schneider, Charles Conrad. *The cantilever bridge at Niagara Falls. With discussion*. American Society of Civil Engineers. Buffalo, NY, USA, 1885.

We are particularly interested in its character as a paradigm of cantilevered bridges and its relationship with the career of Julius Kahn. The impact of the bridge is demonstrated through the importance of the monographic conference on this construction celebrated in 1885 in Buffalo by the American Society of Civil Engineers and the publication that resulted from it. [15]

The cantilevered bridge over the Niagara, built in only 8 months, was a 910-foot (277.37-m) long structure that spans a central span of 470 feet (143.26 m). It was built on two supports with two double-cantilevered beams in balance. These central cantilevers were then joined with another beam that supported at both ends and that was built using an auxiliary structure sliding over the overhangs.

Charles Schneider was the chief engineer of the design of this bridge and the construction contractor was the Central Bridge Company. This company was the union of two others, the Union Bridge Company and the Morrison-Field Bridge Company. In a summarized biography of Albert Kahn's brother and associate, Julius Kahn [16], that after graduating in civil engineering in 1896 from the University of Michigan, he worked in the Union Bridge Company. It seems, therefore, a quite feasible hypothesis that he was perfectly aware of the details of the design of this bridge in particular and cantilever bridges in general.

7 Albert Kahn. Persistence and transmission of the technical form. Bridges, cantilevers, and fractals.

To illustrate this typological way of transmission of form, this text will now focus in some cases extracted from the enormous industrial production of Albert Kahn. The use of the industrial architecture of Kahn is pertinent because they show a design methodology that is in the threshold between architecture and a technical object. They are also in the confluence of three different technical industries: railroad engineering, industrial architecture, and aeronautical engineering.

We will use two buildings for our purpose, the two additions to the Glenn L. Martin Company Assembly Building (built in 1937 and 1939). Both of them are characterized by the use of what we called previously the “Railroad Principle”.

The first extension to the Glenn L. Martin Company Assembly Building (1937) was an important structural challenge since it was to build a diaphanous space of 300x450 feet on the floor (91.44x137.16 m). One of the sides of this huge shed should be able to be completely open by some system of doors or moving panels. There was an internal contest in Kahn’s office for this project and each proposal was literally weighted. Kahn chose the design that had the lowest steel weight per square foot of roof. The design used Pratt trusses spanning 300 feet and of 30 feet of height. These trusses were set 50 feet apart from each other.

There was no precedent for a building with a truss covering 300 feet. Hildebrand offers in his monograph on Kahn two precedents: the 240-foot shed of the Crucible Steel Mill Company in Harrison, (1911) and the railway train sheds of the 1890s span like the Broad Street Train shed in Philadelphia with an arch spanning 300 feet and 8 inches. Hildebrand also acknowledges

that there were railroad bridges with greater spans and gives an example: the bridge of the Chicago and Alton Railroad company in Glasgow, Missouri. [17]

The building was designed with Pratt type bridge beams that were alternately joined by an upper or lower platform formed by Warren beams that span the 50 feet between trusses. Due to this duplicated situation, the structure looks like as if it were a series of inverted "pony" type bridges supporting a low deck between each of them. In this structure, no use was made of the cantilever, but of the simply supported box trusses typical of the first American bridges built of iron. Regarding the building process, if we look at the photos of the construction (fig. 3), we will see how temporary supports of mobile metal scaffolds similar to bridge construction held these beams [18]. The main Pratt beams, exposed to moving loads because of the bridge crane, have a reinforcement in the central modules of the span with a smaller triangulation. It follows the model of the Baltimore type trusses, which use the Pratt as a base with diagonal reinforcements in the part near the upper cord to avoid local buckling in the longer elements.

Fig. 3. Glenn Martin Co. Assembly Building. 1937. A. Kahn Papers. Bentley Historical Library. Box 4.

It is an optimal design like those of the bridge engineering. It has as well, once liberated from more complex functional requirements only one purpose: spanning the distance required to allow clearance to assemble the aircraft models PBM Mariner and PBM 2 Mars. The factory creates a curious technological loop between three technological fields: railroad bridges, aircraft construction, and factory building. The trusses are composed of bars built like smaller tridimensional lattices. This construction strategy is similar to the pioneering aircraft construction and is used in order to decrease the own load of the structure. XIX Century steel bridge trusses also used this kind of almost fractal structures with the same purpose. (Fig 4).

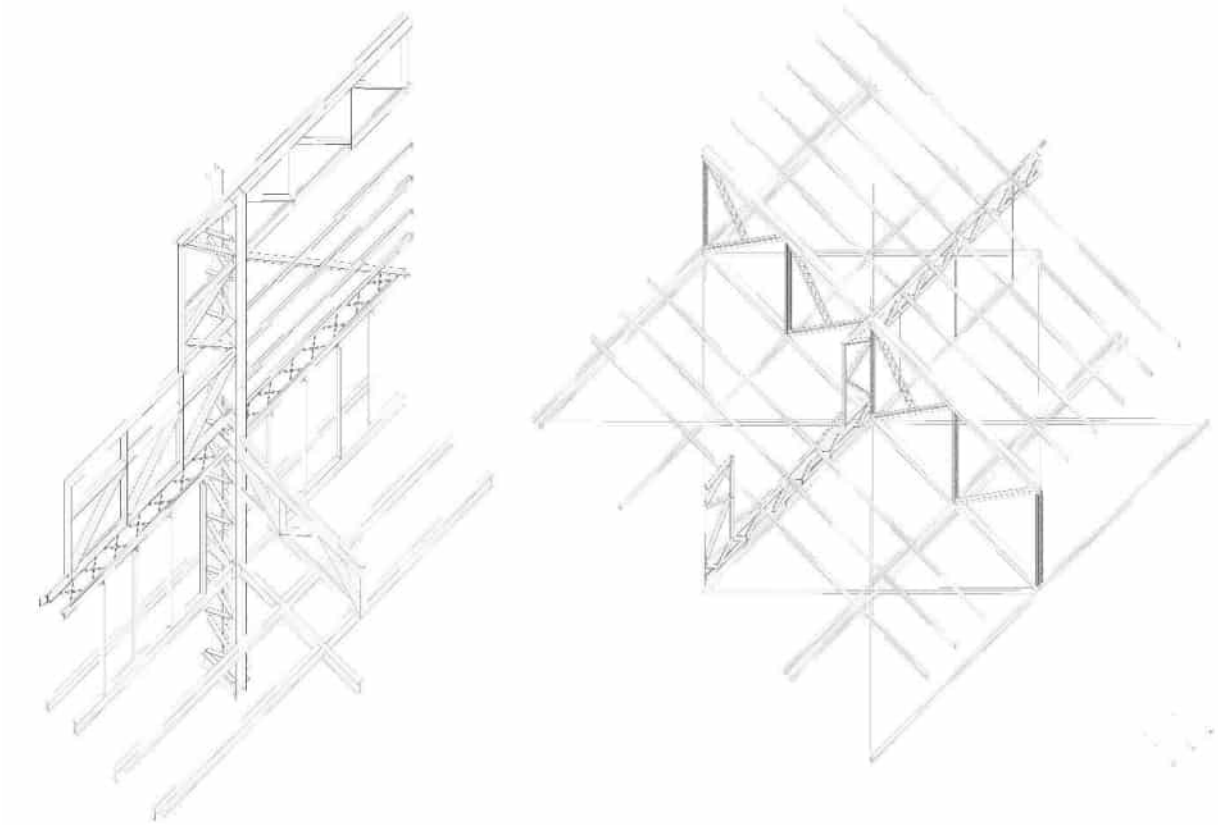

Fig. 4. Glenn Martin Co. Assembly Building. Albert Kahn 1937. Detail of the structure. Drawing: Kendra Chow. University of Virginia.

The story of the second extension of the Glenn L Martin starts with a telephone call. In this call, Albert Kahn was asked to design and build the second extension of the factory and to do so within 84 days (from February 5 when he receives the call to May 1, 1939, when the factory must be operative to contribute to the World War II effort). Kahn planed a concrete structure up to the first floor (to save time since there was a concrete contractor operating at the factory at that time). The concrete works started in 11 days. The building was finished on April 23, 1939, and the production of aircrafts three days later.

The structure of the building is more related to the engineering of bridges than with conventional construction. The structural module used in this case is a double overhang of Warren trusses inclined to form a side monitor. They are grouped symmetrically, forming a low roof between two side monitors. The support is in the center of the two overhangs and Pratt beams span the distance in the other direction. The solution is coincident with those adopted in the railway infrastructures regarding some formal features: the use of the structural cantilever, the stepped section, and the superposition of structures forming monitors. We could say that it is a combination of a "multiple train shed" with a structure of cantilevered bridges. (Fig 5)

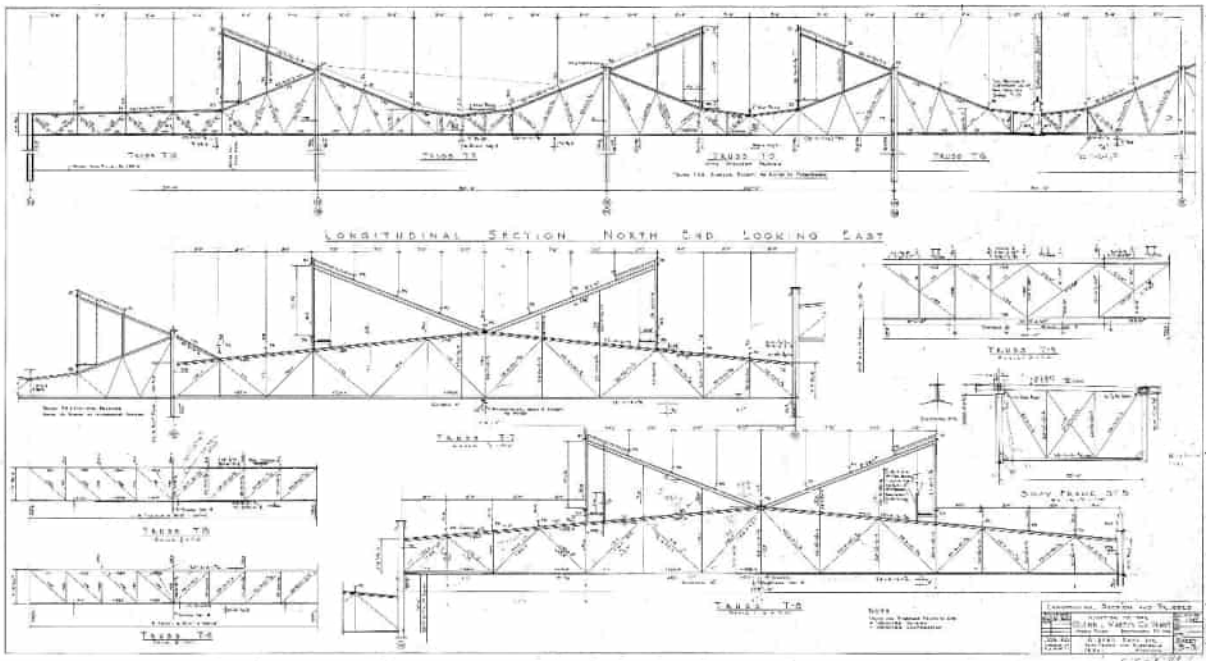

Fig. 5. Glenn Martin Co. Assembly Building. 1939. Structure. Albert Kahn Papers. Bentley Historical Library. Tube 31.

Grant Hildebrand himself makes an assessment of these two extensions that clearly relates them to the engineering of public works more than to architecture and that supports the main thesis of this article:

"*The total plant is one of Kahn's finest designs. Though smaller than many others, it deals with the making of machines at a scale unprecedented even in his own work. The principles behind every aspect of the design are conservative; the power of the solutions lies in the exploitation of these principles at a scale and with a boldness normally found only in great works of civil engineering, from which in fact the principles were drawn".* [19]

There are several examples of this typological use of the cantilever in the work of Kahn. We can perceive that feature especially in the Half Ton Truck de Chrysler Plant (Warren, Michigan), Delco Appliance Division of General Motors (Rochester, NY), Ford Motor Company Engineering Laboratory of River Rouge, and in the Lady Esther Ltd building (Clearance, Illinois).

8 Conclusions.

In this article, two cases of formal convergence between railway bridges and factories are studied. The thesis of the paper is that this formal convergence is not due to a functional coincidence, but to the establishment of a common typological principle in both kinds of constructions. This principle has been identified as the "Railway Principle" and has its origin in the American Railroad Industry of the XIX Century. Furthermore, this "Railway Principle" permeates numerous American technical inventions of the nineteenth and twentieth centuries such as the assembly line, bridge engineering, aeronautical technology, urban planning, and even cinema. This, along with other notable cases of formal convergence with railway elements present in the work of Kahn, allows us to re-establish the figure of Kahn within a new traditional frame: the tradition of North American railway engineering.

Within a more theoretical scope, this research has two main connotations. On the one hand, the research establishes a new hypothesis of work on the form of creation and transmission of the architectural form. This new hypothesis is based neither on the imitation of organic elements, nor on the function or program of use, nor on the parameterization of external conditioning factors to architecture. It is based on a concept of type grounded on structuring principles of the form that have a trans-disciplinary character. This may help to establish a new genealogy of architectural form very different for instance of that established by Nikolaus Pevsner, which despite its title, has nothing to do with typology [20]. This new genealogy would be potentially open to technical forms coming from other not directly related technical fields.

On the other hand, the specificity of the research, which focuses on the form of the structure, can help to extend the idea that the typological mode of creation and evolution of the form is not only applicable to the architectural object as a whole but also to each of its parts or sub-systems. This application of the typology to structural elements reveals, for example, the existence of a close formal relationship between the latticework of bridges, the wings of the aircraft and the structures of the buildings in which these aircraft were manufactured. Furthermore, this formal relationship is not related to their structural performance. This and other similar technological evolutive loops are consistent as well with Simondon's theory about the discontinuity of the technical development. (Fig 6)

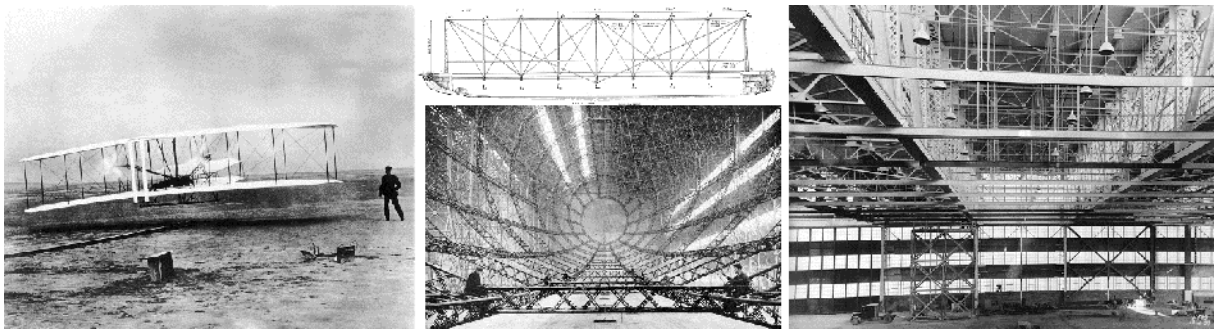

Fig. 6. From left to right. 6.1. Wright Brothers flyer, 1903 (US National Archives). 6.2. Albert Fink Truss, Hunterdon County (HAER NJ, 10-CLIN.V1). 6.3. Dirigible USS Akron, ca. 1933 (US National Archives). 6.4. Glenn Martin Co. Assembly Building. 1937. (Albert Kahn Papers. Bentley Historical Library. Box 4).

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NEUROCOGNITIVE ADVANCES FOR INCLUSIVE ARCHITECTURE: WAYFINDING AND WAYSHOWING

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Abstract

Inclusive architecture has been approached from diverse perspectives, but it has scarcely been considered under the substrate of neurocognitive sciences.

Architectural interventions or reasonable adjustments in spaces designed for people with disabilities are generated under strictly functional guidelines that do not consider deeper levels as those that account for the latest advances in neurocognitive sciences.

The concepts of wayfinding and wayshowing are proposed as a resource to design spaces where it is possible to find and identify places and routes in buildings and cities through natural and intuitive elements. The design under the concepts of wayfinding and wayshowing adds cognitive precepts to the inclusive architecture and is conceptualized as those systems of spatial orientation that in this context take on singular importance.

This paper analyzes the conditions of Inclusive Architecture, Wayfinding and Wayshowing, in order to carry out an analysis of the conditions of sustainable design with this approach.

Keywords

Inclusive Architecture, People with Disabilities, Universal Design, Wayfinding, Wayshowing

1 Introduction

This paper analyzes the importance of inclusive architecture not from an exclusive perspective of accessibility norms, but from emerging concepts, coming from cognitive neurosciences: wayfinding and wayshowing.

It is understood that architecture should take advantage of research on perception and spatial orientation, as a non-visual but cognitive conception, where the pertinence of a mental capacity of location inherent to human beings is exposed and exploited so that it is possible to optimize displacements in any space If advances in universal design are added to these positions, the intention to achieve autonomous displacement for all, without distinction, would be closer to achieving an equitable and inclusive space, which is a right of the people indicated in international policies.

2 Universal Design, Inclusive Architecture and Wayfinding

The universal design promotes a design that is convenient, accessible and understandable for all types of users, regardless of their particularities, so it tries to eliminate adaptations or specialized solutions, which always end up segregating some sector. According to the Expert Committee of Universal Design of Spain [1], its concept transcends the accessibility of people with disabilities to conceive an idea where inclusion in all its manifestations is part of urban policies in general. The importance of this design perspective is that it addresses the needs of users beyond those considered "average", "typical" or "normal".

Inclusive architecture is the response of this discipline to universal design. Under this paradigm, its approach captures and exceeds architecture without barriers. Inclusive architecture must consider the redesign of spaces that satisfy the needs of a diverse user, not as a concession for any one in particular, but as a way to encompass them all.

For its part, the concept of wayfinding [2] refers to a cognitive approach to design focused on design intervention concentrated on spatial information systems to guide people in architectural and urban environments regardless of their particular characteristics.

The concept of Wayfinding has its origin with Kevin Lynch [3] and his proposal was inclined to the orientation and location of the user in the city. García Moreno [2] defines way finding as a series of cognitive mechanisms that, through the information provided by the environment, are part of the process of user orientation in space.

According to this author, the orientation process is limited by: perceptual, cognitive and interaction procedures; and it does not speak of resources of orientation in themselves, but of how people are oriented through analytical processes.

1. Perceptual procedures: consist of information resources obtained from the environment through auditory, visual and haptic channels.

2. Cognitive procedures: information resources obtained from stored memory and evaluated for interaction with space, the so-called route scheme. The route scheme is made up of with three components: location, destination and journey.

3. Interaction procedures: the information that is being processed forces people to update information about their environment and position, so that decision-making is adjusted at every moment and place. This determines the routes in architectural and urban environments.

The interconnection of the concepts of inclusive architecture and wayfinding allow not only to be restricted to formal and functional questions of architecture, but also to approach the displacements under a cognitive, communicative and consequently semiotic approach. From semiotics we can distinguish the three elements present in the communication process: the person, the architectural or urban space and the signals coming from the wayfinding (the intuitive message).

3 A NORMATIVE VIEW OF INCLUSIVE ARCHITECTURE

Since the Convention on the Rights of Persons with Disabilities, held in 2006, which aims to promote, protect the conditions of equality of all human rights of persons with disabilities and respect for their dignity, society has been made more aware of the situation of imbalance that had excluded in many ways minorities of the population, who were expelled by their conditions of a full life, a consequence of centrifugal and little inclusive spaces.

Article 9, on accessibility, states that "in order for persons with disabilities to be able to live independently, appropriate measures will be taken to ensure equal access to the physical environment, transportation, information and communications and facilities open to the public. public or for public use " [4], which addresses aspects such as the identification and elimination of obstacles and access barriers in urban-architectural environments.

This document becomes a global watershed and gradually, committed countries begin to implement measures through rules that regulate the conditions of spaces, although in many cases it is manifested as preferable, but not as an obligation.

In Mexico, the General Law for the Inclusion of Persons with Disabilities is enacted in 2011 [5] and it establishes that one of the fundamental rights of persons with disabilities It is accessibility. In particular, article 17 establishes that "to ensure accessibility to basic infrastructure, equipment or the urban environment and public spaces, the following shall be considered:

I. That it be of universal character, obligatory and adapted for all the people;

II. That includes the use of signage, architectural facilities, technologies, information, braille system, Mexican sign language, technical aids, guide dogs or service animals and other supports, and

III. That the adequacy of public facilities be progressive [5]

One of the most vulnerable aspects in accessibility are those corresponding to vertical and horizontal circulations, since they are the ones that drive the axis of the displacements in the spaces:

1. Pedestrian itineraries, those that guarantee the non-discriminatory use and the wandering of autonomous and continuous way of all people have been defined as accessible [6].
   Among the aspects to observe in the pedestrian itineraries are:
   a) The composition of the public road
   b) Its dimensions, both in width of step and in free height
   c) Maximum slopes, both longitudinal and transverse
   d) Pavements used
   e) Lighting conditions
2. Stairs: It is important to mention that stairs are not considered an accessible element [6]. In its design should be observed:
   a) Geometry (step widths, landings, number and geometry of the steps, etc.)
   b) Protective handrails and breastplates
   c) Pavement and signaling of steps
   d) Interaction with public roads (reduction of width of step in sidewalks, protection of the step under stairs, etc.
3. Ramps: Attention must be paid to the following elements:
   a) Geometry (widths of step, landings, slope, etc.)
   b) Protective handrails and breastplates
   c) Use of pavements
4. Elevators: The lift is a measure that offers a more comfortable and faster use than the ramp, from a certain number of levels, however, the interruption of the service, can be an insurmountable barrier for what should be procured a secondary itinerary alternative [6].
   In its design should be observed:
   a) Geometry (cabin dimensions, step width, etc.)
   b) Buttons and communication elements
   c) Pavements and signage on public roads

The considerations to the standards evidently optimize the function of the space under the criterion of universal design, unfortunately they are not yet obliged in the construction regulations, or their omission in Mexico is not sanctioned.

4 THE *WAYFINDING* AND THE URBAN-ARCHITECTURAL SPACE

Wayfinding refers to the information systems that guide people through physical environments and improve their understanding and experience of space. It focuses on a non-standardized person, that is, on the existing diversity of people and their capacities and physical, cultural, social variables, etc., in relation to the environment in which they operate. The importance of a clear and legible proposal of the urban-architectural space is essential in emergency situations, because in a situation of danger the brain suffers a rational disconnection and acts by instinct, so that the displacement to be safe must be given intuitively There are communicative elements that the architects have managed and that are culturally recognized for the recognition of space, they are: hierarchy, symmetry, and functional zoning, however, under the approach of *wayfinding*, these concepts are translated into principles that should be monitored closely so that, in conjunction with universal design, the risk for all users is reduced.

The principles of *wayfinding*, according to Mark A. Foltz [7] are:

1. Create an identity in each place, different from all the others
2. Use landmarks to provide directional signs and memorable places
3. Create well-structured routes
4. Create regions, subdividing the space, with a differentiated visual character
5. Do not give people too many options in navigation
6. Provide maps
7. Provide signals at decision-making points to help make decisions about the way forward
8. Show what is coming, that is, what we will find next

These principles, transferred to the inclusive architecture, are extremely important in case of emergency, since the success of an evacuation route or the effectiveness of emergency exits depends on them:

1. Create an identity for each place, so that the user does not get confused. The badges can be colors, shapes, textures, aromas, etc.
2. Use reference points such as landmarks, visual auctions, textures, etc.
3. Create well-structured routes, through compositions of logical, legible, wide and without dimensional changes, accusing themselves as an evacuation route
4. Subdivide the space, create clearly identifiable zones or subzones: the heights and the lighting constitute perceptible signs for people with visual weakness or blindness (by the aid of sound)
5. Do not give too many options of navigation or circulation, generating labyrinthine displacements or that do not lead to the exit
6. Place haptic location maps
7. Place signage indicating exits, which can be with signage or architectural messages such as height change, enlarge spans, expand scales, etc.
8. Show contiguous spaces and preferably general spaces of location (central courtyards that allow to understand the global conformation of the architectural space)

If we add to this the normative proposals for universal design, the possibilities of space being a barrier will be reduced.

5 *WAYFINDING* AND *WAYSHOWING* AS AN INCLUSIVE ARCHITECTURAL RESOURCE

Under the premise that *wayshowing* makes *wayfinding* possible, Per Molleru [8], Danish designer and academic reconfigures the passive role of *wayfinding* -the what- (as a cognitive capacity that intuitively allows spatial location and orientation) to direct the gaze to the spatial implementations that contribute to the development of this cognitive capacity: the *wayshowing* -the how-. That is to say, once the human beings capacity to orient themselves through neurocognitive codes of great simplicity is understood, the idea is to consciously perpetuate these codes in the design of spaces.

The concept of *wayshowing* is a term coined by Mollerup, who from this trench pleads for simplicity as the basis of design. For him, the relevant way to "show the way" is to generate a series of codes, already immersed in the human brain to systematize it as a language that

guides the user in space, regardless of their conditions, and thereby contribute to inclusive spaces.

For Mollerup the basis of this new code lies in two basic principles in the design: Simplicity and Redundancy. Simplicity is based on a functional proposal where the designer relies on perceptual, cognitive and interaction procedures, according to which elements that complicate the displacements or configurations of the place are eliminated by considering elements that generate noise, errors or misunderstandings in its composition. The redundancy, on the other hand, constitutes the axis of the systematization of codes, and in this the readability of the place is sustained.

As it is inferred, the wayfinding refers to the way in which mentally the displacement is planned for a place, but not as a simile to a visual-mental map, but it involves symbolic components and past experiences that are determinant in the spatial location. The information that we store in our memory allows us to highlight aspects of the environment that are necessary or important to locate us and move around in space.

According to the Center for Inclusive Design and Environmental Access of the University of Buffalo [9], the design of the guidance systems (*wayshowing*) should consider: a.- identify and mark spaces; b.- grouping spaces; c.- link and organize spaces; and d.- communicate this information to the user.

Despite the convenience of adopting inclusive measures, architecture is still governed by functionalist and rationalist measures inherited from the modern movement, where the concept of inclusion did not exist.

Today, the concepts of zoning that architects prefer are based on functional principles of space optimization (avoiding displacements and saving construction spaces) and the relationship between them is given by functional logic and facilities economics, but not by *wayfinding* concepts and *wayshowing*, which involve questions of spatial cognition and orientation based on simple codes and resources.

Architectural spaces should consider the principle of a cognitive map, that is, the spatial cognitive structure, and with it three elements:

1. places (from its micro concept as furniture, to premises, patios, structures, milestones, etc.)
2. associations between places (consider in the design the relationship of distance and direction from one place to another so that it is clear, legible and memorable)
3. travel plans or itineraries (translations of cognitive maps about the environment).

Elements of construction of cognitive maps are environmental variables [10], of which four are distinguished:

a) Visual access, generally handled with hierarchical elements (such as larger scale, architectural elements such as pediments, arches, giant columns, etc.).

b) Degree of differentiation, through distinctions in the management of spaces generating contrast with color, shape, finish height, etc.

c) Complexity of spatial design related to the way in which the articulation of spatial elements is presented to each other.

d) Signaling, referring to the use or application of external guidance resources to the individual to facilitate travel.

The lack of consideration of these cognitive aspects means that most of the buildings absence of measures that address concepts such as those of inclusive architecture and *wayfinding-wayshowing* in a deliberate manner.

Clear evidence are these images that constitute strong evidence of the importance of their study and consideration. The space is badly solved, without considerations of the relations of places, associations or plans of displacements. In the first case (Image 1), we can see a space that, although it may have been readable, the elements that without consideration are located as islands impede free movement by invading areas designed to walk. In image 2 the obstacle in which the urban furniture is converted is seen as its location is not considered under *wayfinding* and *wayshowing* concepts, but only aesthetic. In case 3, restrooms are located on a different level of a cinema hall, in invisible and intuitive locations, as well as being an inaccessible space for people with motor disabilities. In the image 4, the stairs, which are fundamental for the displacement, have to be announced with a sign (not accessible to people with visual weakness or with total blindness) due to the irrelevant architectural solution. Also, in this case there is no ramp. Finally, in picture 5 the toilets are solved in labyrinth conditions and without possibility of association, and not to say the lack of existence of ramp.

Image 1 Facilities that interfere with intuitive and accessible free transit (Solano, 2017)

Image 2 Urban furniture becomes an obstacle when its location is not considered under concepts of wayfinding and wayshowing (Solano, 2017)

Image 3 Sanitary ware in a different level of a cinema hall, in little invisible and intuitive locations (Solano, 2017)

Image 4 The stairs have to be announced with a sign due to the irrelevant architectural solution (Solano, 2017)

Image 5 The toilets are solved in confusing conditions and without the possibility of association (Solano, 2017)

All these elements are barriers to intuitive displacement because they do not give credit for the construction of a concept of simplicity and redundancy, in order to contribute to the cognitive processes in which the instinct of orientation in space is decisive, hence the importance of *wayfinding* and *wayshowing* concept in inclusive architectural design.

6 THE *WAYSHOWIN*G: THE IMPORTANCE OF THE ELIMINATION OF COMPLEXITY AND COMPLICABILITY IN ARCHITECTURAL SPACES

As it has been demonstrated, one of the basic principles of the design under the concept of *wayshowing* is the simplicity and the elimination of elements that complicate the legibility of the spaces. The possible readability of a space can be analyzed semiotically under two criteria: complexity and complicability [11].

The concepts of complexity and complexity deal with two aspects: function and use. The function obeys to a rational interpretation that bases the issuer proposal, but that is subject to the relevance and particular conditions of the user. On the other hand, the use is more pragmatic: it is the interpretation that the user makes of the object and that will not always correspond to the ideals thought by the author but that are equally legitimate, since they obey the impost of the user.

The authors distinguish for their analysis the principles of the complexity (that attends to the number of elements and the function) of the complicability (that attends to the difficulty that could arise in the use of the space)

The 4 principles of complexity that serve the function are:

1. Conceptual models.- They reside in the memory of the user, are the mental schemes that allow generating an "a priori" structure of a space from previous experience, this due to the similarity between elements of a building with the same essential condition, time that allows the identification, simplification and ordering of aspects that facilitate its location. The locations and dispositions go beyond aesthetics, since the reading can

be based on the perceptual, cognitive and interrelation characteristics that the person knows before and is repetitive.

2. Modular Structures and Semes.- This concept refers to the structural basis of a building: the number of spatial components of a building and the functional link that joins it. This structural analysis is reflected in the architectural program, which is the list of the different spaces that make up a building and that correspond to different functions: the kitchen to prepare food, the bedroom to rest and the bathroom for cleaning. These spaces in the architecture are organized by the functional association, which determines the zoning of the building: public areas, private areas and service areas, to give an example. Because it is a repeated discourse in architecture, it can serve as part of the cognitive procedures that the user already carries out in advance.

3. Graphic Signs.- Refers to the signs that make a building readable (not necessarily the signs, since, being graphic, it is beyond the reach of a minority). In its perceptive and cognitive approach it has to do with the hierarchy that is usually made of more important spaces or of greater demand, such is the case of stairs or a large portico to accuse an access. The resources of the architect are: the proportion, the color, the materials, the textures, the forms, etc. All these cases constitute an architectural language that helps the user to understand space and its function.

4. Potentialities. - In a building there are different possible functions, since the needs change over time. That a building has the capacity to adapt to such changes, or flexible, gives the possibility of being reused. However, we must consider the perceptual and cognitive codes already described in these changes. Specifically, in Latin American architecture, where permanent construction is privileged, this is of great value.

For its part, the 4 principles of complicability, which focus on the way spaces are used, are:

1- Ergonomics: Considering the building as a system, this involves the study of the interactions between the users and the related system always in the optimization of their displacements and orientation.

2- Affordances: They are based on the architectural signs (both formal and functional) that have been constituted historically, and that by analogical principles people "understand": for example, the management of hierarchical elements in accesses such as: stairways, lateral pilasters, pediments, arches, larger scale, color, etc. and that constitute indications to how to use a building.

3- Protocol and Sequence of use: Its adequate study raises dispositions in spaces that are defined by the logical order of doing a task, it is the case of a kitchen, that are

attached to the sequence of sequential functions, such as: food store, cleaning, preparation and cooking of them.

4- Learning time: The quantifiable time in which for the user the understanding and familiarization of the architectural object is possible. A sign is the references with which the same architect defines the spaces.

The ideas of complexity and complicability become argumentative instruments, which, by association, refer the interpreter to perceptive, cognitive and interrelation fields that make possible the reading of the spaces enriched with the approaches emanating from the principles of *wayfinding* and *wayshowing.*

7 PROPOSALS TO GENERATE READABLE SPACES UNDER THE CONCEPT OF *WAYFINDING* AND *WAYSHOWING*

In addition to considering the principles of Universal Design in the design of the spaces, it is necessary to add to it, the interventions thought in the three mentioned procedures: perceptive, cognitive and interrelation that are inferred from the proposal of analysis and design that revises the complexity and complicability.

It is proposed that, when generating a spatial arrangement, the following aspects that contribute to the *wayfinding* and *wayshowing* concepts are addressed:

- **Standardization, generalization and systematization of functional patterns (Riffing),** that although the zoning of the spaces has been given by functional approaches (taking into account the economic interests of facilities efficiency and displacements) today it is reconceptualized not only by economy of displacements, but also by cognitive logic. To this can be added, that spaces with close functions homologous finishes, materials and spatial locations to create a cognitive map that obey the association by likeness or similarity. In this way common spaces would share finishes in floors, walls and ceilings, as well as colors and materials of preference with olfactory qualities.

Image 6 Homologation of heights, wall finishes and situational continuity as an example of functional patterns (Solano, 2017)

• **Visualization of orientation elements (perceptual milestones),** this implies leaving signs or signals that, through their achievement, allow the user to understand the space in a global way and thereby build their journey. This requires codes that the designer proposes such as: double heights, domes handling, floor treatments, etc. especially in public spaces, which allow to visualize the milestones regardless of the layout or location of the different areas of the building.

Image 7 Example of the bad application of finishing design, textures and colors on the floor, because it is not based on wayshowing concepts because it does not take advantage of the possibility of serving as a guide on the route. (Solano, 2017)

• **Use of color as a displacement code and location**, which constitute a signal that facilitates the location, in which the change of color indicates change of area in the architectural or urban space, or change of spatial function. In confusing spaces such as typical buildings (hotels, parking lots, etc.), color is a location argument**.**

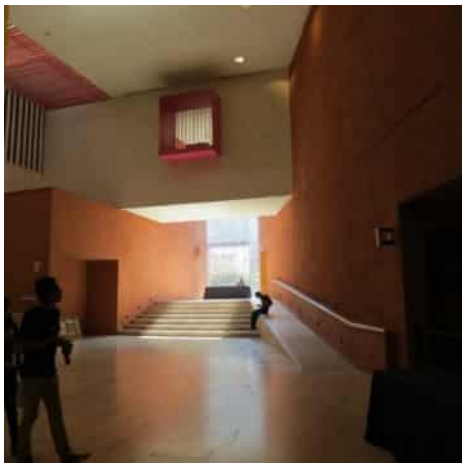

Image 8 The use of color as a location resource in the MARCO museum; Monterrey, Mexico (Solano, 2015)

- **Use of olfactory and sensory guides,** so that signs such as light, aromas and air currents generated with resources such as interior patios, gardens, light wells can be elements that facilitate location in space, while they act as passive systems to reduce energy demands and non-sustainable installations.

Image 9 The recovery of spaces such as cloisters or double-height spaces, where open spaces, air currents, plants or gardens with aromas are present, and more lighting to build a spatial reference (Solano, 2017)

- **Direct, straight and without barriers,** with which it is necessary to avoid elements such as columns, furniture, plants and other elements in the middle of the circulations that constitute a barrier or generate noise in the construction of the user's cognitive map.

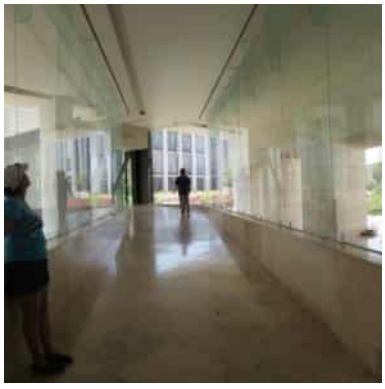

Image 10 Example of free movement of obstacles, simple and straight in the MUNE, Monterrey (Solano, 2015)

• **Elevations of roofs and widths of circulations** that serve as hierarchies' codes, whose pattern recognizes that, with greater width of circulation, greater importance of the walker, corridor or street. With this it is possible to resort to the ambulatory of greater dimension to locate the exits.

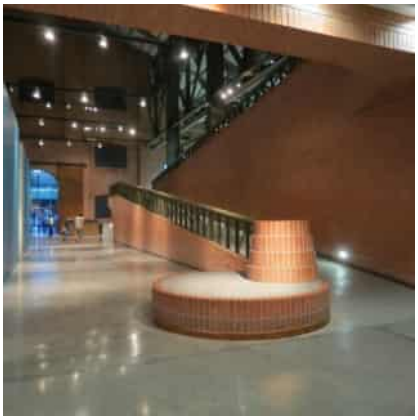

Image 11 Allow the discrimination of spaces by their characteristics such as width or height to allow orientation. (Solano, 2015)

- **Goal attempts as guides,** elements configured as milestones, from which their sound qualities are exploited, as in the case of fountains or waterfalls, but always seeking to avoid physical conflicts due to their location and not to be confused with banal aesthetic proposals.

Image 12 Sound elements not with aesthetic intention, but as an element of sound perception as a guide and orientation milestone (Solano, 2015)

8 CONCLUSIONS

Despite the importance of the principles of inclusive architecture and its implementation in the construction and operational efficiency of buildings, there are no regulated rules on design that unify the concept of Universal Design with the concepts of *wayfinding* and *wayshowing*.

In the design of architectural spaces, it is necessary to consider spatial learning and thought through patterns, since as it is seen, it is not the same as visual learning and thought.

Integrating the concept of *wayfinding* and the *wayshowing* in the architectural design implies the use of sensory and cognitive inputs not generally considered in the functional and aesthetic proposals that predominate in the non-inclusive design. The qualities of the architectural signs provide the possibility that, based on simplicity and redundancy, already exposed principles of the *wayshowing*, inclusive architecture is generated that encourages inclusion for people with disabilities, through a more meaningful association with the space that you live That is why exploring the codes and architectural resources configured with perceptual, cognitive and interaction procedures allows the legitimization of them as a means of socialization that enriches the understanding and inclusion of people to whom a functionalist and aesthetic architectural criterion prevents them experience the world around you.

It is the commitment of architects and designers, through architecture and design, to build guidance systems that include the implementation of the principles of Inclusive Design through the generation of spaces that contemplate the aforementioned inclusive means, either with reasonable adjustments or inclusive architectural proposals.

Also, considering the concepts of *wayfinding* and *wayshowing*: generate clustering or zoning spaces based on proposals for standardization, generalization and systematization of functional patterns; visualization of elements of orientation, use of color as a code of displacement and location, use of olfactory and sensorial guides, direct, straight and barrier-free routes, heights of covers and widths of circulations and auctions as guides; link and

organize spaces under basic cognitive schemes which allows the identification, simplification and ordering of aspects that facilitate the location, such as visual access, degree of differentiation, through distinctions in the management of spaces generating contrast with color, shape, finish height, etc; complexity of the spatial design related to the way in which the articulation of the spatial elements is presented to each other and signaling, referred to the use or application of resources of orientation external to the individual to facilitate the displacements and finally communicate this information to the user in a legible manner and universal through the systematization of these processes.

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ENERGY RETROFIT: A REVIEW OF TRANSDISCIPLINARY APPROACHES

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Abstract

The purpose of this paper, which reports work that has been undertaken as part of a H2020 Marie Skłodowska-Curie project, is to examine the transdisciplinary (multidisciplinary and interdisciplinary) practices in energy retrofit in the UK. Energy retrofit is defined as the refurbishment of existing buildings to reduce their energy demand. Currently, it is recognized as a relevant strategy to improve the environmental and energy qualities of buildings and cities. Nevertheless, its full potential cannot, at present, be exploited due to lack of integration among disciplines. This disintegration is considered to be one of the key reasons behind the performance gap between the design aspirations and performance in use. A literature review was conducted through a qualitative approach to evaluate the state-of-the-art in transdisciplinary practices and to identify emerging lines of inquiry in Energy Retrofit. The findings are presented as a novel conceptual framework, which illustrates the need to develop capabilities to manage the complexity inherent in these projects. Future steps, which seek to move from a conceptual framework to an integrated learning platform, are also presented. This platform will be exploited by built environment professionals for deep energy retrofit as a step towards managing complexity.

Keywords

Transdisciplinary Approaches, Deep Energy Retrofit, Knowledge Management, Knowledge Transfer

1 Introduction

Energy Retrofit (ER) concept plays an important role in the transition to low carbon cities, because buildings make a substantial contribution to the total energy demand. In an analysis of UK emissions, Boardman [1] reported that buildings accounted for 18% of greenhouse gas (GHG) emissions in 2015, with 75% of this share attributable to residences, 15% to commercial buildings and 10% to public sector buildings. Additionally, in another major study the Committee on Climate Change [2] showed that over two thirds of the buildings that will exist in the UK in 2050 have already been built and, in particular, over three

quarters of the 28 million dwellings in the UK were built before 1980. It is thus clear that the existing energy-intensive building stock needs to be upgraded to high performance buildings for success in the long-term reduction of energy demand and of the related GHG emissions [11]. Furthermore, the low carbon cities transition discourse acknowledges the need for developing a transdisciplinary approach to ER, by advocating collaborative and interactive research [14], in order to close the performance gap between the design aspirations and performance in use [3]. Here, the term "transdisciplinary" refers to both multidisciplinary and interdisciplinary approaches [8]. It requires the stakeholders and experts, who take part in mutual and joint learning processes, to develop new cognitive skills and habits [14].

Several studies have examined transdisciplinarity in Energy Retrofit, and suggested new integrative processes to holistically evaluate a multitude of technical and non-technical factors. For example, Ma et al. [9] state that a plethora of retrofit technologies are available. They acknowledge the challenge in terms of assessing the appropriateness of different technological solutions to different problems in different scenarios. They propose the following criteria are used in making this assessment: 1) the desired reduction in heating and cooling demand, 2) user-technology match, 3) efficiency of the system; and 4) adoption of low energy technologies, renewable energy technologies and electrical system retrofits. Dixon et al. [4] explored the evolution of the retrofit concept, and its manifestation at multiple socio-technical levels, i.e. building, neighbourhood, city-regions, and domains, i.e. energy, water, use of resources. They suggested the concept of Urban Retrofit as a means to delivering the transition to low carbon cities. Hong et al. [5] draw our attention to the impact of human behaviour on building technologies and operation as a specific aspect of energy retrofit. They identified four components that need to be integrated into the energy modelling process: the drivers of behaviour, the needs of the occupants, the actions carried out by the occupants, and the building systems used by the occupants. Moreover, they consider this integration relevant in order to reduce the performance gap between predicted energy performance of buildings and actual measured energy use once buildings are operational. Jagarajan et al. [7] investigated how the concept of green retrofitting plays a pivotal role in reducing the environmental impact of existing buildings and not just reducing energy demand. They developed a conceptual framework which identified the challenges in 'green retrofit'.

Together, these studies have pointed out that initially, the ER concept has been mainly related to technical issues (i.e. considering building insulation and financial assistance strategies and building energy demand). Then, its transdisciplinary nature in terms of providing socio-technical solutions, which take into account energy, environmental and social impacts of retrofitting strategies at scale, emerged. However, considerable uncertainty still exists regarding the relationships between ER and transdisciplinary approaches, because such relationships require the involvement of a wide range of actors who are encouraged to engage in deep, integrative interactions. These actors need to develop and operationalise the necessary knowledge and skills for these interactions to be enacted [6].

The reviewed literature characterises the transdisciplinary research on ER. These prior studies suggest the importance of transdisciplinary approaches in ER. Moreover, they stress the need for stronger interactions among disciplines. Nevertheless, the problem of both activating these integrative ER interactions and developing the required knowledge in a meaningful and structured way, remains unresolved. Consequently, transdisciplinary approaches emerge as fragmented experiences and the significance of the integrated ER

process is not adequately highlighted. Furthermore, a transdisciplinary conceptual framework for ER has not yet been developed.

This paper seeks to close these gaps by analysing the literature on transdisciplinary approaches to ER within the UK context. The central question is the significance of an integrated process in the context of ER projects; and the way this process can be managed. The investigation and analysis reported in this paper were undertaken as part of a broader set of activities to promote knowledge integration in Energy Retrofit. The research programme structure is shown in Figure 1.

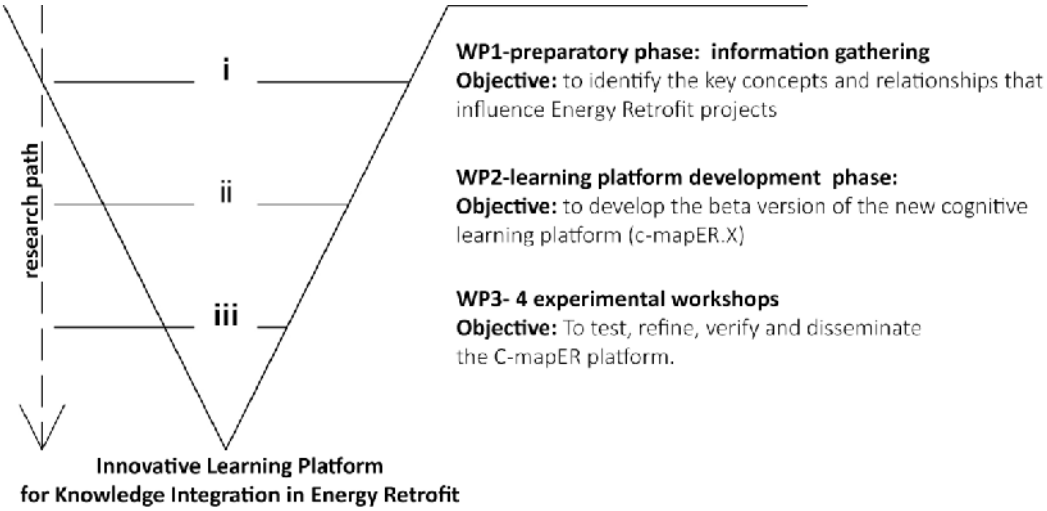

Figure 1. The structure of the research

This paper reports the progress in WP1, which aims at identifying key concepts that influence Energy Retrofit projects. It underlines the development of a conceptual framework on Transdisciplinary Energy Retrofit (TERCF).

It is organized as follows. The next section first introduces the preliminary version of the TERCF, and then discusses the methodological approach. Section 3, illustrates how the identified themes were integrated to elaborate on the TERCF. The final section discusses the significance of the integration in the context of ER projects and presents the next phase of the research.

2 Methodology

Grounded Theory was adopted to identify specific transdisciplinary themes in the literature. This literature review was conducted in two phases. In the second phase, which is the focus of this paper, Grounded Theory was combined with cognitive mapping. In both phases, data collection and analysis continued until theoretical saturation had been achieved, following Marying's [10] qualitative approach. The researcher continued to code the data until no new categories could be identified and until new instances of variation for existing categories had ceased to emerge [12]. In some instances categories were modified or changes in perspective occurred as the Grounded Theory approach was implemented [12].

In the first phase, 136 peer-reviewed journal papers were selected for content analysis. This content analysis followed an inductive approach. An initial conceptual framework on Transdisciplinary Energy Retrofit (TERCF), which is characterised by 5 categories, 15 lines of research and 50 main concepts, was thus developed and paved the way for this paper. The results from the first phase of the analysis are shown in Figure 2.

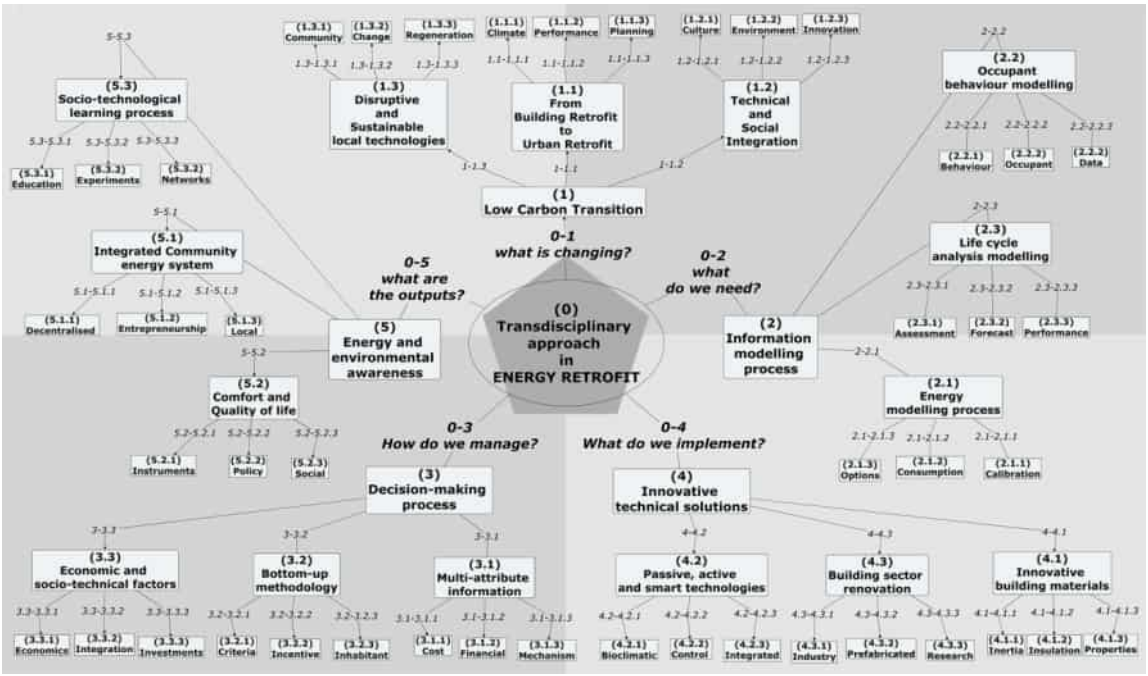

Figure 2. Transdisciplinary ER Conceptual Framework developed in a prior phase.

The following criteria were used to select the papers for analysis in the second phase. The first set of selection criteria was that papers studied multidisciplinary and interdisciplinary practices in Energy Retrofit. They were peer-reviewed and published in prominent journals. The second set of selection criteria was that papers:

- were published between January 2014 and December 2017; and
- mainly focussed on empirical experiences in the UK.

The publication period meant that the selected papers represented current examples in terms of energy policies, innovation technologies and social issues. Only UK examples were selected so that they were relevant to the UK-based workshop participants who will take part in the final step of this research. These selection criteria yielded 77 journal papers (Annex 1).

Descriptive data was generated for every paper. Coding facilitated the identification of patterns and allocation of concepts to the existing lines of research. A deductive approach to coding was adopted. The new set of data was analysed in relation to the existing cognitive structure represented by the initial TERCF before introducing new categories. NVIVO was used to conduct word frequency and pattern analyses. Once categories and lines of research were determined, patterns were integrated using cognitive mapping [12], which enabled the comparison and re-organisation of the concepts. Finally, the integrated themes were incorporated into the TERCF.

3 Results

Table 1 provides the results that the above process yielded. It illustrates how the themes identified (Annex 2) were integrated.

Summary, put in hierarchy order at two level, the most general and inclusive concepts were positioned at the first level (e.g. to re-engineer systemically their built environment and urban infrastructure in response; to combine effects of mitigation and adaptation measures), the more specific and exclusive concepts arranged hierarchically below (e.g to climate change and resource constraints; to adapt suburbs physically to mitigate against further climate change and to adapt to inevitable weather patterns; to integrate retrofit and governing). The integration process involved only the first level; while the second level will be articulated and integrated in the final structure of the TERCF.

Table 1: Trans-disciplinary Conceptual Framework on Energy Retrofit

Code	Integrated themes	Source (ANNEX 1)
01.1	To re-engineer built environment and urban infrastructure and combine effects of mitigation and adaptation measures	[13]; [58]; [76]; [12]; [73]; [69]; [34]
01.2	To describe drivers and barriers and sociological implications to the adoption of sustainable retrofit measures	[65]; [68]; [32]; [39]; [1]; [57]; [64]; [42]; [2]
01.3	To explore community-based energy retrofits for the practical realisation of the smart city imaginary	[70]; [27]; [67]; [61]
02.1	To integrate knowledge to an appropriate level in order to assess the impact of a diverse range of retrofit measures	[53]; [6]; [55]; [38]; [62]; [46]; [17]; [77]; [50]; [37]
02.2	To investigate on the relationship between buildings and people through a process of interactive adaptation' and co-evolution of the physical and the social factors	[29]; [7]; [41]; [15]; [44];[47]; [52]; [59]; [45];
02.3	To integrate life cycle energy and environmental performance	[31]; [28]; [3]
03.1	To reduce the level of uncertainties taking into account the multi-benefit of retrofit measures.	[4]; [36]; [35]; [24]; [16]; [23]; [40]
03.2	To follow a multi-stage development process to improve local green building features	[18]; [5]
03.3	To pursue social justice reducing fuel poverty and promote innovative financial mechanism	[71]; [26]; [30]; [19]; [74]
04.1	To assess the performance and the environmental impacts of life cycle insulation	[9]; [11]; [8]
04.2	To define and preserve the building envelope features	[43]; [21]; [75]; [22]
04.3	To consider the level of knowledge of local micro-enterprises and stakeholders' perspective when sustainable energy technologies are promoted.	[10]; [54]; [51]; [25]
05.1	To pursue more socially transformative pathways to sustainability involving community organisations	[60]; [14]; [56]; [72]; [63]; [33]

05.2	To analyse different technologies that have been adopted and their perceived effectiveness.	[65]; [49]; [20]
05.3	To improve the participatory process taking into account practitioners and academic perspectives	[48]

A number of significant aspects of Energy Retrofit in the UK emerged. First of all, transdisciplinary approaches recurred throughout the dataset. No new lines of research were identified. Hence, at the moment, the TERCF saturation is validated. However, it is apparent from the data, that the distribution of papers among the existing lines of research is not homogenous. Consequently, our findings suggest a hierarchy among the themes which are investigated in UK.

In addition, the results obtained from the second phase of the analysis allowed us to refine the lines of research in the original TERCF. What is interesting in this data is that the integrated themes provide an objective for each line of research (e.g. each line of research is articulated starting from a verb, which introduces a scope providing details about the concept arranged hierarchically below). The results that were integrated into the original TERCF cognitive structure is shown Figure 3.

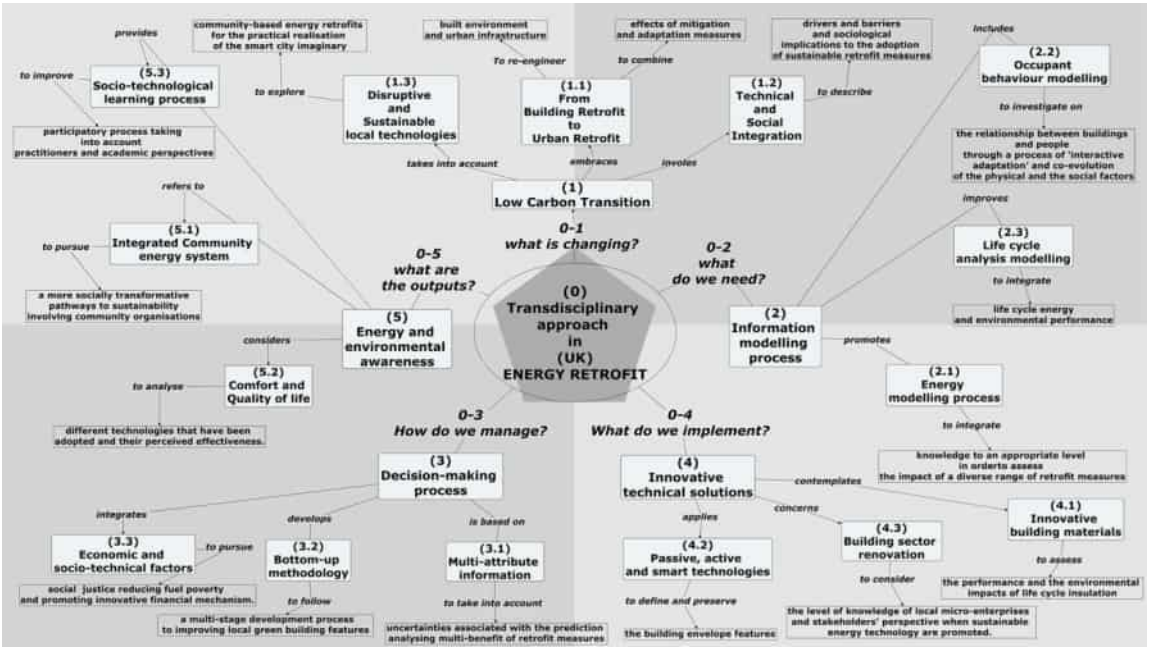

Figure 3. Transdisciplinary ER Conceptual Framework combined with integrated themes.

The relationships among the concepts began to be clarified through the second phase of the analysis. The integrated themes were articulated as concepts and linking phrases, following the principles of cognitive mapping (Figure 3). It is argued that cognitive maps are more likely to trigger connections between the results and the user's prior knowledge than the representation of data in the traditional text form (see Table 1 as an example). It could be argued that the users' are passive consumers of textual information presented in Table 1 and they are more likely to interact with the information presented as a cognitive map (Figure 3). User feedback will be collected as part of the workshops, which will run during the last phase of this research, in order to test these assumptions.

4 Discussion

The discussion focusses on the research question regarding the significance of integration in ER projects and how the process of this integration can be managed. This study identified 15 Integrated Themes concerning transdisciplinarity in ER in the UK. The most interesting finding was that the development of knowledge transfer strategies among actors emerges as a main component in integration. This component is clearly traceable in Table 1, and in particular, in the following Integrated Themes: 01.3, 02.1, 02.2, 03.1, 03.3, 04.3, 05.1, 05.2, and 05.3.

Therefore, these results are in agreement with Hope's findings [7], indeed they emphasize the need for discussing the role of knowledge creation, exchange and transfer in order to develop innovative approaches to deal with sustainability challenges. Hope [6] describes the transdisciplinary approach as one that transcends traditional disciplinary boundaries, and that disciplinary integrations involve interactions between actors and institutions which have different approaches and scopes. Furthermore, these interactions require the re-orientation of the research agenda, which has to be conducted in a multi-stakeholder environment to address complex societal problems that require a multidisciplinary approach [13 quoted in 6]. Therefore, Hope [6] proposed a conceptual framework for knowledge exchange in sustainable development which was based on specific attributes and well-structured mechanisms. The attributes were: "transdisciplinarity, participatory, problem-oriented, practice-oriented, formal and informal interactions, networked" [6, p. 801]. Hope [6] explains that many attributes can be combined through mechanisms such as knowledge transfer partnerships.

The findings of this study provide further contribution to the discourse on how knowledge transfer partnerships can be improved. They concur the significance of integrated processes in the context of transdisciplinary ER projects. Conceptual frameworks, which are not just limited to describing the pre-requisites for integration, are suggested as tools for facilitating integration through the development of new cognitive skills, i.e. the ability to observe, manipulate, articulate and discuss how concepts and relationships interact in multidisciplinary contexts. It is argued that traditional conceptual frameworks could be inadequate for this new scope, because they are mainly used to describe findings rather enabling users to interact with it.

Comparison of the TERCF with previously developed conceptual frameworks provides encouraging insights. For example, Jagarajan et al. [9] and Ma et al. [6] elaborated two innovative ER conceptual frameworks. Jagarajan et al. [9] suggested the concept of green retrofitting, while Ma et al. [6] explored key influences on building retrofit. These studies have provided a considerable contribution towards clarifying the issues concerning transdisciplinarity in ER projects by developing conceptual frameworks which comprise of innovative categories and concepts. On the one hand, this study confirms that working on categories and concepts can be considered to be a useful approach to introduce advanced concepts. On the other hand, the findings show that categories and concepts on their own do not facilitate integrated approaches, which are substantially based on the relationships rather than categories and concepts themselves.

This study provides such a cognitive apparatus, which is focused on specific themes of integration in ER. This apparatus can be adapted and modified with regard to specific topics

and contexts through the combined use of the ground theory method and mapping technique, has been provided in this paper. The users are called to interact with this apparatus, through cognitive mapping as a dedicated learning procedure. The finalisation of the cognitive maps by the users enables the improvement of their cognitive skills and the development of meaningful ER discourses. The integrated themes are incorporated into the TERCF as a sequence of relationships. Here, the aim is to facilitate the integration of different points of view and different levels of prior knowledge, which is a determinant of the level of knowledge transfer in transdisciplinary contexts.

Finally, the research findings may contribute to the development of an instructional design tool, which facilitates the integration of transdisciplinary knowledge in ER in meaningful ways. This approach may also be considered as good practice aimed at preparing qualified graduates for their respective professions by addressing the various obstacles to the implementation of transdisciplinary curricula which focusses on the concept of ER as a means to delivering low carbon cities.

5 Conclusion and perspectives

The purpose of this study was to determine the significance of an integrated design and delivery in ER projects. Specifically, this study has shown that the cognitive structure of the Transdisciplinary Energy Retrofit Conceptual Framework can be adapted to suit specific contexts, revealing a preliminary set of meaningful relationships. The results of this study support the idea that there is a need for innovate learning methods and tools in order to facilitate the integrated process. Although this study has successfully demonstrated that the combined use of the grounded theory and cognitive mapping offers an effective way to develop a learning apparatus, this process has not yet been completed. A natural progression of this work is to define all the relationships among the concepts proposed in the TERCF. The next step is to transfer the final version of the TERCF into a computer environment using the IHM Concept Map Software and to prepare the instructions for using the Learning Platform according to different levels of prior knowledge. Finally, the platform will be tested in four experimental interdisciplinary workshops, which will be dedicated to researchers, undergraduate and post-graduate students and practitioners. Feedback from these experimental experiences will be useful to improve the learning tool. The emergent tool has the potential to be adopted to undergraduate and postgraduate higher educational programmes.

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ANNEX 1 –Literature review: list of references

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ANNEX 2 – Identification of relevant ER patterns and their hierarchy

Cod	1-LOW CARBON TRANSITION:	
	Patterns and hierarchy*	**Source (ANNEX 1)**
01.1	**I level (inclusive patterns:** to re-engineer systemically their built environment and urban infrastructure in response to combine effects of mitigation and adaptation measures **II level (detailed patterns):** to climate change and resource constraints; to adapt suburbs physically to mitigate against further climate change and to adapt to inevitable weather patterns; to integrate retrofit and governing; to promote systematic reconfiguration of socio-technologies of energy in the existing built environment and infrastructure; to link the energy-reducing and energy-increasing effects of urban morphology characteristics in 'place-specific' neighbourhoods; to analyse the scale of rebound effects of energy retrofit measure; to drive change in urban energy systems.	Eames et al., 2013; Rydin et al., 2013; Williams et al., 2013; Dixon et al., 2014; Webber et al., 2015; Urquizo et al., 2017; Hodson and Marvin, 2017.
01.2	**I level (inclusive patterns:** to describe drivers and barriers to the adoption of sustainable retrofit to consider the sociological implications about housing energy retrofit **II level (detailed patterns):** to encourage the use of renewable energy for electricity generation; to balance thermal issues against a range of heritage and aesthetic concerns; to identify the range of factors that influence domestic energy consumption; to support the local economy; to explore the role energy co-operatives; to analyse the core characteristics of the ESCo model; to install renewable micro-generation energy sources; to assess the compatibility between renewable systems and aesthetics and significance of historic buildings; to define energy system stakeholders and community-based partnerships	Swan et al., 2013; Tham and Muneer, 2013; Hannon et al., 2013; Karvonen, 2013; Agbota et al., 2014; Reid et al., 2015; Sunikka-Blank and Galvin, 2016; Li et al., 2016; Ambrose et al., 2017
01.3	**I level (inclusive patterns:** to explore opportunities and tensions in the practical realisation of the smart city imaginary to improve city-scale retrofit and community-based energy retrofits **II level (detailed patterns):** to investigate on the capacity of urban governments to control their infrastructural destiny; to reduce the gap between intent and outcome; to analyse uncertainties in the wind and solar generation; to consider carbon capture and storage (CCS) technologies	Watson et al., 2014; Gupta et al., 2015; Taylor Buck and While, 2017; Sharifzadeh et al., 2017
Cod	**2-INFORMATION MODELLING PROCESS:**	
	Patterns and hierarchy*	**Source (ANNEX 1)**
02.1	**I level (inclusive patterns:** to assess the impact of a diverse range of retrofit measures to integrate knowledge and model estimating to an appropriate level **II level (detailed patterns):** to reduce energy consumption through the reduction of energy demand; to analyse the relationship between expectations of building energy performance and the financial value of real estate; to simulate scenarios developed for analysis; to assess heating patterns; to improve exergy-based multi-objective optimisation tool; to use computer aided design (CAD) software; to examine the effects of early stage design energy modelling technology on architects' design practice; to model renewable energy supply to model battery storage; to investigate on spectrum of analysis parameters; to define high standards of energy efficiency; to improve 'systems based' approach	Parkinson et al., 2014; Calderón et al., 2015; Pye et al., 2015; Kane et al., 2015; Shatat et al., 2015; Makantasi et al., 2016; García Kerdan et al., 2016; Xie et al., 2017; Oliveira et al., 2017; Jones et al., 2017
02.2	**I level (inclusive patterns:** to investigate on the relationship between buildings and people through a process of 'interactive adaptation' to assess the interactive adaptivity and co-evolution of the physical with the social factors **II level (detailed patterns):** to improve a persona-driven study; to involve a occupants' needs; to analyse a post-occupancy evaluation; to analyse the implications for technical and behavioural research in the built environment; to improve agend-based model; to analyse actions of individual homeowners in a long-term domestic stock model; to improve comfort and living standards, reducing waste and saving on energy costs; to integrate householder attitudes and behaviours and household occupancy patterns; to assess internal heat gains; to	Haines and Mitchell, 2014; Chiu et al., 2014; Lee et al., 2014; Fawcett et al., 2014; Long et al., 2015; Marshall et al., 2015; Marshall et al., 2016; Parker et al., 2017; Santangelo and Tondelli, 2017; Lowe et al., 2017

	estimate occupancy schedules; to elaborate dynamic simulation models; to avoid reductionist approach; to assess building performance	
02.3	**I level (inclusive patterns:** to integrate life cycle energy and environmental performance to compare embodied versus operational environmental indicators **II level (detailed patterns):** to take into account the risk of projected post-2050s overheating in existing buildings	Hammond et al., 2103; Gupta et al., 2015; Azzouz et al., 2017
Cod	**3-DECISION-MAKING PROCESS:**	
	Patterns and hierarchy*	**Source (ANNEX 1)**
03.1	**I level (inclusive patterns:** to analyses multi benefit of retrofit measures to take into account uncertainties associated with the prediction **II level (detailed patterns):** to analyse financial risk; to avoid overestimation of the energy savings; to improve long-term monitoring; to individuate Building stakeholders; to analyse the role of private retrofit industry; to improve Energy Efficiency Retrofitting Services sector and define its requirement; to define the risk allocation between client and contractor in Energy Retrofit actions; to analyse the self-sufficient retrofit measures outside of a policy incentive; to compare operational performance and environmental merit of the options	Booth and Choudhary, 2013; Jones et al., 2013; Ibn-Mohammed et al., 2014; Gooding et al., 2016; Fennell et al., 2016; Gooding and Gul, 2017; Kerr et al., 2017
03.2	**I level (inclusive patterns:** to define the local green building features to follow a multi-stage development process **II level (detailed patterns):** N.D.	Gibbs et al., 2015; Busch et al., 2017
03.3	**I level (inclusive patterns:** to pursue social justice reducing fuel poverty to promote innovative financing mechanism **II level (detailed patterns):** to enhance investment impacts; to recover and reinvest some of the savings generated by early investments; to pursue government targets; to consider implications between special categories (e.g. disable people, low-income families) and energy measures; to re-configure the power sector though business model and technical innovation (e.g. distric heating)	Webb, 2015; Gouldson et al., 2015; Hamilton et al., 2016; Gillard et al., 2017; Wegner et al., 2017
Cod	**4-INNOVATIVE TECHNCIAL SOLUTIONS:**	
	Patterns and hierarchy*	**Source (ANNEX 1)**
04.1	**I level (inclusive patterns)** to assess the environmental impacts that occur from extraction, processing and manufacture of insulation to quantify and compare the environmental impact of insulation materials **II level (detailed patterns):** to disseminate the application of superinsulation materials; to provide superior thermal performance; to optimizing insulation thickness of super-insulation materials; to analyse external wall insulation; to analyse internal thermal super-insulation; to quantify thermal bridging effects	Cuce et al., 2014; Densley Tingley et al., 2015; Cuce and Cuce, 2016
04.2	**I level (inclusive patterns)** to define the building envelope features to preserve the aesthetic and structural qualities of historic buildings **II level (detailed patterns):** to investigate of the effectiveness of airtightness measures; to analysis the mechanically ventilated heat recovery system; to follow guidance relating to energy efficiency in heritage buildings	Liu, Shuli et al., 2014; Gillott et al., 2016; White et al., 2016; Ginks and Painter, 2017
04.3	**I level (inclusive patterns)** to consider the level of knowledge of local micro-enterprises to take into account stakeholders' perspective to integrate sustainable energy technologies **II level (detailed patterns):** to innovate process of construction and management; to build more adaptable buildings to consider mechanisms and management energy retrofit schemes to support private industry; to consider influence of advisers and installers in householders' decisions to adopt low carbon technologies	Day et al.,2013; Pinder et al., 2013; Owen et al., 2014; Gooding and Gul, 2017

Cod	5-ENERGY AND ENVIRONMENTAL AWARENESS:	
	Patterns and hierarchy*	**Source (ANNEX 1)**
05.1	**I level (inclusive patterns)** to pursue a more socially transformative pathways to sustainability to improve community organisations **II level (detailed patterns):** to consider tenants' lifestyle; to investigate on local authority energy plans and exploring governance process; to improve direct control of the occupants about renewable energy system	Scott et al., 2014; Elsharkawy and Rutherford, 2105; Reeves, 2016; Webb et al., 2016; Smith et al., 2016; Hodson et al., 2106
05.2	**I level (inclusive patterns)** to analyse different technologies that have been adopted and their perceived effectiveness. **II level (detailed patterns):** to discuss the adoption of new technologies with local community to integrate marketing and outreach strategies about energy retrofit measure	Swan et al., 2013; Milner et al., 2015; Gillich et al., 2017
05.3	**I level (inclusive patterns)** to improve participatory process to organise workshops, integrating practitioner and academic perspectives **II level (detailed patterns):** N.D.	Martin et al., 2014

*Methodological note: the patterns were hierarchized in two levels. The most general and inclusive concepts were positioned at the first level, the more specific and exclusive concepts arranged hierarchically below. The integration process involved only the first level, while the second level will be articulated and integrated in the final structure of the TERCF.

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ARCHITECTURAL DESIGN RESEARCH WITH THE CONTEXT-AWARE METHODOLOGY

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Abstract

Architecture as a measured structure, appealing to models and rules of composition, responds to architecture as an instrument with function and form. First defined as articulating building usage, and second as articulating the distinctive values of a cultural system. The connotative connection between what architectural reasoning signifies and what is signified in the design of the form it builds is thus marked in the building as a proper measurement of objects in relation to their appearance and use. The work of architecture is generated by detaching itself from instrumental codes accepted by usage. The new design approach shows that architecture escapes determination by functions, striving to be assimilated into a context.

The actual role of architecture in the new social framework, conditioned by the transition processes in Bosnia and Herzegovina, largely deviates from the enrooted aspirations of architecture as the human paradigm of the society and culture. It is a big challenge today to design and to build in the neoliberal and transitional period, especially with significant awareness of the local existing context. That is why it is important to improve the teaching system with new context-aware methodology, which will motivate students to perform their future task, that of forming the space of local cities within the context and to give every new appealing architectural form a proper relation and value in the existing context.

Case Study: Context-related architectural design of family houses in Bosnia and Herzegovina

Keywords:
timeless principles, spatial/cultural context, design awareness, context related methodology

1 Introduction

The time we live in, because of the widespread distribution of change in all spheres of life, is one of the basic issues of contemporary architecture – how to adapt to the existing environment with the new architectural structure, united in the whole of the shaped contextual correlations that we call the context. Although it may sound like a cliché, this issue gives rise to some questions, and intrigues its duality.

While we are witnessing neglect of the significance of the context by building "disturbing" forms that undermine the existing spatial relationships, the theoretical discourse is overwhelmed with texts that promote a careful integration of new architectural structures into the existing context, with the aim of adding a new value to the existing one.

As urban contexts are constantly changing, in order to meet the requirements of new programmes, it is now more important than ever to deal with the new dimension in the process of space design. Such a constellation of the problem urges the profession to rethink the positions of its attitudes, and the research returns to the beginning of the very design process.

With that in mind and in parallel with the transformation of the existing or insufficiently fragmented or functionally overcome content and volume, new architectural interventions must offer a solution that vitalises the environment, a possible answer sets the context-aware methodology into the centre of the educational process, and the beginning of the project-taking process that takes place in practice. Only after putting it equally at other stages can one talk about a dialogue that leads to a sustainable architectural context.

Aware of that, contrary to the notions, the notion of context does not promote closeness and does not support the status quo; rather, it promotes a continuous development of the spatial experience in the eternal symbiosis of the place and the spirit of time (opening up to its new specific time), issues that are diverted to by introducing a methodology within which numerous interdisciplinary analyses will be structured so that they can lead to an eternal solution to the question – to what extent and in what way should the new structure be integrated into the existing (urban) context.

Contrary to the intentions of the considered issues of context protection through representative architectural structures, created on a wider or narrower urban site, this research will affirm the family house (in a local context) as the most important architectural product and the case study will confirm.

2 Contemporary understanding of the term *"context"*

"Form is a solution to the problem;
context defines the problem."
(C. Alexander)

In order to be able to properly investigate the problem and offer an adequate solution, it is necessary to define the concept of context and then define its specific occurrence in the space we are talking about. Here we will refer to the definition in which the context implies a compound of the complex conditions in which events implied suggest that each constructed structure functions as a living organism in the inextricable relation of all its parts and in an inextricable connection with the events around it, making unity with its surroundings.
Affirming contextuality of the context through vitality, it is clear that in the process of its formation, apart from material, physical structures, all those spiritual, immaterial, visually elusive but present influences that give it a specific atmosphere and a unique ambiance and atmosphere, simultaneously participate.

Hence the needs to look at and explore the issues through the entire cultural context, in which both material and spiritual values have been incorporated into history through history. From the first interventions in space, humans have built in a certain context (time, cultural, natural, etc.), and changes that are continually happening seek their form. New interventions are then inevitable, and directly affect the formation of spatial values that are different in terms of their period of production, and also differ in their quality.

Today's understanding of the notion of a context in which architecture is viewed through dialogue with its environment in a physical sense, and also through its historical dimension, including the new term "ambiente", was first used by Ernesto Rogers, an Italian architect of the 1950s. Considering criticisms of modern architecture at that time because of the neglect of the existing environment, and stressing, as well as numerous theorists had until then, that modern architecture results in a generic language that is not congruent to the environment, E. Rogers refers to the terms "ambiente" (ambient, environment) and "preesistenze ambientali" (the existing environment), and draws attention to the importance of respecting and preserving historical continuity of the constructed whole.

In the 1960s, C. Alexander and later C. Rowe translated the term "ambiente" into "context" by adding a new dimension to it. Namely, including the question of the external features of a work, meaning the forms, as Alexander had emphasised, and analysing the relationship between space and place, insisted by Rowe, we come to a more complex and more contextual approach. Embodying the link between architecture and humans and their mutual needs is the right path to reintegration of a disintegrated incubator. "Understanding history is essential to forming an architect, since he must be able to put his work within the existing ambience and take it dialectically." [1]

3 Visual continuity in connecting humans and space – a part of the architectural strategy

Architecture, as a physical structure, has its own personalities derived from the foundations from which it originates – tectonicism, geometry, proportions, scale, composition, form, function, etc., and tendencies to their visual synchronisation that have permeated architecture over the centuries.

“Architecture is not the amount of built and completed accomplishments, but rather the development process at many levels in which they are constantly born, in some interaction, new solutions, new forms, new materials and constant changes in the concept of construction.” [2]

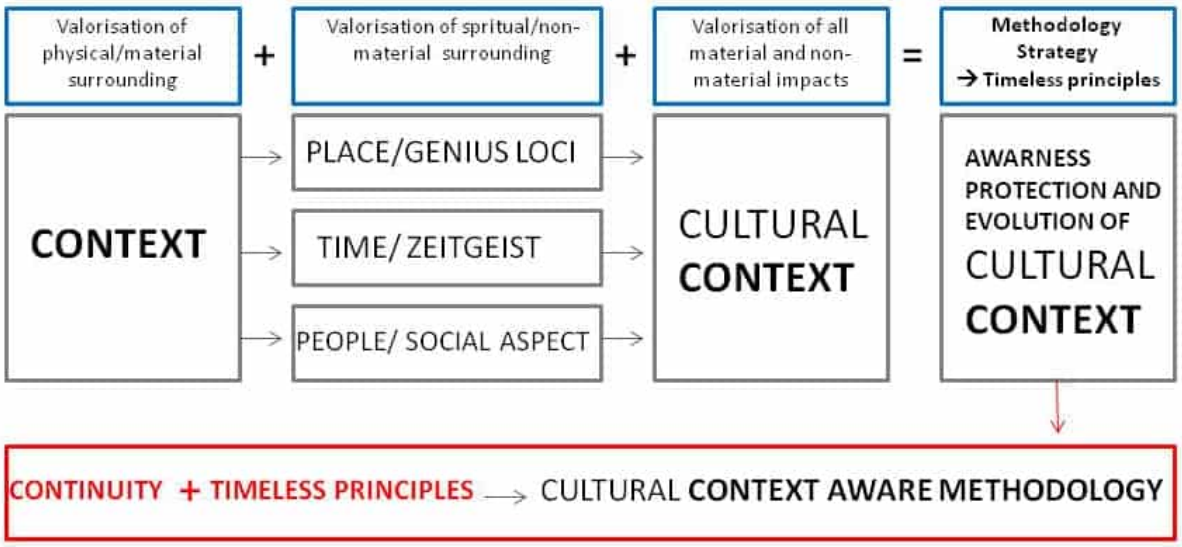
In a specific social, political and economic moment, in which we speak today of a sustainable context for real architects of architecture, and therefore of the built environment, and besides the aforementioned, we also assume: social change, spiritual values, and, finally, *zeitgeist* (the spirit of time).

From this position, we are talking about a context-aware methodology through the establishment of interaction of the affected influences in order to achieve harmony of visual continuity, and a physical and psychological connection of humans and space within their surroundings. “The ability to make this connection today goes beyond the usual synchronization views. It is done two: physically - shaped, juxtaposing the spatial relations, taking into account the size, the scale, the rhythm, the proportions, and the psychological - symbolic, critical, ideological, through history and philosophy.” [3]

Research of the context as a whole suggests a parallel existence of the past and the present, embodied in a common physical structure, and the re-composition of the form is understood as an upgrade in which architecture represents a means of expressing culture and contemporary attitudes about it. The real role of architecture within the social framework in which it is created will promote another peculiarity of research of the built context. It tells us that architecture is not a mere layout of shapes and their composition; architecture is today an active participant in all events, it is more than one building, that is, it is multiplied – a multiplied community that constitutes the architecture of the city. Therefore, contemporary views on this issue initiate the establishment of a certain context-protection strategy, which will respect the stated and follow new interventions in the enclosure. (Tab. 1)

- Valorisation of the present architectural structures - physical environment,
- Research on the cramped cultural identity (place, time, people),
- Researching the needs of users in line with new concepts of life at global and local level (values and opportunities).

Table 1: Scheme of the methodological process



This defined strategy within the given socio-economic realities is a dominant precondition for the emergence of high-quality architectural achievements in the area and increasing the standard for the inhabitants of the city and the users of the space.

4 Social vision about the role of architecture

4.1 Appreciating the past

The context in which we focus our research is the neoliberal, transitional context. It was preceded by socialism, in which the social project and architecture had a common goal: to build a better society. Of course, the process of modernisation was accompanied by a continuous tension between instrumental goals and progressive ambitions, but it is crucial that there was a clear idea that architecture serves to “repair” the world, and that it also represents a materialised image of a better society. That is why it is interesting to observe the avant-garde role of architecture.

“Thus, in some domains, Yugoslav socialism clearly outlined goals such as the cultural emancipation of the broadest masses, but instruments were not fully defined, they were still being sought. Here architecture arrives that proposes new architectural typologies, but also new forms of institutional as well as informal sociability, overlap between ‘organized’ life and everyday life, architecture concretizes what social theory has drawn.” [4]

The architectural paradigms that were transmitters, mediators between the global modern culture and the local context were very skilfully built. In that period, the society provided a framework and prerequisites for the development of modern culture, and the architects saw this opportunity well and used it.

4.2 Understanding the present – societies in transition

Today's local architects are often very dissatisfied with their status. Some have turned into pure collaborationism with capital and regressive social tendencies, some persuading them to fight for the public good. But architectural discipline is global in seeking its new role and we can call it the "shock of postmodernism"; not the stylistic, but social postmodernism. [4]

Namely, architecture, historically, has never played the role of the social avant-garde as in modern times. But the social movements that carried modernism are in defensive today, and are perhaps facing extinction. We think that architectural discipline, which is traditionally capable of acting in an integrative and transdisciplinary manner, should today first deal with the design of new alliances and forms of cooperation between the society, technology and culture, which will help keep mankind and the planet from collapsing.

4.3 Anticipating and preparing for the future – *reality and / or utopia*

> *'Once discovered as a form of capital, there is no choice for buildings but to operate according to the logic of capital. In that sense there may ultimately be no such thing as Modern or Postmodern architecture, but simply architecture before and after its annexation by capital'* [5]

Problems of the contemporary society – social, ecological and economic – require an urgent review and action with the goal of creating alliances, and the results can be achieved only with clear and high goals. In that sense, architecture and the city, as the impression of the society in the space, play a big role. The vision of the society of the future is inextricably linked with the vision of the built environment because they exist only in mutual permeation.

Regardless of whether utopia is understood as a "no-place" (ou-topos) or as a "good place" (eu-topos), it strives to change the current state and to move towards the future, conceived as an ideal. It represents, at the same time, a negation of the current social order and the proposal of an ideal social order in the future.

As architects of the reality of the local context – desiring to achieve a better and ideal living space, we propose a method which aims to create spatial continuity, and which will always have the priority of protecting the context, awareness of the existing context, and evolution of it, based on the timeless principles we have already mentioned: the valorisation of the present architectural structures – the physical environment; research on the encroached cultural identity; researching user needs in line with the new concepts of life at the global and local level (values and opportunities).

Is not every progress, even architectural, necessarily based on utopia, the desire to correct something from the present in the future? Is not every architectural work, regardless of its size and significance, actually based on the desire to be the best possible solution, to be ideal? Examples in the Case Study that will speak of this methodology described by

respecting timeless principles are examples of family houses built in this transition period in Bosnia and Herzegovina. Family houses are the leaders of architectural spatial concepts, introducing all new principles and innovations, and then implementing them on other typologies.

The family houses that we present are specific in their natural contexts (terrain and morphology), contact with the constructed structures (indirectly and directly), spatial relations and the picture of the social environment.

5 Case Study - Context aware methodology – Family houses in Bosnia and Herzegovina

5.1 The role of the architect in the society - timeless principles

Architects must be masters of a wide range of skills and their deployment — a range far greater than architectural education currently prepares them for.

First, architects must be able to decode the past so they can understand how their predecessors viewed their past, present, and future. Armed with this comparative knowledge, they must secondly attempt to read the signs and trends of the present. This is particularly tricky as, while buildings last a long time, current trends may prove ephemeral, and become such within the span of a few years. Third, architects must not only think of their single building, but of its relationship with the wider community. Fourth, and most importantly, they must pull all of the analysis together and design and implement a product which, over its lifetime, can justly win a place in the timeless continuity of the world architecture, as have the great buildings of the past which speak of excellence, not of an age, but for all time!
It follows from the above that the role of the architect in transitional societies such as Bosnia and Herzegovina is indeed pivotal, both in defining the society's sense of its own reality, as well as in refining its perceptions of its taste and its authentic cultural expression, cultural identity. [6]

We must acknowledge the need for important changes in architectural forms as facets of the physical expression of the changes wrought by economic and social development.

5.2 The Family house M in Kakanj

The basic idea of the design of the M family house is the result of creating a relationship to such a primary environment and creating the inner comfort of family housing. Thus, adjacent buildings at the boundary of the plot imposed the setting and shape of the building, while the conceptualisation of the interior space was guided by the idea of traditional Bosnian houses, i.e. its interpretations in the contemporary architectural expression. Irregular form combination of solid edges is created to ensures privacy attitude towards the outside, while the theft of the house is dissolved to give the transparent, inner cloak as much light as possible and create a sense of intimacy. [7]

The interior is divided into more functional, connected units: housing, home affairs, recreation and movement through space, which is also seen through its outer form. Shared rooms, sports facilities (a pool and a fitness area) and a business room (garage and maintenance) are located on the ground floor, while the sleeping block is located on the first floor. Each of them communicates unobtrusively with the atrium courtyard, and with the orchard that is caught and preserved in the west and south of the parcel. (Fig.1.)
Full and empty surfaces are alternately opened and changed. All spaces connect the roof as a cut off space that creates different relationships with the surrounding vernacular individual housing, but also a unique expression and contrast.

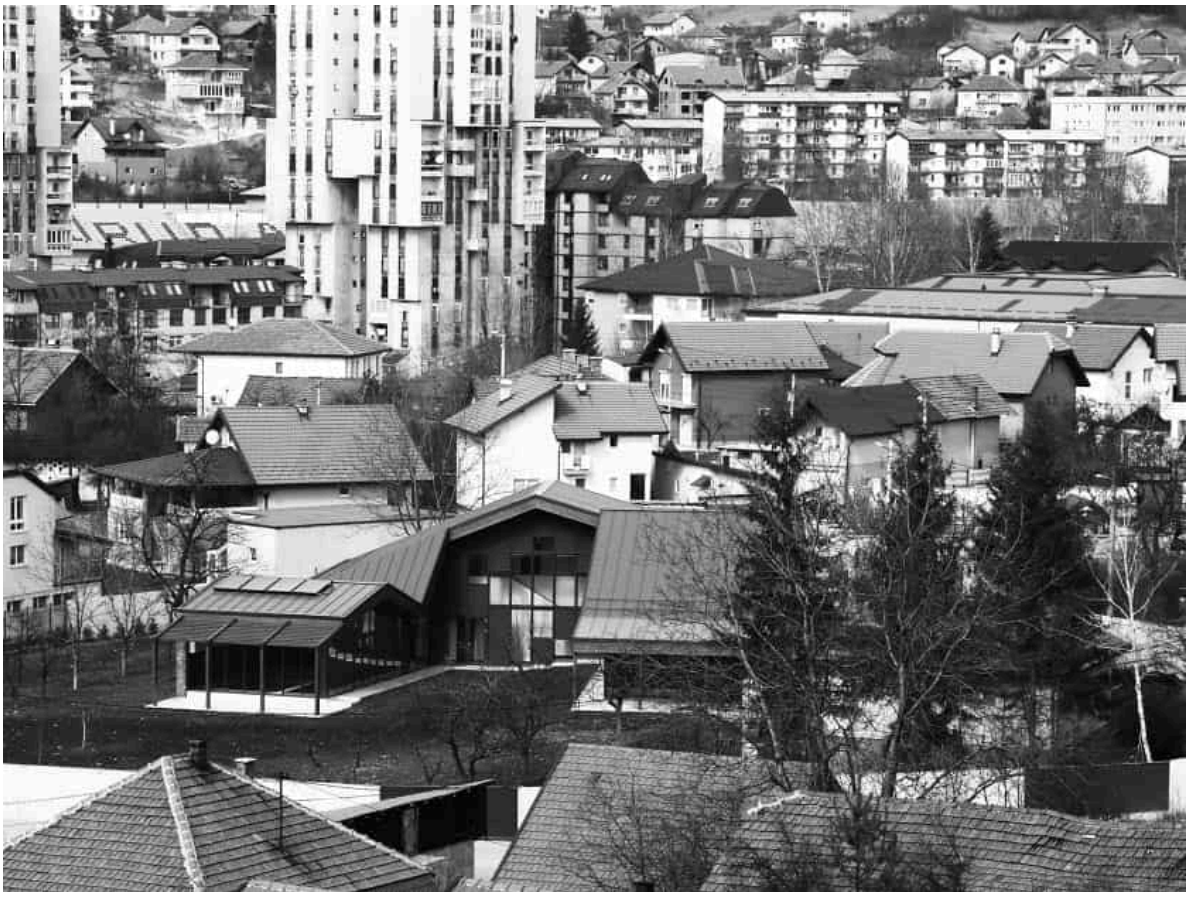


Figure 1. The family house M in the neighbourhood of built family houses in the local town of Kakanj

5.3 The “iKuća” in Travnik

The location of the building is in the city of Travnik, in the Poturmahala Street. The cultural and built identity of this “mahala” is an important fact for the future project. After analyses of a possible redesign, architects, together with the investor, decided to demolish the old and to design a new house. There are two main guidelines they were inspired by while doing the concept. (Fig. 2, 3.)

One is that, in this mahala, there are houses form all periods, starting form Ottoman, and that there is a very important spiritual place opposite the building site – the tomb of Ilhamija (his dervish name means “inspired”).

Figure 2. The perspective view of mahala

Figure 3. The urbanistic site of Poturmahala

The house was named iKuća (iHouse), since it is an inspiration of Ilhamija's neighborhood. Challenge was also to design a family house in the mahala context but in the present moment. Poturmahala is a one-way street. In the design process, we the street elevation was kept and a new building was designed in accordance with the mahala concept. The form of the house resulted from the previous building with some new design proposals. In the ground floor, there is an entrance to the garage form the street, south site, and also to the small courtyard. Ground floor has been recessed form the southern and western side 1 m in order to get more space for the entrance to the garage. It is also reminiscent of the "doksat", a detail form the houses from the Ottoman period.
The shape of the roof as a cut off space creates similar relationships with the surrounding vernacular individual housing, but also a unique expression of the analogue special built form.
(Fig. 4.)

Figure 4. The shape of (the roof) the family house iKuca

5.4 The Country House in Bijača

The approach of the proposal was to develop a residential complex bearing a strong connection to the context. Located in a remote, poorly inhabited part of the West Herzegovina Canton, the site stretches over 35,000 square meters of wild landscape, bounded by strong stone walls. (Fig. 5.)

Figure 5. The main family house view with pavement, © Robert Leš

Figure 6. The view of the house with stone fence wall

Figure 7.The view towards hills of Herzegovina

The ambient relies on the tradition, where places like this provided social contact and events. All three units, six buildings altogether, are carefully placed to gain views according to the client's wishes. Further along, the terrain climbs steeply towards the highest point where the main unit is found. The location offers control of the whole site as well as

exceptional views of the surrounding mountains. Towards the sports facilities, the terrain descends in number of terraces planted with olive trees and grapevines. (Fig. 8.9.)

Figure 8. The house with vineyards

Figure 9. The house with an olive tree

The main unit contains a house for the owner, a guest house and a summer house with a wine cellar and a place for barbecuing. The interrelation between the houses creates fine exterior, protected from the wind, suitable for enjoying time spent on the fresh air. Architectural language is pure and elementary, adjusted to the hand of local builders. The concrete construction is cladded in stone from the local quarry. Stone frames around the openings in facade, also traditional elements, are here made in plaster and emphasised to achieve the playfulness of the basic stone element. (Fig. 6,7.) This project is trying to set a positive example to build in remote areas using what nature has given us and respecting local conditions. [8]

5.5 The NHRV House in Sarajevo

Only ten minutes' drive from the centre of Sarajevo, one can reach a completely different environment of the harsh mountain climate, different vegetation and extraordinary views. This area near the city has traditionally been sparsely populated, often inaccessible, with small cattle settlements most of which were used only in the summer, at the season of grazing, during favourable, summer conditions. Today, the shepherds and the cattle herds can be found there less frequently because these areas represent spaces which have been for decades a subject to the development of residential and weekend settlements. Under the influence of planned and unplanned tendencies of the physical infrastructure development, the area is slowly becoming a certain kind of suburb, a constantly populated site near the city.

Figure 10. Juxtaposition of a new family house and the existing one in the Bukovik mountain

The family NHRV house is placed at the very top of the hill, a site with meagre vegetation, and astonishing views, which extend in the direction of the north-south axis. Towards the

south, the view opens reaching even the distant mountains of Herzegovina, while to the north, a rocky range of the Bukovik mountain appears. (Fig. 10.)
In a compositional sense, the house consists of three physically separate spatial units: the house, the garage and the third, planned volume of the summerhouse, placed at the bottom of the plot. In a formal sense, all the elements represent a derivative of one generic form-archetypal shape of the house, which can be recognised as a whole, only when viewed from a certain distance. Banality of details, their simplification and repetition represent a modern way of adapting to the forces of the context – above all, knowledge and experience of a small local contractor. The low construction cost has been achieved by using conventional building materials, by customising the logic of the underdeveloped, local construction industry, and by careful balancing within the development priorities. (Fig. 11,12.)
Ultimately, seen through the prism of the Bosnian and Herzegovinian daily life, and the average of the houses which dominate the landscape in this country, made within the framework of the same financial and social circumstances, the NHRV house can be seen as an attempt to form a somewhat different experience of spatial reality.


Figure 11. The northern view of the family house


Figure 12. The southern view from down hill

6 Conclusion – The context aware methodology

As shown in the Case study projects, it is important to experience the diversity of this specific local and social context, in relation to others in the world. It is to conclude that the social aspect is important because it points out the “failure” of the average human/user in the context of globalisation, transition and other specificities that this state brings with it. The character of the environment changes with this reality, and architecture must respond in some way. How? By the cultural context-aware methodology, which implies an objective view of space, through its encroached architectural „morphology“ as the foundation of new interventions and the consideration of real needs, which will activate both the object and the environment, and not create „lifeless architectural louvres“?[9]
Only the architect sets the tone for a new generation of buildings, and successfully reshapes a society’s image of itself. The architect, therefore, must act on the one hand as an instrument of change and a forward-looking agent of the transformation and ability to help in this real transitional period, and, on the other hand as the keeper of the existing identity, a preserver and extender of a heritage, and the moulder and reinforcer of cultural authenticity. Just as architecture is inextricably entwined with society, so is the individual architect placed in a pivotal role in the society of which he or she is a member. [10]

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CANYON: DRAWING PRESENCES FROM AN UNDERSEA LANDSCAPE THROUGH GESTURE, VR AND SOUND

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Abstract

Canyon is a project in experimental drawing; it distils architectural ideas from the dynamic undersea landscape of Kaikōura Canyon, Aotearoa, New Zealand. The experiment draws atmospheric qualities from the unseen topography and vast body of water of the canyon, recently jolted by huge forces in the 2016 Kaikōura earthquake. *Canyon* extends ideation through drawing via a novel hybrid of hand sketches, soundscapes and virtual reality (VR). The ominous scale and power of this marine landscape is distilled through these hybrid drawings, which allow abstract architectural possibilities to emerge from the massive subject matter. The *Canyon* project contributes to research into architectural drawing and architecture's relation to landscape: drawing is expanded as a hybrid medium, able to distil poetic knowledge through multiple sensory platforms; and the marine landscape, as a poetic drawn through this hybrid technique, is reoriented as New Zealand's powerful and enduring architecture.

This paper reports on the aesthetic and theoretical results of the project, to be exhibited at the Palazzo Bembo Gallery in the 2018 Venice Biennale. We expand on *Canyon* as a critique of New Zealand architecture, and its romanticised view of landscape. We raise questions about the power of architectural drawing: its capacity to observe phenomena, through the lens of hybrid media, and generate new architectures and new knowledge. *Canyon* breaks new ground in drawing's role through kinaesthetic, sonic and VR modes, and in turn provides valuable new insight into interdisciplinary design practices.

Keywords: Drawing, Virtual-Reality, Soundscapes, Landscape, Imagination.

Figure 1. Presence-drawing study: sediment turbidity

Introduction

Canyon is an experiment in architectural drawing, crossing analogue, digital and sound media. This cross platform, hybrid mode of drawing is used to extract architectural presences from the undersea landscape of Kaikōura Canyon, Aotearoa, New Zealand. The *Canyon* installation is exhibited at the Palazzo Bembo, in the XVI Venice Biennale. In *Canyon*, analogue sketches are made navigable through a virtual environment, allowing their atmospheric intensities to coalesce with the ambiguous space of virtual reality (VR). These navigations are accompanied by spatialised sound, which adds a sensorial dimension to the drawings. This paper comments on the research behind the *Canyon* project, which seeks to extend analogue drawing's sketchy openness into digital and sensorial modes.

Just 500 metres from the Kaikōura coast, the seabed plummets to over a kilometre in depth, and continues to deepen as it flows to the Hikurangi trough, which marks the junction of the Pacific and Australian tectonic plates. Huge forces in this undersea landscape were released in the recent 7.8 magnitude Kaikōura earthquake. The seabed lurched upwards, triggering undersea landslides and turbid flows of sediment; the bathymetric landscape, previously unconsidered, suddenly made its presence felt. The *Canyon* project explores the architecture of this unseen, dynamic environment. It draws atmospheres from the undersea landscape of Kaikōura canyon, one of the deepest and most seismically active submarine landscapes in the world.

Canyon draws intangible presences from the undersea landscape through hybrid drawing. In the *Canyon* installation, visitors are projected into the Kaikōura canyon though a mix of gestural drawing, virtual reality (VR) and soundscapes. Viewers enter a dark space of crumpled, landscape-like paper and are given glimpses into a virtual environment that spatialises analogue sketches. They experience a dark sea-like space enhanced by a soundscape of sonic 'drawings'. The three modes: gestural drawing, VR and sound, combine to create hybrid drawings of the Kaikōura canyon, presenting the visitor with multi-sensorial sketches of the canyon's abstract presence.

This paper reports on the aesthetic and theoretical results of the *Canyon* project. We expand on *Canyon* as an experimental mode of architectural drawing that spans across multiple discursive and non-discursive platforms. Drawing's capacity to observe phenomena, through the lens of hybrid media, is extended and argued to generate new, aesthetically imbued knowledge. The openness of drawing, its unfinished and evocative dimensions, is brought to virtual reality, rendering VR sketchy and generative, rather than solely a visualisation tool. *Canyon* also critiques the traditional, romanticised view of architecture's relation to landscape: it proposes that architecture draws from landscape's abstract presences, allowing landscape to shape architecture rather than simply being a picturesque setting. The *Canyon* project is the first stage of a range of research into the open potential of architectural drawing, using a hybrid of analogue gesture, virtual experience and spatial sound.

Canyon installation

Canyon is exhibited at Palazzo Bembo, a 15th century building on the Grand Canal in Venice, in an invited group show entitled TIME SPACE EXISTENCE, curated by the GAA-Foundation. This show is an official collateral exhibition to the XVI Venice Biennale. The *Canyon* installation is shown in a dedicated space in the Palazzo Bembo, a small 'room' 2.5M x 3M x 3M in height. Once in the small space of *Canyon* a viewer is conceptually in an inhabitable drawing that projects to the abstract qualities of a vast, sketched undersea landscape.

In the installation, hand sketches, soundscapes and virtual reality (VR) generate a sense of the submarine landscape. Gestural sketches explore intangible characteristics, such as pressures, flows and threats of seismic jolts, and are brought into a virtual and soundscape environment. Visitors to the installation are given hints of an abstracted VR canyon through four small screens, partially hidden in the installation surface. Four nodes within the room prompt visitors to move close to the surface, where they hear sonic drawings augmenting the space sketched in the virtual environment, glimpsed in the screens. The VR traces movements through the abstracted sketch-space of the canyon, giving the impression of descending or traversing a limitless space. The result is an installation where the visitor is physically present, in a tiny gallery room, and also projected into a space of vast scale and dynamic movement, that speaks of both the undersea landscape of Kaikōura canyon and the ambiguous landscape of the digital.

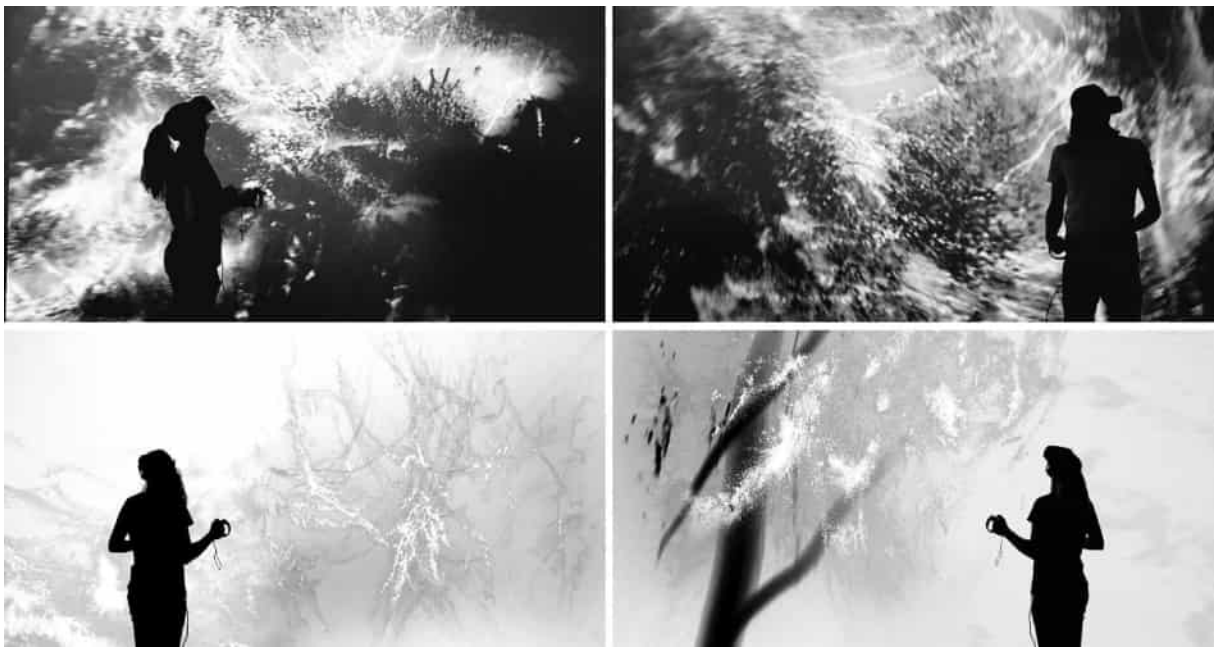

Figure 2. Navigations of VR *Canyon*

Visitors are prompted to move around the room and listen closely to the contoured paper surfaces. The soundscape performs scalar shifts in sound intensity and pitch, in tandem with the VR imagery. Visitors' experience is jolted by flashes of light from the four small screens and corresponding jolts in the soundscape. These present the seismic uncertainty of the canyon. The three modes: gestural drawing, VR and sound, coalesce as a multi-sensorial drawing environment, projecting the visitor into the vast scale, materiality and atmospheric potential of the canyon. The installation is conceptually and perceptually linked to the architecture of the submarine landscape, merging drawing space, at the scale of a person, with the enormity of an undersea landscape.

Analogue drawing

Gestural analogue drawing has traditionally been associated with intangible, qualitative dimensions. Sketches are open: evocative, indeterminate, unfinished, and therefore, full of possibility. Drawing is, to quote Jean Luc Nancy, *nascent*, 'the opening of form' [1]. In the *Canyon* project, the inherent openness of analogue drawing is used to explore architectural possibilities in the undersea canyon landscape. Sketches record observations of the unseen environment, distilling abstract presences through gestural marks of graphite on paper. In

these crude and rapid drawings, there is a correspondence between the performance of drawing and the performance of the drawings' subject matter: drawing, as a gestural trace across rough paper, parallels the dynamics and materiality of the Kaikōura canyon.

Figure 3. Presence-drawing study: gas eruptions

The Kaikōura canyon was chosen as the subject of the drawing for its poetic possibility, as a landscape that can only be inhabited through representation allied to imagination; it cannot be experienced through vision, as a landscape scene, but only through imaginative projection. Architectural drawing allows for space at landscape scale to be inhabited in this way. When imagined though an architectural lens, the space beneath the sea's surface becomes present as a dynamic material, an immense mass of water, mud and rock. A sketch through this space, such as a section, captures its form and contour but is also inflected by what that space is imagined to be like; the sketch triggers images in the drawer's mind of pressure, weight, viscosity and unpredictable flows. These two twinned conditions, of an instrumental understanding mixed with one cultivated through spatial imagination [2], exists in any architectural drawing. This allows an exploration into what drawing might capture, in terms of both tangible and intangible conditions, and in turn into what architectural possibilities such drawings might generate.

The *Canyon* analogue sketches were made by drawing sections, plans and three dimensional 'scenes' over a rock-like surface. The graphite was caused to skip over the paper by the jagged shape of the rock underneath. This skipping allowed unexpected elements to influence the drawing's marks. This was an exaggeration of the feedback normally found in analogue sketching and was used as an analogue of the material dynamics of the canyon; the rock beneath the paper caused the marks to smudge and change direction, so a sectional drawing of the sea floor became not a single line, but an indeterminate series of marks mapping the imagined presence of flows, pressures, mud and rock.

Some of the lines are singular and fine, and describe pure boundaries between things, such as at the water's surface. Others describe transitions between materials that are less defined,

such as where sea water blends into mud then to rock, or where sea cliffs drop vertiginously into an imagined darkness. There are lines that have no material analogue and are merely about directions of current or degrees of pressure or intensity. The drawings, as a set, are not arranged according to different scales but are deliberately mixed, in an attempt to allow ambiguities between scales. The jagged contours of a rock, at 1:1, correlate to landscape forms and flows at large scale and become indistinguishable. The over-arching intention is for the drawings to be a traverse of the imagined space of the canyon, allowing scale and material to be amorphous in order to distil something beyond instrumental description: the architectural presences of the canyon.

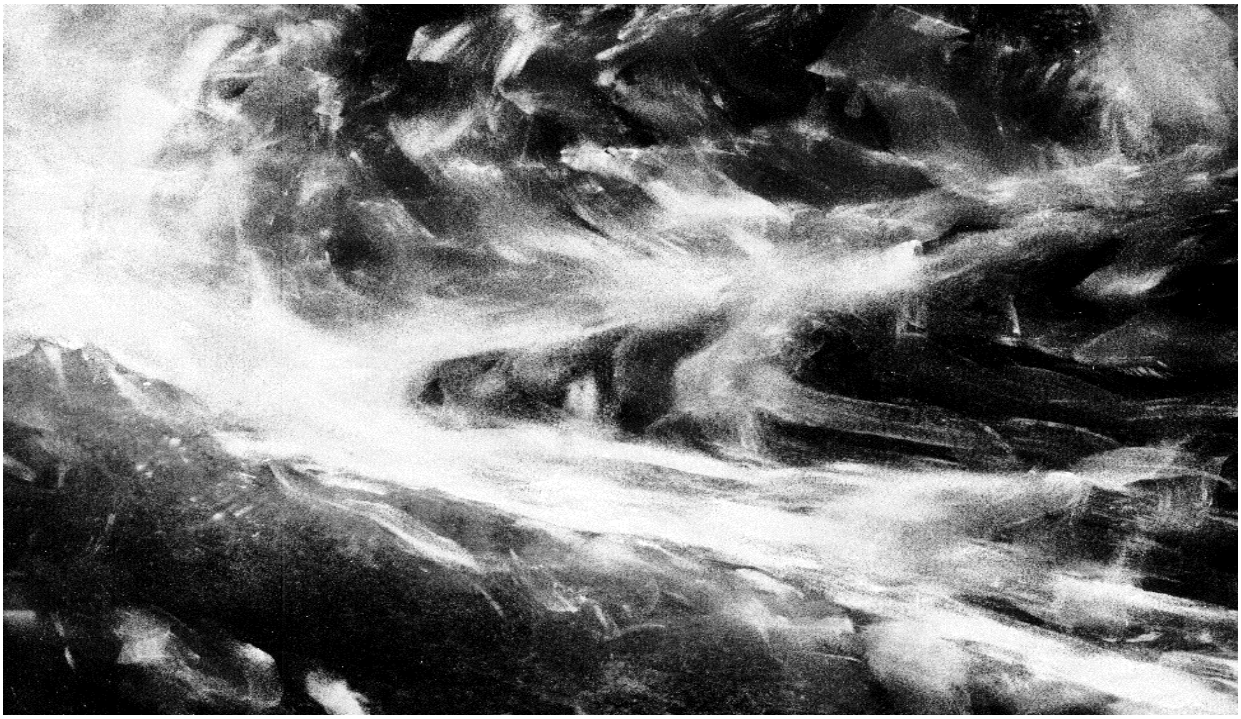

Figure 4. Presence-drawing study: cliff face

The *Canyon* sketches are marks that present the act of their making as well as standing in for something beyond them; they are poiētic marks. As Martin Heidegger explains, they belong to '… the activities and skills of the craftsman (and also) … to bringing-forth, to *poiēsis* …' [3]. They hover between possibilities and evade easy categorisation, which makes them useful to extend architectural drawing from instrumental description to a mode where less discursive characteristics of space can be imagined. This is enabled by the analogue drawing being a combination of gestural action and the resisting, or affording, forces of material. The material doing the affording and resisting, in this case, is both the material in drawing, and the materiality of the landscape being drawn. The skipping of graphite over paper distorted by a rock surface becomes analogously linked to the material of the canyon: the vagaries of rock, mud and water. Drawing in this way is an attempt at observing the canyon's powerful and ominous presence, drawing it out through analogue gesture and material performance.

Architectural drawing involves understanding multiple presences. The rapidly drawn lines, smudges and other 'recalcitrant marks', as described by James Elkins [4], open architectural drawing to possibilities. These marks are where blurrings and unexpected shifts allude not just descriptions of contour, but intangible, imagined characteristics. They are marks whereby '…

nuanced misalignments, approximate thoughts and imperfect moments … resist fixing normative figuration …' [5].

The gestural act of drawing crosses with performative dynamics in the subject matter, which in the case of *Canyon*, overlaps movements in an undersea landscape with arcs of the hand over paper, creating an exploration of the presences in the canyon at the same time as an exploration of how those presences are drawn.

The Virtual Canyon

The physical installation at the Palazzo Bembo provides a concentrated experience of the project, curated as part of a group exhibition. The exhibition is one node in the visitor experience. Typically Biennale visitors are constantly on the move, sampling the many works and installations, often spending no more than a minute in any one space before moving on to the next. The smart phone, with its increasingly sophisticated camera, supplements the episodic survey of the Biennale, providing a record for later contemplation. The *Canyon* installation has been conceived with this in mind, providing a memorable experience, but one that is difficult to consume via camera. Rather, through providing a barcode and web address, we encourage an extended experience that is accessed via an online portal to the work. Here the visitor can download a VR application, that allows a more extensive and leisurely experience of the breadth of the *Canyon* project. In this section we position VR in relation to architectural representation, and outline the procedural approach to its implementation that enables an alignment with the tradition of drawings as open works of conceptual exploration.

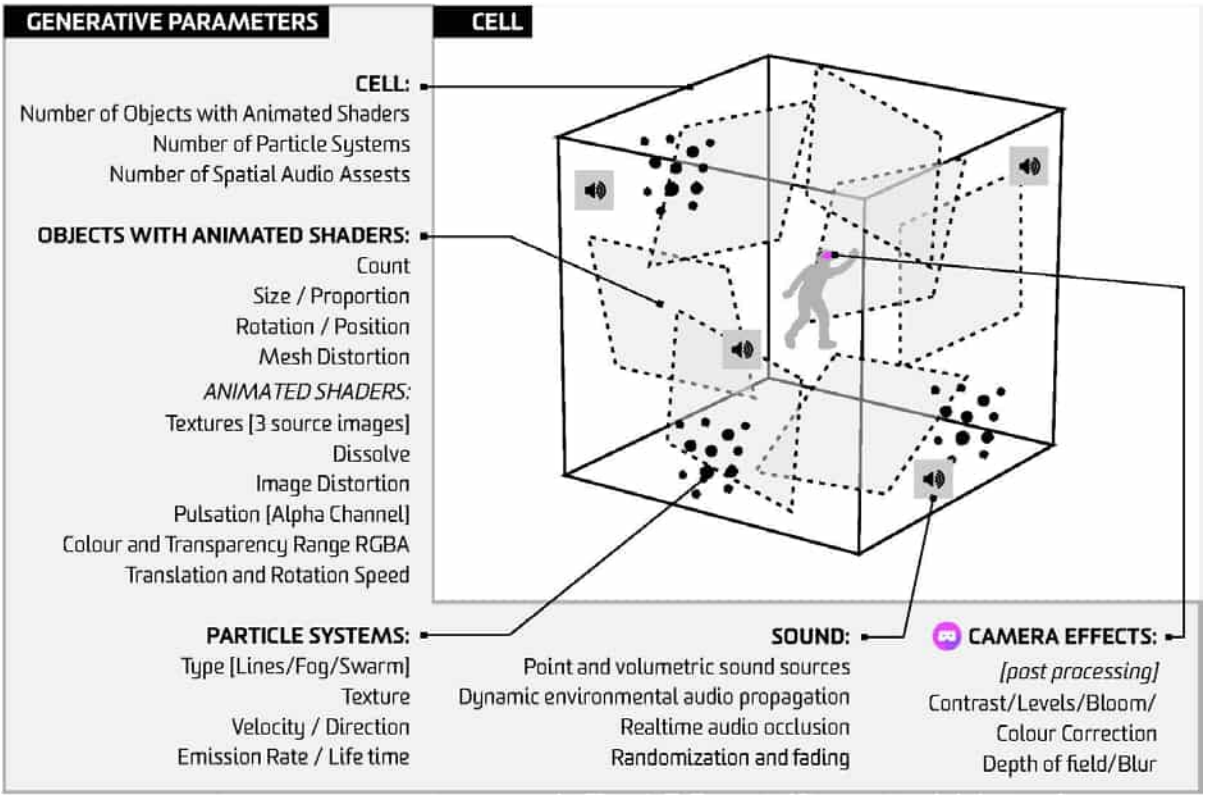

Figure 5. VR exhibition space design

For architecture, virtual reality has typically been considered another form of visualisation, focusing on photorealism. In a similar vein to the transfer of drawing board practice to early CAD, the tendency is to repeat existing practice without fully exploiting the affordance of the

medium. The reference point for architects using VR is the use of animation, which as documented by As and Schodek [6] has been developed primarily to communicate the kinematic experience of architecture. However, as they discuss, animation practice is conditioned by the traditions of projective geometry that underpin architectural content, and the technical apparatus of the animation camera, which utilises principles pf perspective developed in the 16th century. While there are notable examples of architects exploring motion as a conceptual device, such as in the animation of geometric parameters by Greg Lynn [7] or the opportunity for kinetic composition [8], VR as the 'ultimate display' [9] has had minimal impact on the design process. Most applications have been in the field of virtual heritage with a trajectory towards photorealism, such as the use of high definition graphics [10] and the use of 3D laser scanning [11].

Within the field of virtual heritage, the use of VR for the historical analysis of unbuilt architecture, where analogue drawings are translated to a virtual model, opens up the issue of graphic fidelity. Drawings at the early stage of a project are abstractions, a form of notation rather than being prescriptive. In a precursor to *Canyon*, we developed a VR interface for the historical analysis of unbuilt works of Giuseppe Terragni for the Palazzo Littorio competition [12]. Our approach to creating the VR representation was a doubling down of the virtual, prompted by the legacy of architectural drawings, where through vagaries of pencil and paper, built space can't be fully described, the emerging idea remains incomplete, sketchy and reliant on the mind of the drawer and the viewer, who are prompted to imagine space within or between the lines. The VR work produced for the Littorio project deliberately used an abstract approach to developing the virtual environment, the aim was to attempt an 'inhabitation' of the drawing in three dimensional form. *Canyon* extends this agenda – of promoting conceptual openness in early design stages - through a focus on capturing atmospheres that evoke presence within an imaginative spatial condition. The aim is to explore spatial qualities through VR technology, in order for them to be useful in creative ideation, similar to the traditional architectural sketch.

The research is informed by the theory of affordance. Initially developed in psychology by James J. Gibson [13] the concept of affordance has been re-defined and used in a range of domains. This simple definition by Stuckey in relation to the design of virtual environments is the most appropriate for our research – '... we use the concept of affordance to refer to the latent possibilities for action presented by an artefact, tool or environment.' [14]. From this definition and, given the current state of the technology, we propose that as well as immersive visualisation, VR affords an immersed sense of kinematics that is more visceral than watching animations on screen. In a similar vein, sound is spatialised and experienced, opening up the, comparatively, underexplored capacity to use aural senses to evoke spatial conditions and materiality. Complimenting immersive kinematics and sound are haptic interfaces that, while at an early stage of development, enable an enhanced bodily experience. Triggering the kinematic, aural and haptic senses - alongside the visual - provides one agenda for the virtual canyon. The second agenda is as important - the affordance of the computer to process information in real time. As has been explored through algorithmic and parametric design, this shifts attention away from the discrete architectural representation, and towards manipulating variables within which multiple representations can evolve. So rather than occupying a drawing, we conceive the virtual version of canyon as a procedural machine, that enables a journey through a landscape of possible spatial conditions.

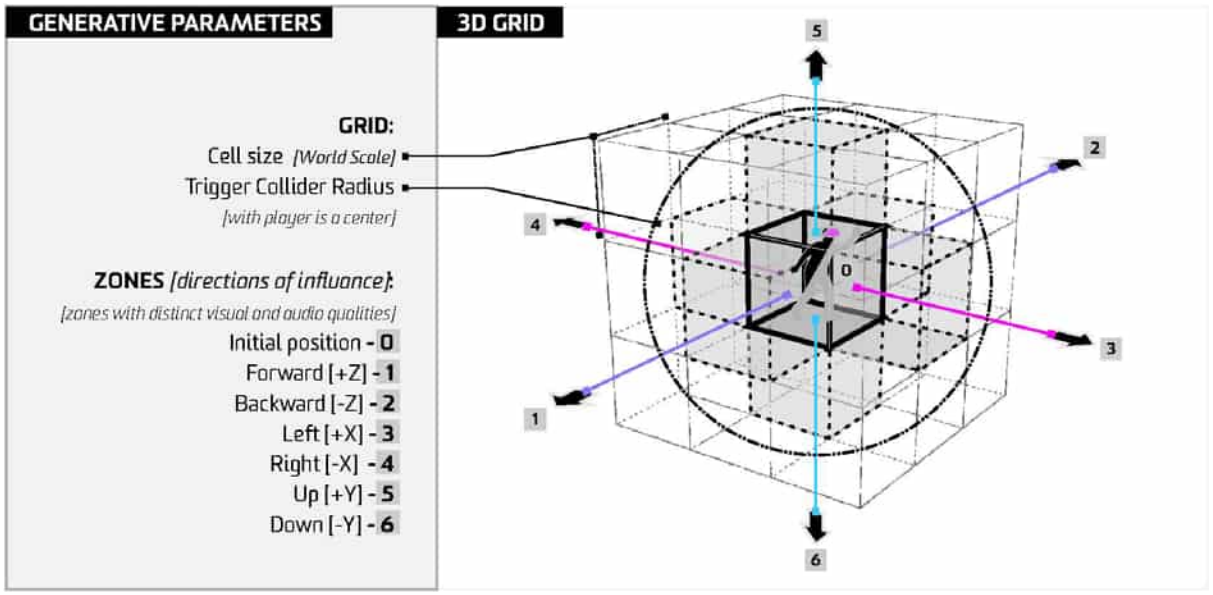

Figure 6. VR *Canyon* parameters

Figure 6 illustrates the procedural generation of the VR work. The surveyor's immediate experience is from cell 0. The initial sensation is one of drifting downwards, while hand gestures through a haptic interface enable a slow trajectory towards four adjacent cells. Each cell propagates a number of transparent planes on which multiple analogue drawings are reproduced and slowly animated, while particle systems generate sinuous lines, layers of fog and an occasional swarm effect. In the distance are other cells that are also spawning content and moving in any direction generates more cells along the direction of travel. These graphic worlds are complimented by soundscapes generated by point and volumetric sound samples, which are spatially distinct and through animation, interactive fading and occasional occlusion, extend the spatial experience and engagement. In a similar manner to the *Canyon* installation, the surveyor experience flashes of light, albeit within the VR work these are much more dramatic and start to trigger after-image effects. At first the movement through the work is slow, as if caught up in a highly viscous fluid but the velocity of movement gradually increases as the one of the four 'currents' are approached. These currents develop in intensity and eventually the surveyor is drawn along at speed, akin to the experience of a tidal rip. The user eventually spins out of the current into one of four quadrants of the work, each of which has a distinct spatial and soundscape quality, and a vertical gradient of light to dark. These spaces can be slowly explored, with the episodic flashes of light revealing shadowy architectonic forms. The surveyor can then navigate back to the central cell by moving back to the current and on to the other quadrants using alternate currents. Through the procedural approach the experience of each visitor is subtly conditioned within the overall spatial narrative of four quadrants and a vertical graduation of light to dark.

Discussion

The *Canyon* installation explores openness in architectural drawing and architecture's relationship to landscape, in an attempt to generate new understandings of digital environments, analogue mark making and sensory, material feedback.

Canyon looks at drawing as an open tool for observation, as a way of drawing out abstract, intangible qualities – presences – from an undersea landscape. *Canyon* looks at how these presences are distilled through drawing and how they might play a role in ideation; how they

might be generative of architectural forms, space or thinking. These two conditions, drawing out and drawing with, engage with drawing's sketchiness, or its power to be provisional, unfinished and hence open to conceptual possibilities. The research looks at the mechanisms of this openness in analogue and VR drawing. It looks at the influence of materiality, in the affordance of graphite on paper and the virtual drawing media, as well as the materiality of landscape. The research correlates these two, mapping drawing's material dynamics to that of landscape.

Drawing involves gestural action in concert with feedback from a material condition of some kind, be it graphite and paper or a virtual, digital medium. In this, there is a play between the actions of the drawer and affordances and resistances in the medium. The marks created through this interaction gain unexpected or uncontrolled aspects that blend with the drawer's cultivated understanding of the line and what it might refer to – be it the line of a wall or the form of a large landscape. The material performative condition of drawing influences the way the drawing is thought about, and how the space being drawn is thought about. Drawing is a complex tool for imaginatively occupying space in this way, mapping drawing media to space beyond it. This condition of drawing is commonly associated with analogue drawing, in the evocative architectural sketch. This research looks at how such conditions of openness can be supported by digital media; how VR can have sketchy, evocative conceptual possibilities.

Drawing in VR commonly involves realistic visualisations and as such is not geared to drawing's traditional openness. This project brings the open indeterminacy of drawing into VR technology, and questions how it might be generative in the same way as a sketch. VR hinges on verisimilitude, but is not often considered for its sketchy, generative possibility. The *Canyon* project argues that VR can afford a conceptual openness, through manipulating the visual acuity of VR space, prompting a viewer to imaginatively project into it, as in a sketch, rather than simply experience it passively. This is part of the hybrid approach of the *Canyon* project, which draws together human, digital and material conditions in a mode of open architectural drawing.

The second research agenda addresses architecture's relation to landscape. In New Zealand, the scale and power of landscape is often romanticised, with landscape the natural, picturesque setting to an ideal, stand-alone architecture. The Kaikōura seismic event in November 2016 reoriented this notion. The sudden, dramatic movements of huge bodies of land and sea bed, redrew not just the coastline but how we consider landscape in relation to architecture. The atmospheric power of landscape, as something with vast mass and scale - and a latent possibility for movement - provides rich possibilities for architecture. Taking landscape's presences into account, we put forward an architecture based on landscape's presences as a way, particularly in New Zealand, that architecture can respond to landscape in a less picturesque way. This allows landscape to have a presence in the design, or drawing, of architecture.

Canyon raises questions about the power of architectural drawing to evoke, its capacity to observe phenomena through the lens of hybrid media, and to generate new architectures and new knowledge. Using a mix of gesture, VR and sound, this project draws presences from the Kaikōura Canyon, speculating on a multi-sensorial mode of drawing, crossing human, physical and digital influences.

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FROM CONCEPT TO EXPERIENCE: A BUILT MANIFESTO FOR A SCHOOL OF ARCHITECTURE

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Abstract

The award-winning Abedian School of Architecture building at Bond University, Queensland in Australia, was designed by Sir Peter Cook and Gavin Robotham of CRAB Studio, in collaboration with Populous and Brit Andresen, as a concrete expression of architectural pedagogy in built form. Drawing upon their outstanding international experience of architectural education, the architects sought to create a rich learning environment. This resulted in a dramatically expressive building, comprising distinct, though highly interconnected spaces, that range from the grandeur of the 'Forum' to the intimate 'Scoop' exhibition and critique spaces, defined by sculptural structural elements, connected by the central 'Street' that bisects the building, between the open 'Atelier'-like studio spaces and the equally open staff areas and seminar rooms, which interrelates all activities within the building. The inspiring spatial quality of the building is heightened by the tectonic integrity of the sculptural concrete forms, at the same time moderated and humanised, by the use of timber panelling and vibrant colours.

In order to clarify these architectural and educational principles, this paper investigates the visions and ideas that underpin the design of the building, the origins of these intentions, how they were developed through Peter Cook's unique storyboard sketches and articulated in words, and then how they were translated into built form. Now that the building has been in active use for five years, this paper critically considers how the design of the building has impacted the design methodology in the curriculum of the Abedian School of Architecture. Also, what discernible benefits can be attributed to the design, in terms of the students' heightened creativity? Has the building fulfilled the expectations of its architects? And are there shortcomings and unsuccessful consequences, as result of focusing on and achieving other objectives?

Keywords

Abedian School of Architecture, design concept, architectural pedagogy, user experience.

1 Introduction

The Abedian School of Architecture is notable not only because it is the newest architecture program in Australia, at the Bond University that is the country's first private university, but also internationally significant because of the School's award-winning building design by Sir Peter Cook and Gavin Robotham of CRAB Studio (Cook Robotham Architecture Bureau), in collaboration with Populous and Brit Andresen. The School's architecture creates a distinct contrast to the otherwise rather conventional, postmodernist architecture of the Bond campus, while the distinction is reflected by the architecture curriculum as well. The latter is apparent in its studio culture in a building that is accessible for students 24/7 without spatial boundaries defined by walls (with a few exceptions), which has allowed the development of a curriculum that focuses on the integration of all subjects from design studios, to technology, to environmental studies, to history and theory, to professional practice. This is enhanced by the open floor plan of the building and the attached workshop facilities with both conventional tools and those for the state-of-the-art digital fabrication, including robotics, which supports the School's hands-on and learning by doing approach to architectural pedagogy.

Bond University was founded in 1987 and the initial stage of the campus at Varsity Lakes in the Australian Gold Coast welcomed its first cohort of students in 1989. Following the masterplan by Daryl Jackson and Robin Dyke, the landmark of the campus is the 'Arch' building by renowned Japanese architect Arata Isozaki [1]. The main building gets its name from the triple arches that support the primary administrative offices and reception areas above and connect the two wings housing the main library on one side, facing other study spaces below more offices, with symmetric loggias in the ground floor aligning the watercourse in the main axis of the campus. One enters the campus from a large roundabout on a hill and proceeds down along this axis aligned by jacaranda trees and other planting, with the faculties of Law and Business behind, among supplementary administrative offices. Next, one arrives on a circular plaza, followed by the aforementioned watercourse, and ends by a pool-like bay with a fountain, which is visible through the central arch as a *point de vue*. More buildings are located along a secondary axis tilted ten degrees from the main thoroughfare and, like the Arch building, are mostly clad with Australian sandstone. Both the axial layout of the campus and the design of its individual buildings, with faux arches, campaniles and other references to classical, Western building tradition, are emblematic features of postmodernist, Italianate architecture of the 1980-90s and hint at inspiration from the likes of Aldo Rossi and also James Stirling, amongst others. (Figure 1).

Figure 1. Views of the Bond University campus and the Arch building by Arata Isozaki (copyright: Bond University and Rix Ryan Photography).

On the other hand, the Abedian School of Architecture along the secondary axis stands out in a stark contrast due to the absence of any historic references seen in the main buildings of the Bond campus by Isozaki. Other than Peter Cook's own idiosyncratic evocation of Mendelsohn and Chermayeff's De La Warr Pavilion in Bexhill-on Sea from 1935, a reference to Cook's childhood memories of the south coast of England, was similarly juxtaposed as an appendage to the otherwise fluidly organic and blob-like Kunsthaus in Graz, realised previously by Peter Cook with Colin Fournier, in 2003.

As a result of an architectural competition launched in June 2010, the winning entry is characterised by a dramatically expressive building, comprising distinct, though highly interconnected spaces, that range from the grandeur of the 'Forum' lecture area to the intimate 'Scoop' exhibition and critique spaces, defined by sculptural structural elements, connected by the central 'Street' that bisects the building. Along this spine that gently climbs on the sloping site are the open 'Atelier'-like studio spaces on the south side and the equally open staff areas and seminar rooms in the north, which interrelates all activities within the building. The inspiring spatial quality of the building is heightened by the tectonic integrity of the sculptural concrete forms, at the same time moderated and humanised, by the use of timber panelling and vibrant colours. Drawing upon their outstanding, collective international experience of architectural education at the AA, Bartlett, Harvard, SCI-Arc, Columbia, Frankfurt, UCLA and the University of Queensland, the architects, Sir Peter Cook, founding member of the Archigram group, together with Gavin Robotham and Brit Andresen, sought to create a rich learning environment as a concrete expression of architectural pedagogy in built form (Figure 2).

Figure 2. Views of the Abedian School of Architecture exterior and interior with the 'Street' and one of the 'Scoops' along it (copyright: Bond University and Peter Bennetts).

Professor Brit Andresen, a Royal Gold Medallist who has a long career as an architectural practitioner and educator in Australia and abroad, knew Cook from her years at the AA in London and he asked her to be involved as a local expert. "I can't say that I had any major role in the design process, except for the siting," she emphasises and continues that "it would have been difficult anyway, as most work was done in London." Consequently Andresen was the one studying the topography and vegetation on the site and sent her sketches and suggestions to CRAB. She recollects that "the 'Street' was there from the beginning," though "there was a real danger that the 'Scoops' would not have happened" due to the challenges of their construction. Although many alterations had to be made throughout the ensuing design and realisation of the building, these essential features remained. Andresen remembrances Cook's comment when he first entered the completed building: "Oh my god, how cathedralesque it

is! – a typical word for Peter" [2], which is a common perception of anyone arriving through the front doors.

Hence, this paper investigates the visions and ideas that underpin the design of the Abedian School of Architecture building, the origins of these intentions, how they were developed through Peter Cook's unique storyboard sketches and articulated in words, and then how they were translated into built form. Now that the building has been in active use for five years, we critically consider how the design of the building has impacted the design methodology in the curriculum of the Abedian School of Architecture. We also ask, what discernible benefits can be attributed to the design, in terms of the students' heightened creativity? Has the building fulfilled the expectations of its architects? And are there shortcomings and unsuccessful consequences, as result of focusing on and achieving other objectives?

2 The Design

The first Head of the Abedian School of Architecture was Professor Philip Follent, former Queensland Government Architect, whose initial task in 2010 was not only to launch a new architecture program but also to start the process for the creation of a building to house it. He points out that "the administration didn't at first realise that a new building was necessary" and, why an architectural competition was needed. "They just wanted the same firm that had designed the Institute of Sustainable Development next door to do a similar design," Follent recalls. However, the benefactor of the School and a longstanding supporter of the University, Dr Soheil Abedian, shared Follent's view that the building designed for a new architecture program should be a result of an architectural competition, although there was not enough time for an open international competition. Of the twenty-one invited architectural firms, eighteen submitted proposals, of which five were shortlisted. Peter Cook's involvement was almost accidental, as a consequence of Follent unexpectedly meeting him at the State Library of Queensland in Brisbane at the time that the invitees were being selected. In the next stage, all five shortlisted firms gave presentations of their proposals to a selection committee that was asked by the University to choose three finalists in no particular order; those were M3architecture, Donovan Hill Architects, and CRAB. According to Follent, the latter was chosen primarily because of Dr Abedian's strong support and financial commitment, even though the two other proposals would probably have been less expensive [3]. Yet, the approximate AUD 6500/ m^2 final cost, including the furniture, is not especially high figure for an educational facility of 2500 m^2.

In an interview at the Inside Festival 2014 in Singapore, in which the Abedian School of Architecture building won the Health and Education category, Gavin Robotham describes the architecture of the School being "designed from the inside out" corresponding to "the curriculum that we also helped design, based on a lot of anecdotal or episodic moments from various schools that we've taught at" [4]. Instrumental part of the competition entry proposal were the lively storyboard sketches by Peter Cook, with which he communicated the basic design concept of user interaction (Figure 3). Follent remembers Cook's presentation as "spectacular" and his sketches as "quite disarming" [5], which at least partly explains CRAB's success in the competition.

Figure 3. Some of Peter Cook's storyboard sketches envisioning the future life in the Abedian School of Architecture building (https://www.archdaily.com/465030/abedian-school-of-architecture-crab-studio).

Other awards for the Abedian School of Architecture building include the AIA Queensland Public Building Award 2014, AIA Gold Coast and Northern Rivers 'Building of the Year' 2014, and National MBA Public Building Award 2014, among the total of eight awards that year (not including shortlisted nominations) [6]. Robotham ascribes their accomplishment to the openness of the building which creates "friction between the students – friction in a good sense" and explains that the goal of free space was to let the students learn by seeing what is going on and designed around the building. He also maintains that the openness of space allows spontaneity "so that it can be used in unforeseeable ways". For instance, the various built-in fixtures, articulating the open spaces and more intimate areas, function as seats and shelving but also as model display stands "for an archaeology of the product of the students' work" with the result that it "becomes part of the fabric of the building itself" [7]. Although the interior is otherwise dominated by rather raw, exposed concrete of the sculptural walls and the polished concrete floors, warmth is provided by plywood panelling of some walls and balustrades, as well as splashes of orange and yellow paint on a few selected concrete walls and all doors. The same applies to the furniture, which CRAB designed as well, in the rainbow of colours and variety of organic shapes.

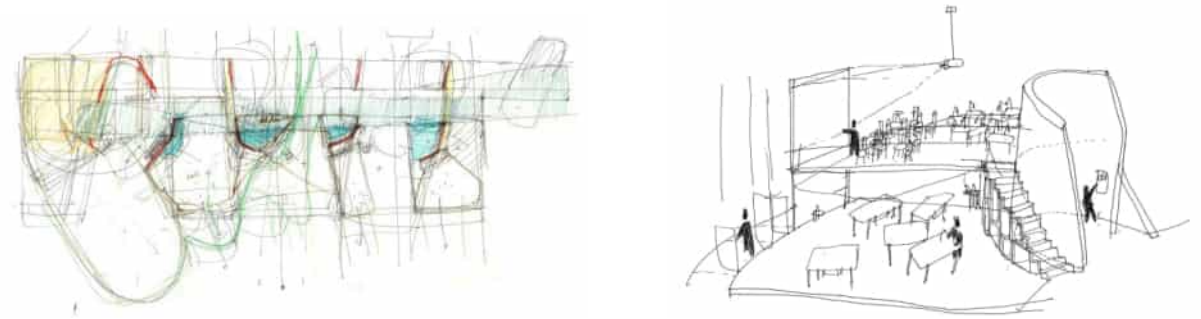

Figure 4. Concept sketches by Gavin Robotham showing that, in the competition phase, the 'Forum' was in the southwest end of the building (lower left corner), whereas the perspective sketch visualises the vertical connections between the mezzanine and ground levels (https://www.archdaily.com/465030/abedian-school-of-architecture-crab-studio).

As is customary, the design of the Abedian School of Architecture, too, changed from the competition phase to some extent, "though not a lot," as Follent puts it, "except for the workshop that was originally to be in the basement like at AA, which would have been too

expensive" [8]. Andresen considers this a loss, as it would have allowed views to the workshop from the street, similar to AA where anyone can see what is happening there [9]. The location in the separate 'shacks' behind the School building, though, can be seen now as a fortuitous, since it has allowed them to expand exponentially to meet increasing use. Another big change was to move the 'Forum' to the eastern end of the 'Street' next to the main entry along the campus walkway from the roundabout (Figure 5). The rationale for this shift was that "I wanted the building to be a handshake to the community", according to Follent [10]. This has turned out working well in reality, as the large glass wall reveals the activities inside the 'Forum' welcoming visitors to the many public functions at the School.

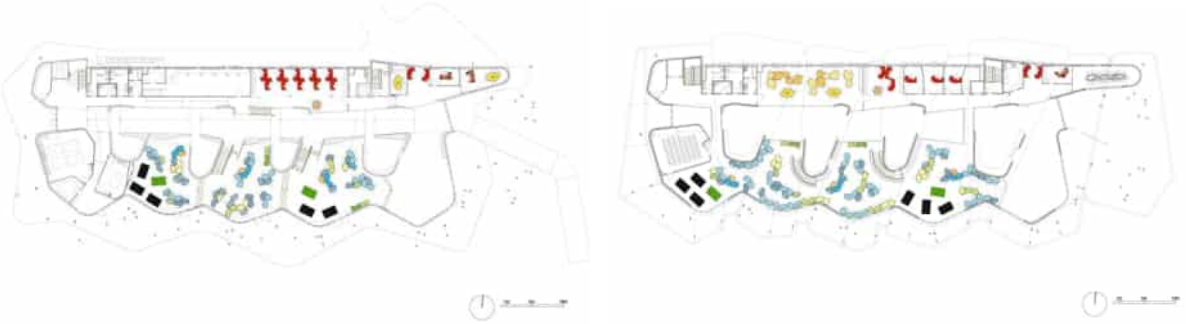

Figure 5. Final floor plans of the Abedian School of Architecture; (left) the ground floor that follows the contours of the site from the eastern entry to the higher ground in the west, and (right) the mezzanine floor, both with the two-story-high 'Forum' on the lower right hand corner (https://www.archdaily.com/465030/abedian-school-of-architecture-crab-studio).

Follent also points out that it was difficult to convince the contractor company ADCO about the intentional coarseness of the concrete walls. "They did not understand CRAB's idea that the concrete does not have to be perfect" so that the students can learn about the construction method. In addition, the openness was a bit problematic, especially the 'Scoops' that cannot be designated for separate functions, since the University administration "did not know how to deal with non-bookable spaces" [11]. Nevertheless, the University in general and the Faculty of Society & Design in particular now organise numerous receptions and other gatherings in the 'Forum' of the Abedian School of Architecture that has become a new landmark of the campus, and ADCO proudly presents the building on its website as a "world class facility", though emphasising its complications:

> Translating the complex design into reality presented many challenges for the delivery team. This was particularly evident in the form work component, particularly the design and construction of the four 10-14 metre off-form concrete "scoops". These "scoops" provide the essential structural supports for the stairways and main roof, whilst also permitting light and air into the building. They provide a visually stunning and functional interior by dividing the building into its dedicated studios and work spaces. [12]

3 The Curriculum

The challenges of construction are precisely among the reasons why the building itself is a 'textbook', providing the instructors with chances to point out – literally – examples relevant to each subject taught at the School. Just to mention a few instances, the spatial articulation of the open spaces of the 'Forum', the 'Street' and the studios for communal activities; supplemented by the slightly more separated areas of the 'Scoops', the semi-open seminar

rooms and staff offices; contrasting to the most enclosed and private spaces, such as the reading rooms, a 'black box' space for life drawing, some offices for confidential discussions, and the board room in the 'nose' of the building's east end; are lessons of the public-private relationships and hierarchy. As those are connected both horizontally and vertically within the building (Figure 6), the design also exemplifies the *raumplan* concept discussed in the history-theory classes, besides the many, many other trends in architectural discourse, with Archigram being one of them. And the workshop facilities with both conventional and most advanced digital fabrication tools have provided the design communication subjects with ample opportunities to experiment with a range of 'hands-on' approaches. Moreover, Robotham's drawings are excellent models of *parti pris*, concept and other diagrams in design processes implemented in all architecture subjects. Because most of the mechanical installations are visible, the students actually see how they look like and how much space they require. The tectonics of the building, in turn, visualise the strategic plan of the School's 'learning by doing' paradigm, which relates to the phenomenological approach of the theory subjects as well. As for the latter, the students can personally experience the impact of the building's orientation along the east-west axis and how it minimises exposure to sunlight in the studio spaces in the south, allowing the two-story-high glass facade to connect with the environment of the campus. Correspondingly, the more solid façade on the other side shelters the interior from the harsh northern light of the southern hemisphere.

Figure 6. South elevation and cross section of the Abedian School of Architecture by CRAB Studio (https://www.archdaily.com/465030/abedian-school-of-architecture-crab-studio).

Conversely, we have also come to realise that the illustrious 'eyebrows' above the northern windows work only most of the year, but not in the peak of southern winter when the low-lying sun penetrates into the interior and requires internal blinds in those windows. Andresen emphasises that "horizontal shading devices do not work here and should be vertical" [13]. This further relates to the theoretical framework of critical regionalism, environmental studies, and other climate- and/or culture-specific foci of the curriculum, including both active and passive sustainable strategies. With regard to that, we can criticise the impact of a late decision to not have operable windows, although the original intention was that the building would have been naturally ventilated, in which the airiness of the central spaces and the 'chimney' effect of the 'Scoops' was in an important role. The openness of the interior, in its part, has both advantages and disadvantages. "Acoustics was always to be a problem," says Follent, though he adds that initially there were to be absorbing panels reducing the echo. Then again, the same openness and 'open-door policy' allows direct interaction between most spaces, including the staff offices. As Follent expresses it, "we cannot go hiding from the students and must be visible for them" [14]. Finally, the design process is an invaluable case in point of professional practice in terms of the relationship and communication between a

designer and a builder, reflected by the earlier ADCO statement. And most importantly, the design methodology of CRAB has been a source of inspiration for both the students and the academic staff.

The first students in the Abedian School of Architecture started their studies in January 2011, though the current building wasn't completed until in 2014, and at first the teaching took place in the Institute of Sustainable Development next door. In fact, the plan was to connect both the buildings and the curricula of these two units more effectively, which was recently realized by establishing a combined Masters of Architecture and Masters of Project Management degree, and there are other dual degree plans on their way, although the physical connection between the buildings is still under consideration. Even if the outdoor amphitheatre and some other landscaping ideas of CRAB's competition entry have not been materialised either, Cook and Robotham envisioned from the very beginning that the exterior of the Abedian School of Architecture would be a 'classroom' itself, which is possible owing to the long overhangs of the roof (Figure 7), under which the student organisation also holds its monthly barbeques. In addition, the enclosed 'Atelier' space in the ground floor, next to the main entry and visible from the secondary campus thoroughfare, still has the potential of functioning as an office for pro bono community design of an architect in residence, which it was meant to be.

Figure 7. Peter Cook's storyboard sketches of the envisioned ways to utilise the exterior of the building (https://www.archdaily.com/465030/abedian-school-of-architecture-crab-studio) and Associate Professor Daniela Ottman's studio review actually using the outdoor area in that way (photo courtesy of Daniela Ottman).

Certainly the design of the Abedian School of Architecture does quite clearly encourage social interaction and provides a conducive environment for the exchange of ideas and development of creative endeavours. The architecture, however, cannot alone create an optimal learning environment. The good intentions of the architects are variously countered and compromised by the inability – or perhaps by the former education – of the students to more fully utilise the potential of the design. This is due in a large part to the necessity of the students to work elsewhere to be able to fund their education and living expenses. Also, the highly competitive and grade-fixated attitude of many students, runs contrary to the ethos of teamwork and collaboration, within a studio culture. Yet, our students are gradually realising the benefits of their inspiring environment, in terms of peer-to-peer support, which leads to spending more time in the building, beyond the designated studio tutorial sessions.

Coinciding with the issues of mental health and other anxieties within schools of architecture, which are coming increasingly into focus as being of great concern, the support of peers within

a collegial studio environment provides one of the best ways to moderate and cope with the stresses of the competitive nature of architectural education, an ingrained expectation of working long hours, uncertainty about the future, as well as the burden of mounting student debt. Fortunately, the monumental drama of the Abedian School of Architecture building, balanced by its joyous and colourful exuberance, uplifts our spirits and encourages a sense of optimism. This helps to alleviate the above-mentioned concerns by providing, on a daily basis, a concrete example of what can be achieved through good architecture, which stimulates confidence in going forward.

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THE RELEVANCE OF THE CREATIVE PROCESS OF DESIGN IN DEVELOPING LEADERSHIP-COMPETENCIES FOR TRANSITIONS TO THE SUSTAINABLE CITY

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Abstract

In order to address the challenge of leadership engendering the transition to a sustainable city, the creative processes of design used by architects and the methods used by leaders were investigated. This was done in order to determine the extent of common ground and to shed light on whether the architectural creative process and the associated skills, competencies and attributes can inform the process of leadership. These processes were investigated through the theoretical lens of backcasting and phenomenology and within the framework of the four stages of the creative process, i.e., preparation, incubation, illumination and verification. To address the primary data requirements of the study, semi-structured interviews were conducted with an architect, a business leader and a sustainability leader. Secondary data were collected from writings and interviews of architects and biographies of leaders, together with a wide variety of published material pertaining to leadership in the sustainable city arena. Data were then analysed based in terms of critical attributes related to the creative process in relation to leadership.

The key findings are that although architects follow a specific design methodology, there is no *explicit* reference to the creative process in their explanations of their design process. Furthermore, architects' creative processes accord with the creative process (as elucidated in the fields of psychology and neuroscience), and as experienced phenomenologically. There are similarities in the manner in which architects and leaders envision new solutions, even though their methodologies differ. The study concludes there are similarities in the way in which architects and leaders experience the *process* of creating and pursuing their visions. However, *manifestations thereof* differ across their two domains.

Furthermore, the well-developed methods used by architects could be relevant for the practices of leaders who are aiming to realize cities which are sustainable. These methods could be adapted towards developing leadership competencies in enabling the transition to sustainable cities.

Keywords: design process, leadership, sustainable cities

1 Introduction

Increasing global urbanisation, especially within developing countries, means that over 50 percent of the world population now live in cities – indeed, by 2050, this figure will reach between 70-80 percent [1]. Even although cities occupy only 3 percent of the earth's land surface, they account for 80 percent of global GDP. However, cities use 75 percent of natural resources, produce 50 percent of global waste and are responsible for 60-80 percent of global GHG emissions [2]. Furthermore, many cities rely on (dwindling) resources from distant bioregions and the myriad environmental problems cities face serve to weaken their social systems, thus reducing cities' liveability [3].

Urban sustainability then, is a multi-dimensional problem that requires a systemic, holistic, integrated and participatory approach [4]. This does not occur in an institutional and organizational vacuum though, and enlightened leadership is vital for effecting the "sustainable city." Such leadership has largely proven elusive -- "conventional" leadership methods do not seem to meaningfully address sustainability challenges, due to *inter alia*, contextually inappropriate and/or myopic outlooks, the application of primarily techno-centric solutions, and the fact that unprecedented (urban) problems need to be tackled [5].

But there *are* examples of sustainable cities displaying able governance and leadership, such as Curitiba in Brazil. Under the enlightened leadership of Curitiba mayor Jaime Lerner and his team, preference was given to public transportation, working with nature rather than against it, using relevant/appropriate, rather than high-technology solutions, and "bottom – up," rather than modernist master planning. [6].

As an architect, Lerner may have applied the architect's methods and skills, (together with his innate characteristics of leadership), to bring about these changes [5]. The successes achieved in Curitiba were emulated by some other cities around the globe, but few cities can be said to have actually achieved "sustainable status." There are many reasons for this, not least though, is a dearth of protagonists who might spearhead the necessary transitions to "sustainability." The question thus arises: how might innovation and creativity be fostered amongst those who are charged with leading the transition to sustainable cities?

Accordingly, leadership styles, theories**,** tools and techniques and the creative process are examined from psychological, neuroscientific and phenomenological perspectives, as indicated in figure 1 below. The methods and processes used by architects and by city leaders are compared, in order to determine whether the *architect's* process might influence the *leader's* process in a more creative and systematic manner.

Thus, a qualitative approach using a case study strategy was undertaken. This involved in-depth interviews with purposefully sampled respondents, namely an architect, a business leader and a leader in the sustainable city sector. Phenomenologically guided self-observations by the researcher (an architect) were used to supplement the primary data. Secondary sources were publications by or interviews with well-known architects, business and sustainable city leaders in the literature. [5]

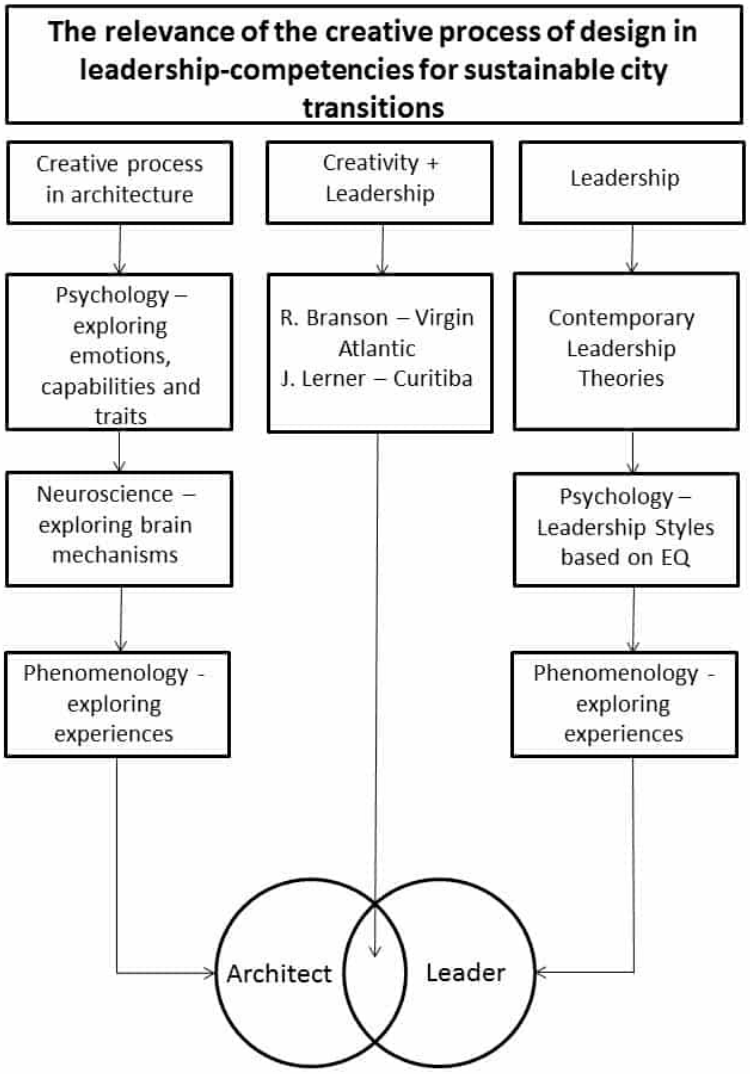

Figure 1. Research design [5]

The case study was exploratory in nature, as it pursued an understanding of the creative process (with its four stages of *preparation*, *incubation*, *illumination* and *verification*), and the attributes used in architectural design and leadership processes which could be applied to sustainable city transitions. These attributes were divided into the six categories of creative skills; thinking, drawing, decision making and thinking styles; use of metaphor, simile, symbolism and analogy; technical skills, people skills, and leadership skills.

2 The Creative Process in Architectural Design

The creative process is a driving force in the evolution of mankind [7] and is utilised by creative people (such as architects), in order to bring about innovation and change. The architect's design process is a complex, multi-step process, and it generally involves three to five iterative stages of activity which include *analysis*, *synthesis* and *evaluation* [8].

As depicted by Nalkaya [9] in figure 2 below, the creative design solving process is generally seen to consist of two categories of activity (*conceptualisation* and *realisation)*, which in turn entail five levels of *decision-making* [9]. The conceptualisation stage includes design concept development, formal explorations, and preliminary design development. The realisation phase concerns the development of the engineering project and construction drawings and the finalisation of the working drawings and specifications. From this phase the design is then transformed into a building through the tendering and construction process. [9].

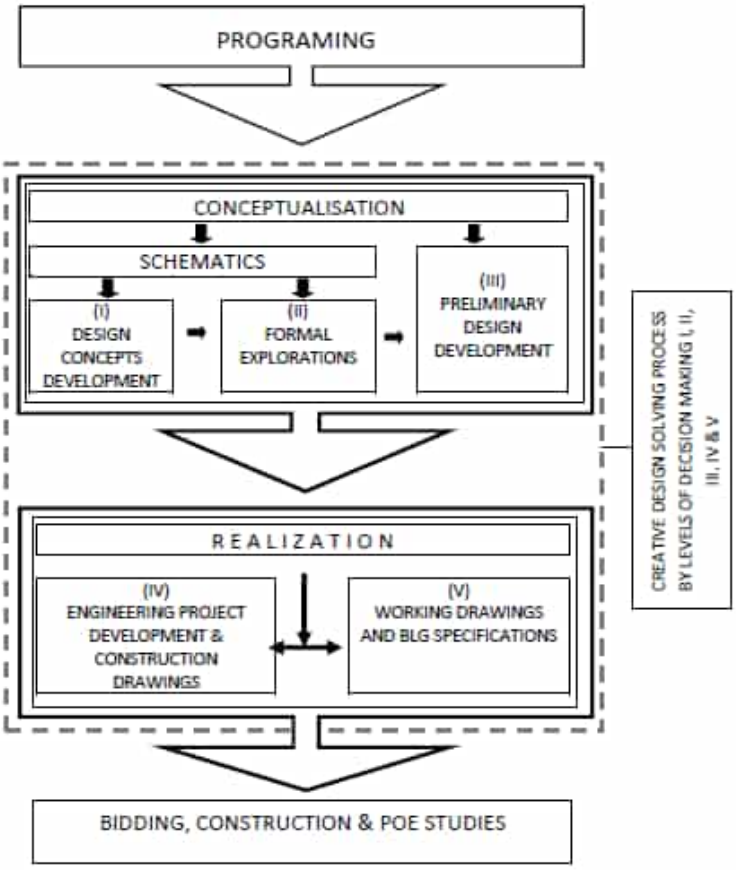

Figure 2. Levels of decision-making in architectural design [9]

2.1 Creativity as part of the architectural design process

Creativity is an intrinsic part of the architect's design process [8] and requires conscious *and* unconscious processing in the brain [10]. Creativity is a function of divergent and convergent thinking and it is characterised by the above-mentioned four stages of the mental process [11; 12].

Understanding the undesirable present state occurs during the preparation stage. Primarily analytical and conscious thought processes occur and it is active work [10]. During the incubation stage, the problem is not being resolved and occurs when *unconscious* mental processes are active [12]. This is the stage where *lateral* or *divergent thinking* takes place. In the third stage of illumination, sudden insight occurs unexpectedly and there is a transition from *unconscious* possibilities to *conscious* insight [13]. This is also known as the 'Aha!' moment [14]. The conceptualisation stage is at the core of the architect's creative process

and it envisions a desirable future state [5]. During the final stage of verification, the transition of idea to form takes place [13], and it is characterised by *conscious* mental processes [14]. At this stage the desirable future state is attained [5].

Backcasting, as opposed to forecasting, is utilised by architects to attain the realisation of their vision. The building the architect wishes to build is envisioned as the desired future and subsequent actions are taken to attain that future or vision [15]. Backcasting is particularly suited to complex problems that require major change, such as sustainability issues [16].

Feedback is also used at every stage to fine-tune each intermediate result relative to the original concept of the design [17]. It leads to *iterations* of the design in an effort to improve upon the previous *iteration* [5].

2.2 The Neuroscience of Creativity

Neuroscience attempts to understand how the processes, skills and experience required for creativity work in the brain.

Creativity could be considered as a product of the complex interplay between ordinary cognitive processes like memory, attention, executive function, emotion and problem solving [18]. This interplay appears to occur between multiple and distant brain regions which form a network that may be associated with creative cognition [19]. The popular division of functions between the left and right hemispheres has been shown to be an oversimplification. In fact, the connections between both sides of the brain are reconfigured as artistic skill increases [14], and interactions between the left and right prefrontal cortex may be critical for good design solutions [20].

Neuroscience actually validates the stages of the creative process, indicating that different brain regions contribute to different activities and that *unconscious* processing forms a large part of the creative process.

2.3 Creativity traits/ skills/ phenomenology

Traits that are thought to contribute to creativity include intelligence, motivation, knowledge, personality and cognition. There is little correlation between levels of creativity and the intelligence quotient (IQ) of architects [21]. It has been shown that above an IQ of about 120, creativity cannot be predicted as much as when the IQ is below 120. For architects, this IQ threshold is 120 [21]. The IQ threshold theory led to the understanding that intelligence is a necessary but insufficient 'condition' for creativity [22].

In terms of skills, domain-specific knowledge and special skills are pre-requisites for creativity [23]. Other requisite skills include *divergent* and *convergent thinking styles* [8]. Contemporary architects also use *metaphors*, *analogies* and *questions* when they employ the concept-based framework to structure their response to the design brief [8].

Phenomenological experiences also derive from the concept-based framework [8]. While ideas are flowing and the creative person is producing and developing many ideas, they are said to be in a state of *flow* [24]. When the idea penetrates into consciousness and *illumination* occurs, surprise, delight and certainty are experienced [13]. However, the creative person may also have to deal with self-doubt and idea doubt [25].

3 Leadership Process and Creativity

3.1 Leadership theories, styles and context

Contemporary leadership theories have experienced a post-industrial paradigm shift [26]. Leadership is no longer seen as a *position* held by a leader, but as a *process,* involving the leader and followers in an organisational context. It is thus a relational, contextual and ethical process [27] [28], and it is now viewed primarily as a social process [28].

Leadership *style* fundamentally affects a leader's role, because it influences the organisational climate, which in turn affects the organisation's performance [29]. By identifying their most effective styles, it is possible to help leaders harness their underlying emotional intelligence (EQ) competencies, in order to achieve their goals and to reflect on the process they follow [29]. The six basic leadership styles, (based on EQ competencies) are the *coercive*, *authoritative*, *affiliative*, *democratic*, *pacesetting* and *coaching* styles [29]. Leaders need to master as many styles as possible so that they can choose the most appropriate one for the different circumstances they face [29], especially in the context of *sustainable city transitions*.

The six key drivers that influence an organisation's working environment or climate [29] are flexibility, responsibility, standards, rewards, clarity and commitment. These are affected by leadership style, which in turn affects employee performance. The driver correlating most closely to creativity is that of flexibility, and flexibility (and organizational climate) primarily are affected most positively by the authoritative leadership style [29].

3.2 Leadership traits/ skills/ phenomenology

Leadership is complex by nature and requires creativity, intelligence, knowledge and wisdom for the successful implementation of creative solutions [30]. Creativity is actually vital for leadership [31] and could be considered as a core leadership competence, because both leadership and creativity deal with change towards a future outcome and associated uncertainty [32]. Intelligence, in the form of *academic or analytic intelligence,* serves creativity through the *evaluation* of ideas, whereas *practical intelligence* aids creativity through the implementation of ideas and persuading others of their validity. A feature of practical intelligence is *emotional* intelligence, which is argued to be a positive forecaster of leadership [30]. *Divergent thinking* [33] is also positively correlated with leadership success [30].

Knowledge, as a key component of intelligence, is important in Creative Problem Solving (CPS), which is one of the tools leaders constantly use [31]. In addition, wisdom uses *analytic and practical intelligence* (together these are known as successful intelligence). All of the above help to weigh the interests of all parties and ensure that the actions of the leaders pursue a common good [30].

3.3 Creativity as part of the leadership process

Change is at the core of leadership [32], which means that the leader's function is to identify goals, create feasible goal-paths and guide people, all the while addressing the

unpredictable and changing socio-technical environments [31]. This correlates with Sternberg's [30] argument for a *systems view* which sees leadership as a set of decision processes in which ideas are generated, followed by *analysis* and, ultimately the implementation of the ideas.

Leaders and creative people use shared sets of skills and attributes. Leaders use effective (operational) and affective (emotional) skills, as well as *divergent* and *convergent* thinking during the CPS process [32]. However, when creativity is actualised, it appears that creative people favour an independent artistic bent, whereas leaders have a functional and social orientation.

4 Leadership in Sustainable City Transitions

Cities have been in continuously transitioning states since their emergence in human civilisation. In order to ensure their resilience, they have had to adapt and transform to new and ever-changing circumstances [5]. There have been leaders who have served central, but varied and contrasting roles in shaping cities, for example, Robert Moses and Jane Jacobs in New York, and Richard Daly in Chicago [34].

Cities that have made the transition towards sustainable development include Singapore, Curitiba and Chattanooga [6]. Their common success factor is that they had at least one public and/or private entrepreneur who championed the changes required for sustainable-city transitioning. The robust, creative and reliable political leadership of the respective leaders brought about many benefits to their cities. [6]

Leaders need to guide people towards their sustainable city vision, in order to provoke a change of mind-set, and decision making in favour of more responsive lifestyles and behaviours. They will need to target the values on which choices and decisions are made and also convince people that these values need to be reassessed, if the transitions are to be pursued and attained [4].

4.1 Curitiba as an example of a sustainable city

Lerner and his team implemented many initiatives which changed the course of Curitiba to become a sustainable city. They analysed the problems facing Curitiba and reconceptualised a more desirable future for the city. This transition, however, would not have been possible without Lerner's dedication to bringing about the needed change [5]. Leaders thus have a key role in understanding the issues that cities face, creating appropriate structures to deal with these issues, as well as initiating changes and incubating the sustainable city vision.

The core issues being investigated in the study are: how do the similarities between creativity and leadership guide the enhancement of leadership skills? Could the manner in which architects are inducted guide a more systematic induction of leadership competencies, compared to the prevailing "trial and error" approach – and could this aid leaders in making transitions to a *sustainable city*?

5 Findings

Space does not permit a fuller treatment of the literature and detailed responses from the interviewees in this study. However, the findings [5] are instructive. Overall, the research

found that there are many similarities *and* differences between the processes followed by architects and leaders in their working methodologies. These are discussed below under various themes.

In terms of *process***,** the architects investigated follow a defined, systematic and largely *conscious* process when creating designs for architectural projects. In contrast, the leaders investigated follow a step-by-step, intuitive and mostly *unconscious* process. Architects' systematic approach is indicative of the four stages of creativity, although perhaps they are not aware of the unconscious nature of these stages. Leaders, on the other hand, embark on this process rather intuitively with very little, if any, awareness at all.

The commonalities for architects and leaders are that both processes are complex, as many factors need to be taken into account, and so a *holistic* approach is required. Both require the *conceptualisation* of a vision of a desirable future from undesirable present circumstances. They then develop ways in which to attain the desired future, by intuitively using the *backcasting* method.

The phenomenological experiences of leaders and architects in terms of their respective roles and processes, can be viewed as the "hero's journey" [35], with its many trials and challenges. It is an emotional journey, with both groups experiencing positive and negative emotions during the course of action they take. The experiences of the leaders in the sustainable city sector indicate that their processes were not as fraught with difficult experiences as were those experienced by architects and leaders in the business world. The sustainable city leaders recalled more positive experiences and equated the use of creativity with fun. This could indicate that combining the methods used by architects and leaders can lead to more fruitful, creative and enjoyable experiences and solutions.

In the context of architecture, a key difference between architects and leaders is that leaders typically *originate* a vision, whereas the architect *interprets* a vision for the building. The leaders involved in the *sustainable city transitions*, were very focussed on making changes that would result in liveable buildings and sustainable cities for the future, because their focus was on the citizens of the future.

There are many traits that architects, (as creatives), and leaders have in common, including intelligence and domain-specific knowledge in their respective arenas. Wisdom and emotional intelligence (with a particular emphasis on *social skills*), have been identified as key traits for leadership, but not necessarily for architects or creative individuals. Inasmuch as creative traits can enhance leadership, *social skills* can improve the *verification* process of architectural designs. *Sustainable city transition* leaders show a combination of leadership and creative traits. Creativity, IQ, domain-specific knowledge, wisdom and *social skills* are evident in the *conceptualisation* and *realisation* of their visions. Their engagement with all these traits led to the successful outcomes of their visions. This indicates that all these factors are important for leadership, especially for those in the *sustainable city transition* sector.

Architects use *divergent thinking*, *metaphors*, similes, *analogies* and symbolism during the creative process, in order to make associations that are novel and different. Leaders, on the other hand, seem to use these skills or tools to a much lesser extent, if at all. Both groups use *convergent thinking* to reduce the number of options available to them, although architects tend to generate many more options than leaders. A crucial skill for architects and

leaders is *collaboration,* which requires *social skills* for its success. However, these skills appear to be more highly valued by the leaders than by the architects. The *verification* phase is primarily a *collaborative* experience for leaders and architects, whereas they view the *conceptualisation* phase (which generates a vision), as primarily an *individual* and personal exercise and experience.

Architects' primary tool for manifesting ideas into reality is drawing, which they use to "think" through their ideas. Leaders mainly use words to convey their visions to others and to persuade others of their viability. Architects also need to persuade clients, consultants and contractors of their ideas in order to ensure that the reality matches the vision. The architect in the *sustainable city transition* role used similar methodologies and worked from a creative standpoint and first principles, rather than using previously used solutions that were not appropriate. This is a clear indication that using creative thinking tools such as *divergent thinking* can solve unprecedented problems that are more effective than previously used solutions. *Collaboration* with all stakeholders is imperative in this sector which ensures buy-in and the success of the implemented solutions.

The leaders interviewed displayed several leadership styles in their interactions with others which led to successful outcomes. Architects could benefit from knowledge of leadership styles and by developing the associated EQ skills to enhance their *conceptualisation* and *verification* roles in the creative architectural process. These skills would lead to better *collaboration* and, therefore, better implementation of the projects. Leaders in the sustainable city arena need to employ various styles, due to the complex nature of the context within which they work. Although strong leadership type personalities may appear dictatorial, this at least indicates a strong commitment to the vision and its successful implementation. Leaders in these roles need to be cognisant of their approach so as not to alienate collaborators or team members.

Both architects and leaders work within the context of the city. Architecture may have a more direct relationship with the city than the leader's organisation, but the organisation networks across the cityscape, so as to attain the services it requires. A thorough understanding of the context is essential for architects, business and *sustainable city transition* leaders, without which appropriate and relevant solutions cannot manifest.

Initially it appeared as though the processes followed by architects and leaders have very little in common, but as the study concludes, it is evident that the two processes have much in common, as shown in Figure 3 below.

6 Conclusions and Recommendations

In essence, leadership is about transformation or bringing about change. The research indicates that if leadership is viewed as a process which effects change, it can be viewed as a creative process and can therefore be developed into a systematic process that all leaders can follow. The originality of the solutions results from the creative traits and capabilities within the leaders and their organisations. The process is the vehicle which ensures that the actions taken within the process bring about change. This is how the architect's process results in the *realisation* of ideas and, therefore, this can apply to leadership as well.

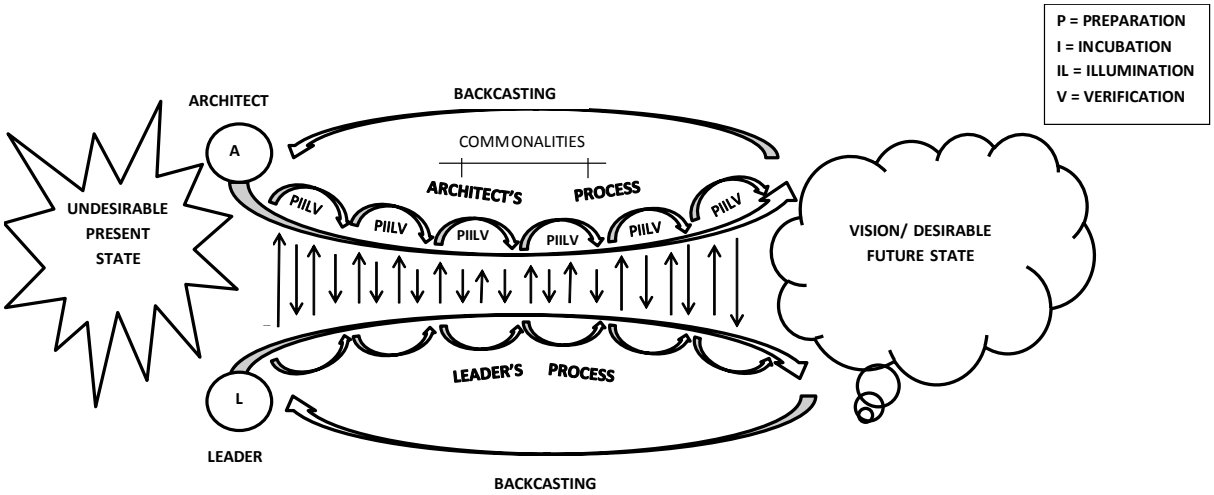

Figure 3. Potential for the architectural and leadership processes to contribute to competencies for *sustainable city transitions* [5]

The architect's role is not just about creativity, but requires leadership skills in order to attain the built form of the architect's vision. This leadership role needs to be developed and embraced further by architects and to be accepted as a fundamental part of the creative process in architecture. Due to the many shared traits and capabilities, it can be expected that leadership styles and EQ capabilities (amongst others), can lead to improvements in architects' leadership roles.

The comparison of leadership and architect processes, activities and capabilities indicates many similarities. Indeed, leaders and architects may well be able to positively influence one another. As a result, it can be concluded that the working methods of architects can be applied to leadership-development for *sustainable city transitions*.

It is also essential for leaders to have wisdom and to be altruistic in nature, otherwise their roles can become self-serving. This altruistic aspect is very evident in terms of the sustainable city sector leaders investigated.

In conclusion, architects may significantly influence leaders in terms of using all the creative stages and following a systematic process, rather than having the latter rely mainly on their character traits, which emphasise the person, and not the process. This would assist leaders (especially those in the sustainable city transitions arena), to develop innovative solutions when faced with new challenges. It is also recommended that programmes, as identified in the study [5], are developed, in order to enhance the traits, skills and techniques of leaders, so as to improve their creativity.

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CONTRADICTIONS IN ARCHITECTURE DESIGN STUDIOS: REFLECTIONS ON THE CONCEPTS OF DESIGN EMBEDDED IN ARCHITECTURAL EDUCATION

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Abstract

In Architecture Schools, Design Studio modules are conceived as the core learning activity, in which students must generate and develop a design proposal. In this context, there is an implicit notion that lecturers and students share a common idea of what the Design Activity is. However, this may not be true as divergent, and sometimes, contradictory ideas of design seem to coexist within the framework of architectural courses. Moreover, such contradictions can lead to lack of coherence among learning activities modules, limiting modules integration and, consequently, hampering the development of key competences, as collaborative skills, by the students. Thus, this paper aims to discuss how different ideas of design coexist in an Architecture School, and how to resolve such contradictions promoting better integration among distinct modules. The findings are based on a literature review on the topics of Design theory, Architecture Education and Collaborative design, as well as on the researchers' own experience in teaching. Examples of the adoption of Problem-based learning (PBL) in the Architectural Educational context have been explored to overcome gaps over the idea of design in the curriculum. In conclusion, it is suggested that Architecture Schools need to be able to engage in activities of collective reflection on the operational level. First, existing silos need to be questioned in relation to the overall structure of the course. Such reflection should reveal contradictions in the ideas of design among the modules' leaders. Consequently, wrong assumptions embedded on the existing structures need to be broken down, and new structures and supportive initiatives should emerge with a sense of collaborative practices focused on the co-construction of knowledge.

Keywords

Architecture Education, Design Theory, Contradictions, Design Studios, Collaboration

1 Introduction

In general, there is an assumption in Architecture Education that design is commonly understood in the same way by individual members in Architecture Schools, including students and academics. However, such assumption could be arguably wrong. For example,

taking into consideration previous research on design theories [1][2], it has been suggested that diverse paradigms of design coexist in the context of design research and practices [3][4], which emerge as different interpretations of what constitutes design activities. Consequently, such diversity of design conceptualisations will influence the emergence of different approaches in the way lecturers structure design modules. In general, the over specialisation and the development of independent domains of design theory within Schools of Architecture have led to different understandings of the design activity [5].

The flexibility of design as a discipline allows for different philosophical interpretations about its practice, and this can lead to different understandings about its nature [6]. Moreover, such diverse interpretations can generate a lack of coherence and ontological contradictions on teaching and learning procedures, affecting the students' experience.

Therefore, this paper addresses two research questions: what is the impact of the coexistence of diverse concepts of design (underlying theories of design) within the context of Architecture Education? And what needs to change to resolve these contradictions? These questions triggered an inquiry into the current state of Design Theory in the literature, in terms of suggested approaches to define design activity and how they reflect specific strategies in architecture design education. The purpose is to highlight limitations and possible incompatibilities between conceptualisation and design teaching practices. The discussion and findings are based on a literature review in the field of *Architectural Design Education and Design theory*. This work has been developed as part of an ongoing PhD on Collaborative Design.

2 Contradictions in Architectural Design Studios

In Western Society, Architectural Education has been dominated by '*studio teaching'* [7]. The design studio practice became common in architectural education after the Bauhaus experiments of 1930s in Germany and their further influence on architectural institutions across the world [8].

The common understanding is that in a design studio situation, "*students are given a design problem that allows them to direct their own learning through the search of potential solutions. During this process, teachers or experienced practitioners guide the students by questioning their design proposals during face-to-face tutorials and reviews…"* [9]. According to [10], the essential characteristics of Design Studios in Architectural Education are: (1) Student work is organised primarily into semester-length projects, responding to a complex and open-ended assignment; (2) Students' design solutions undergo multiple and rapid iterations; (3) Critique is frequent, and occurs in both formal and informal ways, from faculty, peers, and visiting experts; (4) Heterogeneous issues – ranging from structural integrity to the social impact of the design – are considered, often in the same conversation; (5) Students study precedents (past designs) and are encouraged to think about the big picture (6) Faculty help students to impose appropriate constraints on their design process in order to navigate a complex and open-ended problem and find a satisfactory design solution. In this case, judicious and timely intervention can help a student focus or, when too focused, open up their thinking to explore new possibilities; and (7) The appropriate use of a variety of design media over the course of the project significantly supports and improves students' insight and designs.

However, even with the central role of design studios, there is still an inherent fragmentation of the curriculum of architectural education, involving the other modules around the design studio [7]. [7] suggest that, usually there is an overall lack of integration in teaching, involving individual subjects with little connection among them.

In order to overcome such fragmentation of the traditional curriculum, [2] argued for further exploration on the integrative value of design studio approaches to reconceive architectural education. Following this, researchers have explored the potential adaptation of Problem-Based Learning (PBL) as a pedagogical framework in architecture schools.

PBL was firstly developed at McMaster University in Canada in the 1960s, as a full-scale didactic approach to revise the traditional medical education curriculum [7]. At the time, medical education had been criticised for its over specialization, leading to a curriculum filled with details and fragmented knowledge, which was seen as disconnected with actual medical practice [7]. Thus, in that context, PBL was proposed as a holistic approach, focused on themes representing problems from medical practice, becoming the salient educational agenda, in which students are expected to define their own learning goals and pursue actively the accumulation of knowledge and skills [7].

In Architecture, it has been argued that PBL, as an established educational theory, embodies the best features of traditional pedagogical approaches in design, but most importantly, it allows them to be applied within a single theoretical framework, integrating the whole curriculum [7][11]. In principle, PBL is similar to project work, case studies and studio teaching approaches [11], what changes is the dissolution of the traditional lecturing structure within boundaries between disciplines and subjects, which become incoherent with the student-driven learning process [7]. Collective learning is stimulated and enhanced through small group works around emergent ‘study areas’, in which students define their own objectives and experience a range of interpersonal dynamics [7].

The majority of work exploring the implementation of PBL in architecture education has been limited to present the adoption of new curriculum structure based on an adaptation of the PBL pedagogical approach [12]. Such reports describe how radical changes were implemented in the organisational structure of schools to change the curriculum [12]. However, besides its similarities and potential to enhance architectural education improving integration around design studios, researchers have reported limitations related to emergent contradictions in the adoption of PBL in architectural education.

One of the main limitations is a lack of understanding by faculty members related to the philosophy of PBL [7]. In this case, fundamental changes in curriculum, led faculty members who previously enjoyed considerable status and independence, within the disciplinary context, to be engaged in broader and unfamiliar fields of teaching [7]. Moreover, in PBL, faculty members become facilitators rather than a lecturer, which requires them to engage in reactive activities instead of pre-emptive ones [11].

The problem is that, traditionally, the architectural curriculum has been regarded as implicit by faculty members. Thus, pedagogic strategies (i.e. learning objective, processes and assessment techniques) are regularly not discussed with students [11]. This aligns with previous criticism over design studio practices considering that experienced designers are not always the best educators, because most of the time the pedagogical approach of these tutors is based on an implicit understanding of how they themselves design (Dooren, Boshuizen & Merrienboer, 2013) apud [9].

We draw attention to a key aspect of pedagogic strategies i.e. the concept of the design activity, which is usually considered as problem-solving activity. For example, it is common to consider *design problems*, as the set of a written project brief that should drive the student activity to integrate the various study areas and the content of the curriculum [12]. In this approach, students should engage in solving ill-structured problems "*before they receive all the relevant information necessary to solve it*" [11]. The inherent contradiction of such concept of design, is that "*the problem exceeds the student's current knowledge foundation"* [11].

In this case, the relevance of the word *problem* is key, because in fact what is presented to the students is a "situation", requiring their active engagement to construct "a problem". Tutors, who adopt this approach may not be concerned with how different students may interpret differently the "information gathered". As consequence, students will face confusion around different interpretations of educational strategies manifested through project activities and assessment methods, that were set based on different expectations of faculty members.

Another key aspect of *project-based learning*, which has been incompatible with the concept of design as problem-solving, is the collaborative nature of learning in the structure of design studios [11], involving students and tutors. [13] report on the interactions between student and tutor, demonstrating how design involves co-construction of their idea (concept) of design:

"She (the student) *wants him to appreciate her design; he doesn't think she is designing at all. The two of them miscommunicate both about the nature of designing and about the nature of their own interaction. Here, the predicament of learning to design has become a learning bind." "In order to dissolve such a bind, Northover* (The tutor) *would have to get interested in what she meant by what she said and did, and she would need to explore a new set of meanings for his words. But in the behavioural world they have constructed for one another, such mutual exploration is highly unlikely." … unless Northover* (the tutor) *begins to behave in such a way as to help convert this situation (win/lose game) into a process of reciprocal translation. But such a change… would signal that he had begun to reflect-in-action on his own practice as a studio master. Indeed, I believe that good design teachers do sometimes become reflective practitioners of studio education, learning how to negotiate a "ladder of reflection" that can include as one of its objects even the behavioural worlds of student/teacher interaction."* [13, p. 19].

Therefore, it can be argued that divergence and lack of inconsistency about the nature of design may hamper design studio activities, even within an integrated curriculum, as it is the case in PBL. In order to resolve this, is necessary to revisit, explore and expose the origins of such contradictions around concepts of design and their impact on design situations in educational settings.

3 Design Theories: Deterministic vs. Dialectical approach

3.1 The Determinist approach to Design

The majority of Design Theory is based on the fundamental assumption that the nature of Design is a rational activity of *problem solving*. One of the foundations of this perspective is proposed in the work of Herbert Simon, "*The Science of the Artificial*" (1969) [1]. According to [1], the essence of design activity is to devise courses of action aiming to change existing

situations into preferred ones. Following this rational, designing is something that everyone does [14], and does not always has to be linked to abilities, as the wish to design is therefore inherent in human beings [15]. In that sense, [1] suggest that design, as an intellectual activity, is present in many human activities ranging from prescribing remedies for a sick patient, to the definition of a social policy. For [1], while Natural Sciences are concerned with how things are, design concentrates on how things should be by the means of devising artefacts (objects) to attain goals.

Such perspective is drawn from the idea that design starts with a problem [1][15][16]. For example, [15] suggest that designers are usually faced with very poorly defined problems. Hence, designers deal with two difficulties, one to understand the problem and the other to find a solution [15]. The main assumption of such conceptualization is that design situations can be determined in terms of problems and solutions.

[17] suggested that the word *problem* fitted the purpose of objectivity embedded on a positivist way of defining Design. This because, during the first half of the last century, Thorndike's (1931) apud [17] definition of *problems*, as something that emerges when an organism wants something but the actions necessary to obtain it are not immediately obvious, have influenced Design theorists [17]. [18] suggests that there are two types of problem. The *well-defined problems*, in which ends, or goals can be directly prescribed, so to obtain the solution it only requires the provision of appropriate means. The other type of problems, which best represent design situations, were described as *Ill-defined problems,* in which both ends and means of a solution cannot be known at the start of the activity. Consequently, design involves defining a problem [18].

[17] also suggested that 'Design as a Problem-Solving activity', which was influenced by a Behaviourist Positivism, led to the development of models of design, based on the determination of specific states, or *phases*. Embedded on these models is the assumption that it is possible to describe Design by breaking down the activity in phases [17], e.g. *defining the problem*. Here, design problems are usually defined by someone else, like the client for example [15]. Consequently, a sense of rational determinism emerged, in which the whole design activity could be clearly and explicitly described in a process model, as the ideal artefact, indicating the parameters and the relevant data to be gathered [17]. This ontological position emerged as the *Information Processing Theory of Problem Solving* [18], which later influenced the work of Simon describing Design as particular kind of science [1]. Such theories suggested that an adequate explanation of observed human behaviour can be afforded by a "program", or in other words, a process model of primitive information processes that accounts for the cognition associated with an action [17]. Thus, design can be interpreted as a sequence of distinct and identifiable activities which occur in some predictable and identifiably logical order [19]. Prescriptive models have been used to persuade or encourage designers to adopt systematic procedures as a particular design methodology [15]. In fact, many scientists and practitioners continue to find the idea of a linear model attractive, as it represents the only way for a logical understanding of designing, allowing its replicability [6].

Mostly, these models have been suggesting a basic structure to the design process as *analysis – synthesis – evaluation*, in which *analysis* refers to performance specifications logically derived from the design problem, *synthesis* as the generation of design solutions, and *evaluation* as a rational decision-making on the choice of the best alternative solution [15].

3.2 Critique to Determinist Approach and its implications on Architecture Education

The idea that design activities occur in order, or even the suggestion that they could be identified as separate events can be questioned [20][19]. In contrast with the *determinist view* of Design, emerged an argument for a subjective and interpretivist view, in which design is seen as a dialectical activity. In fact, [21] and [22] explored the nature of Design Problems as it is proposed by Simon [1]. In *Dilemmas in a General Theory of Planning*, Rittel and Webber (1973) [22], questioned the nature of social interactions in design and planning activities, and the prevalent idea of problem solving. They suggested that design problems are so ill-defined that they should be called *Wicked Problems*, because they are problems without the possibility of becoming fully defined. Their work can be interpreted as an original criticism towards the positivist and reductionist approach, referred as Descartes "heritage", and the use analytical thinking.

In essence, the fundamental nature of design problems regards the relationship between *determinancy* and *indeterminancy* [6]. According to [6], while linear models of designing suggests definite conditions of determinate problems, the idea of wicked-problems is constructed in a fundamental *indeterminancy* related to design situations, in reference to the social reality of designing.

[1] and other followers of the *determinist* perspective, suggest that designers should rely on procedures and decision-making protocols that respect such principle of *determinancy*, trying to establish and follow common rationales that surround the objects of design (i.e. problem and solution) [6], However, following the indeterminacy principle, [4] argue that the methodological description of design activities as "design problem" is very problematic or even meaningless to say if we cannot define it or crystalize it in empirical descriptions.

In their paper, "*Cooperation and Individualism in Design*", Coyne and Snodgrass (1993) [24] develop a comprehensive critic on the historical Cartesian tradition, manifested through the *deterministic perspective* on design, and presented an argument for an alternative Hermeneutic account of Design. The authors argue that the *deterministic perspective* assert the primacy of the individual subject as the way we understand the world, which consequently, produce strong bias towards individualism. Another consequence of such *determinist* approach is the fact that design is perceived as an activity separated from making, which also had the effect not only of isolating designers, but it made them the centre of attention [19]. These are ideas that have strongly influenced Design Theory around teaching and practice in Western Society and established an overall prejudice against group activities [24]. Consequently, Design activity is widely recognised as the creative activity of individuals holding a special kind of thinking, and the lack of success is easily attributed to personality clashes [24].

3.3 The Dialectical Perspective

Alternatively, design can be seen as exploratory activity, that is *emergent*, in a way that the relevant features to evaluate the solution emerge embedded in alternative solution concepts [14]. Consequently, it can be suggested that during design the problem and solution emerge together [19]. Moreover, Design is also *opportunistic*, because all that is considered relevant information cannot be predicted and established in advance of designing [14].

Furthermore, the subjective and perceptual aspects of the activity suggest that Design can be considered *rhetorical*, in a way that designers will interpret the brief not as a specification for a solution, but as a partial map of an unknown territory, which leads to the development of a design proposal, as the construction of a particular type of argument [14]. Such argument emerges as a *reflective* dialogue between internal and external representations [14] that designers conceive. Consequently, designers usually find themselves in a field of positions with competing arguments, in which various issues are interconnected in intricate ways [20]. In this case, designers debate about issues with themselves and/or with others, then competing positions emerge, in which pros and cons are established, till ultimately, they make the decision to favour one position [20]. This means that interpretations and reflections in a design situation are *ambiguous*, and arguments are at the same time the means of exploration and discovery as well as the subject to criticism [14].

In this sense, the designers' understanding of the situation changes with their conception of alternative plans to change the situation [20]. It can be said that this reveals an *epistemic freedom* of designing, in which there is no logical or epistemological constraint prescribing the necessary steps to accomplish its purpose [20]. Moreover, the course of designing will be highly influenced by the designers' world view. What designers know, believe, fears, desires will affect his reasoning all the time. Consequently, unless they are persuaded or convinced by someone else of his own perception, they will commit themselves to positions that match their beliefs, convictions, preferences and values [20]. This idea can be further correlated with the concept of *interpretative frames* [2], *world objects* [25]; *common assumptions* [26], and *common ground* [27].

Design takes place in a social context, in which plan-making aims at the distribution of advantages and disadvantages among a certain group of individuals with often contradictory interest and ideas [20]. So, in order to establish this course of actions, designers will use models engaging in a process of argumentation unlike the traditional view of problem solving based on pure analytical thinking [28]. In these activities, different points of view are brought together, and the individuals will usually experience *breakdowns*, in terms of pieces of lacking knowledge or misunderstandings about the consequences of their assumptions [28]. More importantly, participants of collaborative activities should be able to reflect about these breakdowns [28]

In order to engage in such 'plan-making' designers will use models (artefacts) as means of derivative perception and manipulation [20]. The Dialectical perspective of Design suggest that such models assist the construction of the dialogue between reflective criticism, '*seeing that*', and the analogical reasoning and interpretation of these models, '*seeing as*' [29]. In that sense, the modelling activity (producing and engaging with artefacts of design) help designers to perceive unintended consequences of design explorations on how to change the situation [2]. He [2], called this the *reflective conversation with the situation.* Consequently, such perceptions are dynamic, in a way that the understanding of what should be accomplished, and how it could be accomplished is continuously shifting [20]. In this case, speech can be considered as one of the most flexible media to support imagination and argumentation [20], of such dynamic interaction towards the construction of collective perceptions in design.

[6] suggest that seeing design as argumentation and deliberation depends in overcoming the limitations of mere verbal and symbolic arguments, in terms of traditional ideas of a distinction between theory and practice. The Dialectical perspective contributes in raising a new awareness of how argument is the central theme in Design that cuts across the many

technical methodologies employed across different design fields [6]. Furthermore, positioning design as a situated action evolving through discourse like actions (i.e. conversations – dialectic), [4] offers an alternative way to describe design as the resolution of paradoxes between discourses in a design situation. Therefore, if design situations belong to the domain of social actions and interactions that should be investigated in terms of hermeneutic structures rather than determined logical processes (steps) [30], eventual misconceptions on the nature of knowledge and understanding in social interactions should be resolved, in order to fully operate within social systems.

In that sense, as [2] proposes a concept of Collaborative Design, as a fundamental critic to the notion of '*bounded rationality*' proposed by [1], that was embedded, in the *Information Processing Theory of Problem Solving* proposed by [18][1], as the prevalent model of professional training in architecture. [2] suggest that in the context of *collaboration*, designers will interact with different perspectives and systems of inquiry, realised in terms of different ways of framing problems, thus producing diverse design judgments. According to him, reflection and awareness of those conflicts of appreciation, may lead designers to understand the intractability of their *dilemmas* and to suggest an alternative design decision. Moreover, the resolution or dissolution of conflicting views emerging in these purposeful interactions should be treated as negotiation of organisational dilemmas [2].

In this sense, [23][31][26][4] suggest that [2] model of self-reflexive awareness on design situation could offers an appropriate concept of design, as an epistemology of practice, fitting the *dialectic* nature of design situations, replacing the logic-based models that have driven traditional design research, and traditional design educational models. However, this requires challenging the still dominant *deterministic* concept of design [24] which influence the majority of faculty members in architectural education. Moreover, the dialectical approach would allow overcome these conceptual barriers [24] by means of reflective conversations about the nature of design activity.

4 Conclusion

Traditionally, Architectural Education has relied on the Design Studio model as a central strategy integrating the whole curriculum around practical design activity. However, the efficacy of Design Studio practice has faced issues, due to the historical evolution of educational programmes for professional training based on the concept of design, as *problem-solving*. Following this approach, faculty members implicitly believe in the possibility of decomposing the activity in distinct stages of operation, and in the inherent replicability of procedures for similar "design problems". Such traditional conceptualization of design has created a strong bias towards individualism. Hampering the integration of activities and knowledge across modules.

In this context, referring to previous adoption of PBL in Architectural Education as way to overcome this fragmentation of curriculum through project-based activities around Design Studios, we suggest that the existence of different concepts of design have been hampering integration. While the restructuring of the curriculum potentially creates integrative environments around emergent themes, the engagement and philosophical change required by faculty members have found resistance in their traditional concept of design, and its manifestation in module structures and their approaches and expectations towards students' work.

Moreover, we propose that project-based activities, for example Design Studios, as self-organised situated learning practices, should inherently develop conversations around individual and collective concepts of design (i.e. collaborative design). In this case, the concept of design, as reflective conversation with the situation, proposed by Schön, provide an alternative theoretical framework based on the dialectical nature of these interactions.

Further research should explore tools and mechanisms to expose such contradictions within the Architectural curriculum, as way to support faculty members and students' reflections about their underlying concepts of design.

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INTRODUCING THE PRACTICE-BASED RESEARCH MODEL IN THE FORMAL EDUCATIONAL CURRICULUM

CASE STUDY: THE TRANSFORMATION OF THE INTERIOR DESIGN COURSE SYLLABUS AT FACULTY OF ARCHITECTURE, UNIVERSITY OF SARAJEVO

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Abstract

This paper intends to present the outcomes attained throughout the ongoing transformation of the syllabus of the "Interior design 3" course, leading towards a higher level of interaction between the formal education and practice. The collaboration between the Faculty of Architecture University of Sarajevo and several local furniture production companies in Bosnia and Herzegovina has instigated new educational models and methodologies, focusing on the practice-based learning and research in furniture design. The renewed curriculum highlighted the continuity of the process "from sketch to realization" and enabled the students to actively participate in the process of production of furniture prototypes they designed. The idea of upgrading a purely conventional theoretical approach in education with insights in the practice has been achieved by establishing a direct communication of the students and academic staff with the industrial sector, through learning about technical aspects, production possibilities and technological barriers. This paper will include a case study - Faculty of architecture's library remodelling project, which incorporated furniture designed by the three generations of students, hence showing the possibilities of including the proto-practice model in education. The transformation of the "Interior Design 3" course syllabus at Faculty of Architecture University of Sarajevo represents a step forward in bridging the gap between education and professional practice, thus contributing to a better synchronization of the academic models and methodologies with the requirements of the workplace market.

Keywords

Design Education; Furniture design; Theory-practice; Practice-Based Research

1 Introduction

One of the topmost obstacles of socioeconomic progress in the post-transitional and post-conflict context of Bosnia and Herzegovina lies in the discrepancy between the dynamics of the academic environment and the work place industry. The lack of synchronisation between the inert educational systems and the accelerated dynamics of the industrial production is particularly evident in the domains of architecture and design in relation to the prevailing trends in construction and production industries. The impacts of the identified problem are exigent for all the stakeholders: newly graduated architects and designers find it hard to adjust to the real-life professional environment, whereas the employers are often forced to perform additional training and specializations for the young professionals. Starting with the analysis of the historical background, this paper addresses the *status quo* in architectural education in Bosnia and Herzegovina, focusing on the impact of the new educational models and methodologies in selected courses at the Faculty of Architecture University of Sarajevo.

2 Historical background

The Faculty of Architecture University of Sarajevo was founded in 1949 by architects who were educated in technical universities of Vienna, Budapest and Prague, as well as in the neighbouring regional centres of Zagreb and Belgrade, who performed their professional practice in the period between the two world wars. In the first decades since it was launched, the initial academic program developed gradually and organically based on Austrian and Czech models and was not subjected to any extensive alterations.

In fact, the university life in the initial post-war period was characterized by the centralized administrative organization and restricted academic freedoms, within the framework of Socialism. Academic institutions were significantly affected by the general policies of economic rationalization, which affected the persistent lack of academic and professional staff, followed by unsatisfactory working conditions, insufficient information flow and non-existing networking in architectural education and the profession in Bosnia and Herzegovina at the time.
The following decades led to a moderation of the tensions of the social system and the fundamental academic barriers were surmounted by, among other activities, the repeated curricular reforms. Striving towards a more specialized professional education, one of the major reforms was conducted in academic year of 1977/1978, was marked by introduction of three engineering/design branches - architectural design, urban design and engineering. Further occasional reforms of the curriculum at the Faculty of Architecture in Sarajevo were caused by the competitive aspirations between various academic streams advocating either general or specialized education, on one hand, or, artistic, scientific or engineering character of the studies, on the other hand.

2.1 Recent curricular reforms

Curricular modifications were reflected in frequent changes of the duration of the studies and in modifications of the academic profile of graduate students, reaching its peak at the beginning of the third millennium by the inauguration of Bologna educational process. However, the new educational postulates instigated by the Bologna system, which were introduced at the Faculty of Architecture in 2003, did not tackle the matter of integration of theoretic and practical modes of teaching. The main shortcomings of the present-day educational processes in Bosnia and Herzegovina originate from the preserved the conservative-outdate models of teaching, which are still considered to be the "perpetual truths", with rigid and inflexible structure and content. The courses which typically evolved from such a conventional framework, mainly replicate the monotonous theoretic content, overlooking the potential to stimulate the students. This inertness of the existing approach lacks the capacity to adequately respond to the accelerated digitalized processes in the contemporary society, merely assigning the students the role of passive observers.

2.2 Overview of the *status quo* and the path towards reforms

Besides some singular exceptions in the period after the 1992-1995 war in the form of sporadic insights from professional practice within the courses, the mainstream one-way "*ex cathedra*" way of teaching, or „*the story-telling teaching mode*" (1) has still prevails in the curriculum of the Faculty of Architecture of Sarajevo.

Accordingly, the practical assignments within the courses of the Department for architectural design are typically isolated, fragmented and unrelated with other subjects and courses. Assignments are typically based on abstract, invented design briefs, leaving the students without the possibility to face realistic challenges and develop actual design competencies, which go beyond the creative projects on their drawing boards. Moreover, the students almost exclusively focus on graphical presentation of their work, not having spent enough time in the actual design process, leaving them with a distorted and utopian image about the architectural professional milieu.

Current academic state at the Faculty of Architecture in Sarajevo is correlated with the academic staff structure, consisting of academicians/theoreticians and professionals who are balancing between academia and professional practice. For all the above stated reasons, it is clear that the future educational reforms should address the real-life challenges of the contemporary socio-cultural context.

The problem of academic isolation of courses at the level of higher education in Bosnia and Herzegovina has recently been tackled by the proposed introduction of a dual educational system, referring to a new legal obligation to incorporate "the practical training for the students" in the curriculum, as an equivalent of the 30 ECTS. (2)

Although it does not contain sufficient analytic parameters, precise explanations or guidelines, the new regulations represent an important stage in the development of networks between academia, professional ad industrial sectors. The advantages of the incorporation of a balanced relationship between theory and practice as an important segment of the implementation of the curricular reforms, should be manifested in a more

efficient knowledge transfer in economy and society, and facilitate the transition of new graduates from the academic to an actual professional milieu.

3 The bottom-up reforms: the transformation of the course "Interior Design 3"

3.1 Identification of the key challenges of the inherited system

Similar to the majority of subjects within the Department of architectural design, until recently, the original academic framework of the course "*Interior Design 3*" did not include modes of practical learning. The course itself focuses on public interior spaces and furniture design. Until 2009, the student assignments were typically based on abstract project briefs and were not associated to real contexts. The usual course organization consisted of student projects development throughout one or two semesters under the guidance of teaching staff, and accompanied by occasional in-class presentations and critiques. The only contact with the industrial sector in the original course program consisted a one-time visit to the local furniture factory, in which the students got acquainted with the general terms of the production technological processes.

Within such introverted milieu, the students' concepts, however, were unlikely to evolve beyond the "drawings on the paper". Instead of engaging in the process of critical thinking, research and creative work, the students became goal-oriented, pragmatically focusing solely on completing their course assignments. Working in "sterile" academic scenarios, based on virtual project briefs without taking into account the full complexity and reality of the context, such as economic, technical and organisational factors, clearly did not correspond with the anticipated learning outcomes.

On the other hand, the wood processing industry represents one of the most progressive export-oriented trades in Bosnia and Herzegovina, having evolved from the long tradition of craftsmanship and owing its advancing tendencies to the qualified personnel and natural resources. The named industrial sector has been generating a significant foreign trade surplus, and in 2013 "*the coverage of import by export amounted to 350.5%*" (3) with the tendencies of further annual increase. Although the statistical data indicate positive trends, including the fact that in the total export structure a significant share of 48.35 % accounts for the sector of furniture production, there is still a lack of local intellectual and creative involvement in terms of furniture design and authorship. The awareness on the importance of the design and the prototype development in the cases of practices of local producers is still quite marginal, and only quite a few companies decide to invest in the development of their own products and brands.[1] Consequently, the furniture production in Bosnia and Herzegovina is characterised by a significant discrepancy between the production and market prices: "*The processes of transition, however, did not encompass the aspect of design so as to trigger the furniture industry in Bosnia and Herzegovina, possessing a potential vital role in the national promotion of the country*". (4) The overall product value and competitiveness may be increased by the "*involvement of the domestic intellectual potential,*

[1] The described ignorance and lack of interest to improve the *status quo* can be explained by the fact that the prevailing practices are based on outsourcing contracts, in which the design schemes are normally delivered from the foreign partner companies.

thus creating an uninterrupted chain, starting with the quality raw materials and evolving into attractive pieces of furniture" (4), contributing to the increase of the export in the higher level of wood processing.

3.2 The launch of the collaboration between academic and industrial sector

In view of the identified challenges and the necessity to bridge the gap between the education and professional practice, over the last 8 years, several courses at the Department of Architectural design at the Faculty of Architecture University of Sarajevo have undergone transformations, in order to facilitate an easier transition of the students to the realities of the professional practice. Being aware of the insufficient correlation between a purely academic approach design education and industrial sector, the Department for Interior Design academic staff initiated a collaboration with the industrial sector in 2009, which ultimately resulted with a complete transformation of the syllabus of "*Interior design 3*" course, development of four series of prototypes of furniture designed by the students, thus achieving a higher level of interaction between the formal education and practice.

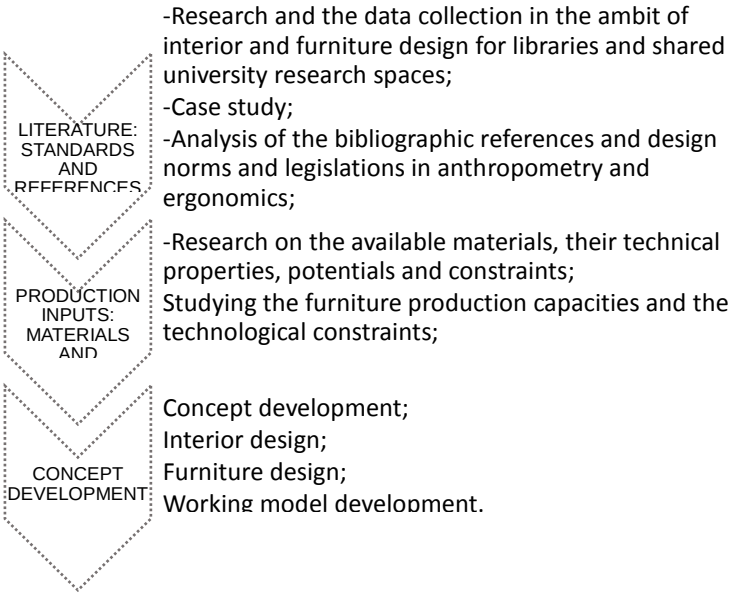

Figure 1.The design process according to the transformed syllabus of the course "Interior design 3"

3.3 Case study: the transformation of the "Interior design 3" course syllabus at Faculty Of Architecture, University Of Sarajevo

Introduction of proto practice in the educational process will be illustrated by the case study of the student project of remodelling and redesign of the library of the Faculty of Architecture University of Sarajevo, which was equipped with the furniture designed by the master students. The launch of a new methodological approach, however, did not originate from a consistent strategy from an institutional level; instead, it was spontaneously organized by the academic staff that led the courses in the domain of interior design, together with the representatives of the local furniture factories. The new and transformed "Interior Design 3" course syllabus was created in a flexible manner, contrasting to the formal and traditional patterns of its previous editions. As a result of the improvement of pedagogic approaches and the introduction of the collaboration with the industrial sector, the structure of the named one-semester course now comprises of the three segments: 30

% of theoretical lectures and presentations, 30% of practical classes in the factory and 40% of classes in the design studio.

The design brief was conceived in close collaboration with the professionals from the furniture factory "Inside by Eco" from Sarajevo, who contributed with important inputs for the assignment, from the scope of the design project to the typology of furniture as well and the selection of available materials and technological processes. The design process consisted of the three main sequences as illustrated in the chart Figure 1.

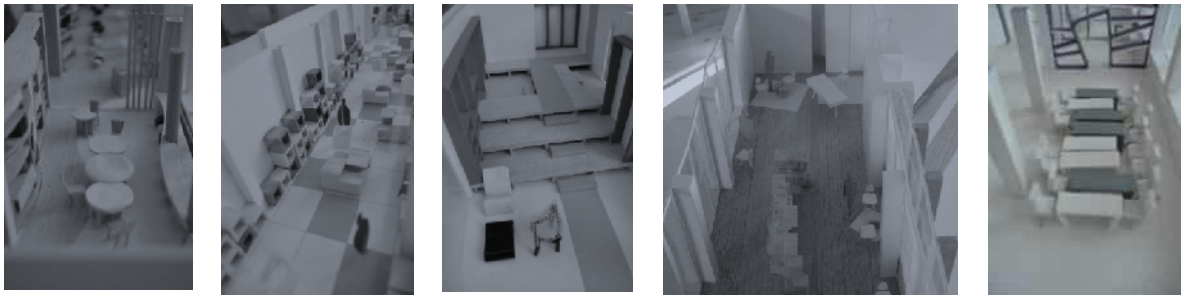

Figure 2. Design the new library interior – students' working models (2013/2014 study year)

Students proposed various concepts for the design the new library interior, all of which share one common objective – and that is, creating large open spaces in contrast to the fragmented layout of the original state. Archive and storage spaces were replaced by open and multifunctional spaces, intended for individual and teamwork, with open access to books and journals. Besides the stated common goals and design manifestos which were shared by the entire class of students, the design studio itself resulted with variety interior design projects, characterized by diverse functional layouts and formal configurations, from orthogonal and simple geometric forms to wavy lines and organic volumes. (Figure 2)

Figure 3. Practical classes in the factory: development of the detailed design

In addition to library interior design, the second part of the assignment focused on the design of furniture collection according to the predefined palette of available materials. The collection included four elements: office/library desk, coffee table and side board (for lounge spaces), and shelves/storage cabinets. The gradual methodological transition from the level of interior to the level of furniture design was guided by both academic staff and the professionals from the furniture factory, and the theoretical lectures were alternated with the factory visits as encounters of the students with the real workplace environment. (Figure 4) The challenges that the students came across with were primarily the technological constraints of the partner factory, as well as the palette of available materials, which encompassed all typologies of engineered wooden panels, and solid wood, to a smaller extent.


Figure 4. Lecture on the wood processing technology by the furniture factory professionals

Figure 5. Selection of the most successful student projects

The design brief inputs and limits raised awareness on the importance of the holistic and interdisciplinary approach, encouraging the students to think critically and creatively on parallel levels and "*to learn how to articulate questions and acquire the skills for finding the solutions.*" (5)

Encounter with the professional realm of rational and economic approach to planning, made the students become more aware of the qualities of design solutions which come up in response to the issues of the reduction of the waste, recycling, and complexity and the duration of the production process. The direct interaction with the factory engineers and other professionals not only helped the students to fully clear up the design process, but it also enabled them acquire and improve their skills of graphic presentation and technical specifications of their projects.

In traditional educational system, the students are often not sufficiently motivated because of the impossibility to see their ideas being realised into tangible objects. The transformation of the course "*Interior Design 3*"syllabus was accompanied by small intramural student competitions with internal and external members of jury, providing additional impetus by presenting rewards and ensuring prototype development for the most successful students' designs. (Figure 5) In comparison to the outputs of the generations that attended course by the previous curriculum, the projects that came as a result of the collaboration between the faculty and the industrial sector have been less influenced by design trends, and were more driven by autonomous creative thinking and technical problem-solving. The final submission was followed by the selection of the most successful projects by a jury consisting of two teachers, one architect from the professional realm and one technology engineer specialised in furniture production. The jury selected four distinctive furniture design projects, which consisted of 2D and 3D graphical presentation and models, and were subsequently developed as prototypes.

- Selection of the most successful student projects

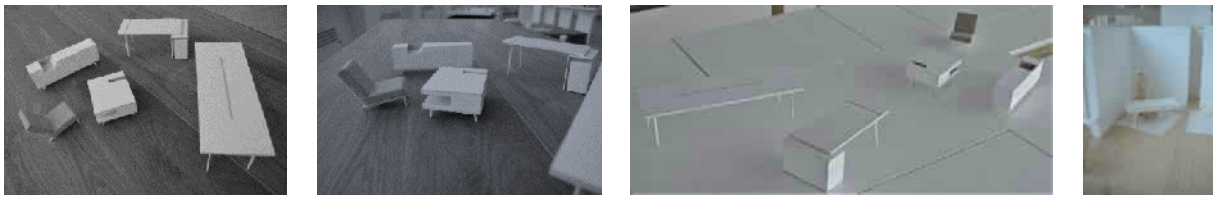

Figure 6. furniture collection by Emina Alić; small scale models (2013/2014 study year)

The presented furniture collection (Figure 6) designed by Emina Alić consists of the following five elements: conference table, office desk, coffee table, side board and an armchair. The materials used in the development of prototypes included MDF boards, metallic substructure and upholstery. The collection is characterised by distinctive design expression,

of simple orthogonal geometry and leitmotifs – stripe-like details in yellow. The described idiosyncratic motives were applied in the design of all pieces of furniture, visually uniting them in one ensemble.

Figure 7. The system of modular tables by Irma Softić and Ermina Bajramović; small scale models (2013/2014 study year)

This innovative collection (Figure 7) designed by Softić and Bajramović consists of six round meeting room tables, with variable sizes, offering possibility of creating different spatial configurations. The worktop is made of round white MDF boards fixed to the substructure of two solid wood lattices. The design is characterised by contrasted shapes and materials, between linear wooden slats forming two lattice frames and the flat worktop surface. Although modularity is rarely associated with circular geometric elements, the essential design potential of this concept lies in the circular cut-outs which enable arrangement of a variety of different spatial configurations.

Figure 8. Furniture collection by Asmir Voljevica; small scale models (2013/2014 study year)

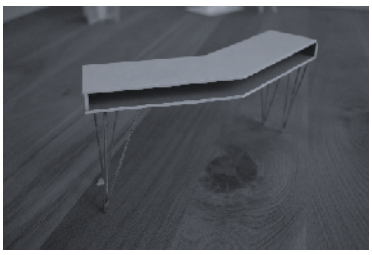

Figure 9. Double access office desk Srđan Dautbegović and Toni Cindrić; small scale models (2013/2014 study year)

Furniture collection by Asmir Voljevica (Figure 8) consists of three pieces: chair, office desk and a multifunctional table, made of a combination of MDF boards and solid wood frames. The key feature of the design is the juxtaposition of horizontal rectangular cantilevered planes and elegantly inclined legs. Additional innovative design leitmotif is the uneven span between the two pair of legs supporting seats and table tops. Though it is stable construction-wise, the design visually implies a concept of labile/dynamic balance. Moreover, the MDF table top surface is enhanced with inlays of solid wood, in the shape of traced contour of the substructure of the table. This student project reflects an innovative approach in the way it successfully connects individual furniture elements into a visually coherent spatial ensemble.

The selected furniture element, office desk, designed by Dautbegović and Cindrić (Figure 9) consists of the table top made of MDF boards and the stainless steel frame. The most distinguishing feature of the design is the dynamic, “boomerang-like” form of the desk, with interior storage space coloured in light grey. The visual appearance of lightness and transparency of the design owes to the four support elements, each comprising of three linear stainless steel tubes, resembling segments of a space frame. Moreover, the design of the desk allows double-access and the rotated, dynamic form of the table top enables it to

be utilized by two persons at the same time. The dynamic design expression was further emphasized by an interplay between solid and void, as well as in the compositional interaction of the surfaces and linear elements.

After the selection of the most successful projects, the students were engaged in the process of elaboration and development of detailed design project and specifications in collaboration with furniture factory technologists and engineers. (Figure 10) The original conceptual design was adapted and further evolved according to the constructional and technological requirements of the production process, guiding the students through the process of elaboration of details and connections between different materials.

Figure 10. Elaboration and development of detailed design project

Practical training in the factory helped the students become fully aware of the complex interactions related to the role of designers, which involves a continuous collaboration with specialists in engineering, economy and marketing. The new experience altered the students' preconceptions about designers as isolated figures creating and experimenting in their own protected world. After completion of practical training, the student themselves confirmed the benefits and values of gaining practical experience and self-confidence in collaboration with different profiles of stakeholders in the process of production. It was the first occasion for the students to participate in the realisation of their own design, which resulted with emotional attachment to the whole design and production process and as well as with the team which participated in the process. Finalization of the production process was followed by the award giving ceremony and the furniture prototypes presentation in the media, and exhibitions in the galleries of the Faculty of Architecture and the city of Sarajevo.

Figure 11. Furniture prototypes presentation (2016) and award giving ceremony (2015)

The follow-up activity was the redesign and reconstruction of the library at the Faculty of Architecture which was equipped with the furniture designed by the students. The seven years collaboration between the Faculty and the furniture industries resulted with over 20 prototypes of various furniture typologies: office desks, coffee and side tables, benches, modular seating elements, freestanding shelves, sideboards armchairs etc., which became the idiosyncratic segments of the new faculty library interior. The furniture and the space is now being used by all students and staff, encouraging all of them to initiate new creative

endeavours, research, explorations, teamwork and discussions. The case study of the prototypes of student furniture design projects, which evolved from exhibition pieces into functional products, serve as a theoretical and practical ground for future developments and upgrades of the course curriculum, provoking new ideas in the realm of design education. The contribution of practical training and the furniture the prototype production made the educational process gain its full significance.

3.4 Course evaluation

Figure 12. Students of the Faculty of Architecture University of Sarajevo visiting the furniture factory

Moving the classes outside the classroom and into the production facilities contributed to a more genuine and efficient learning process, which made the students become aware of the constraints and the potentials of materials and machines, and how to use those inputs to improve their own concepts. (Figure 12) Participation of the students in the furniture prototype development encompassed several iterations of modifications of the design, according to the structural and technological specificities and the settings of the industrial production.

Furthermore, the students have become familiar with the advantages of experimentation, gaining from the trial and error method of learning as *„one of the most effective types of feedback that a student can receive*.“ (6) The process of experimentation opens up new perspectives in terms of functionality, aesthetics and construction and enables the students to grasp the complexity of the development of industrial products in general, while effectively upgrading their theoretical knowledge.

Instead of dealing with hypothetical design briefs, the students are now offered possibilities to take initiative and responsibility for their own projects, at the same time establishing relations with the workplace environment. Interaction with the real working environment provides the students the opportunity to assess their own affinities for further career advancement.

On the other hand, the new legal obligation to incorporate of the practical training in the academic curriculum provides the employers from the private and public sector an opportunity to assess the potential, skills and devotion of the younger generations, and create their human resources strategies and facilitating future employment policies. The importance of interaction between academia and professional practice through establishment of platforms for expressing creative potential, applicative knowledge and diligence, should stir the processes of transition in Bosnia and Herzegovina towards creating a liberal society with equal rights for all, along with eliminating the corruption. Creating opportunities for the younger generations to familiarise themselves with the working environment during their studies, might instigate positive impact on existing practices and

critically reflect on errors in the employment procedures in Bosnia and Herzegovina.[2] The representatives of the industrial sector are given an insight in the process of the student spontaneous creation and way of thinking, leading to a possibility launching a serial production the most successful and innovative projects; the students gain a better understanding of the multi-layered role of designers, not only as authors, but also as key coordinators of complex processes and activities that take place both inside and outside their studios.

4 Conclusions

Some of the most significant educational gains of the collaboration between the Faculty of Architecture and the local furniture factories within the course "Interior Design 3" since 2009, included the implementation of new pedagogic models such as proto practice, project-based learning and practice-based research and resulted with four series of furniture prototypes, which became a part of the new faculty's library. Moreover, the introduction of the dual teaching methodology, joining theoretical and practical knowledge, replaced the purely theoretic approach to lecturing *ex-cathedra* was with practical and flexible courses that are adapted to the spatial-temporal context. In comparison to the original syllabus, the new and transformed educational program offers the students more opportunities to upgrade their theoretical knowledge by their active engagement through studying in factories and workshops, enabling them to directly learn about of coordination and communication between the main stakeholders in the production process. The presented case study intended to highlight the effects of the bottom-up approach in transformation of an educational program at the level of a particular design course, with valuable lessons to be applied on a higher level – the level of the curriculum - in the context of architectural education in Bosnia and Herzegovina.

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[2] Unfortunately, the period of post-war transition in Bosnia and Herzegovina is characterised by corrupted employment procedures, and are closely related to nepotism, social and economic status.

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THE GREAT URBAN—RURAL IMBALANCE

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Abstract

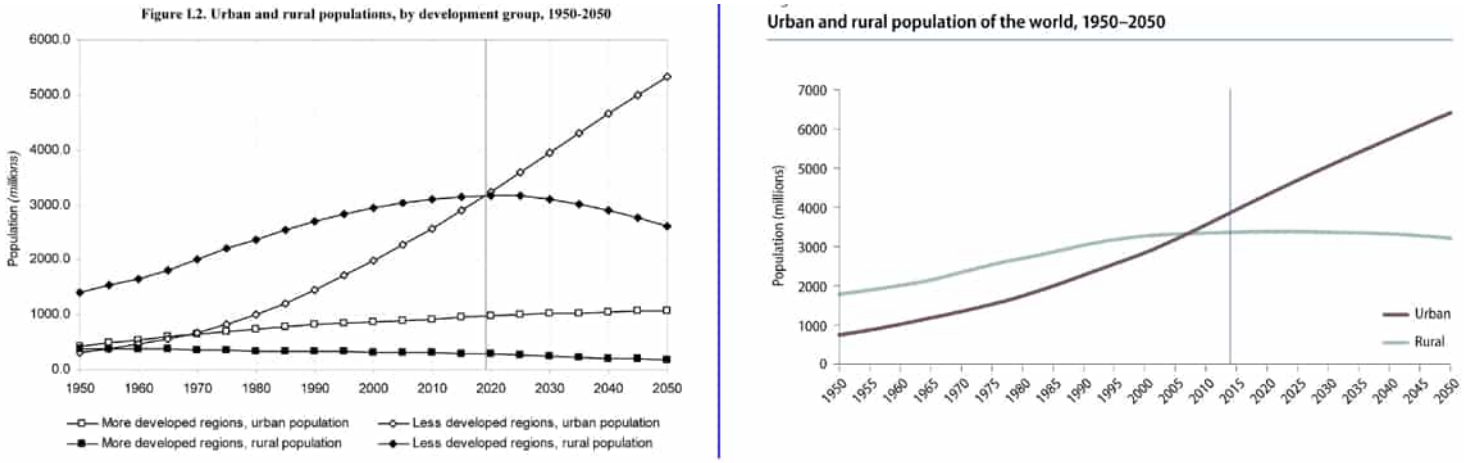
A looming threat to all major cities around the world is over-population and over-densification, which, if left unchecked, will have drammatic consequences to our collective well-being, security and safety. An analysis of articles, papers and interviews of prominent thinkers, researchers and scientists, reveals the risks posed to civilization are great, setting up the "Great Urban-Rural Imbalance" of our time. While we have discovered that cities themselves, if properly designed, encourage sustainability, the increasing human agglomeration will trigger a far greater imbalance in the loss of the urban sector's greatest ally: its rural partner. Cities promise to offer our lowest ecological footprint, yet, we need to radically reconfigure our cities in order to adjust the growing imbalance in population density. A critical question arises: how do we achieve the proper densities of cities without losing the required balance with our reciprocal rural partner? The findings of this research may impact changes to policies regarding land-use regulating systems (zoning, politics, property tax codes, property insurance, and the 'borrow-build' land-use paradigm) to address the current global imbalance.

Keywords

Zoning, Urban, Rural, Land use, Global Population

1 Introduction

On a global scale, over one million people leave the country and move to the city every week. We are losing small towns and villages on a unprecedented scale. Two hundred years ago, the urban population was around 3%. At the beginning of the 20th century, this figure rose to 14%. This shift from rural to urban areas continued so that by the 1950s, the urban population was approximately 30%. It is estimated that by 2030, over 60% of the global population will live in urban areas according to a 2007 rural population study conducted by the United Nations (UN). The UN revised its study in 2014 to highlight the conditions were worse than it forecasted: 59 countries are already more than 80 percent urban. **(Figure 1.1)**



2007 *(left)*, 2014 *(right)* United Nations Department of Economic and Social Affairs, Population Division

Figure 1.1

2 Objectives

To identify, explore, and evaluate the impacts underlining the great imbalance between the urban and rural conditions. Offer the reader: ''Findings & Results'' and ''Implications to Practice'' for further discussion. As a function of testing theoritical underpinnings of the findings, the author offers a view forward in ''Outlook.''

3 Methodology / Procedure

Qualitative research was used for this study. Accordingly, observations made within this context were used and corrobrated with multiple sources where there is more than one type of evidence or source of data. In this study, the problem was defined as an 'imbalance' with an attempt to present the research of scholars, as well as independent research, in the arena of a neutral context, and to source data to explain our present urban-rural dichotomy. This methodology was designed to incorporate a variety of evidence, including observations, interviews, and documents, to deeply explore the multifaceted nature of The Great Urban-Rural Imbalance.

4 Findings / Results

The balancing of anything in the natural world requires equilibrium: in physics, it is quantified as the opposition of forces cancelling each other, so that a static, or balanced, condition occurs; the cancellation of forces acting on an object. In terms of expressing the imbalance of urban-rural spatial environments in this context, one must look to the underlining causes (forces) creating the inertia. Evocative of this ethos is the centerpeice of the economic approach to cities as "people-based" as opposed to a "place-based" outcomes that determine spatial economic topographies. A fundamental aspect of this field is the primacy of person over place, where

economic policies that prevail are based upon whether they increase the choices available to people and not on whether they help rebuild a particular locale. The economic approach to cities relies on a spatial equilibrium for (i) workers, (ii) employers, and (iii) builders. **(Glaeser 2007)**

The most significant piece of urban economic theory remains the spatial equilibrium model of William Alonso (Alonso 1964), which was extended by Edwin Mills (Mills 1967), and again by Richard Muth (Muth 1969). The early Alonso '64 model mirrors the Ernest Burgess Concentric Ring Model (Burgess 1939) of urban development: they both are simple, elegant and contain a fair amount of truth. **(Figure 2.1)**

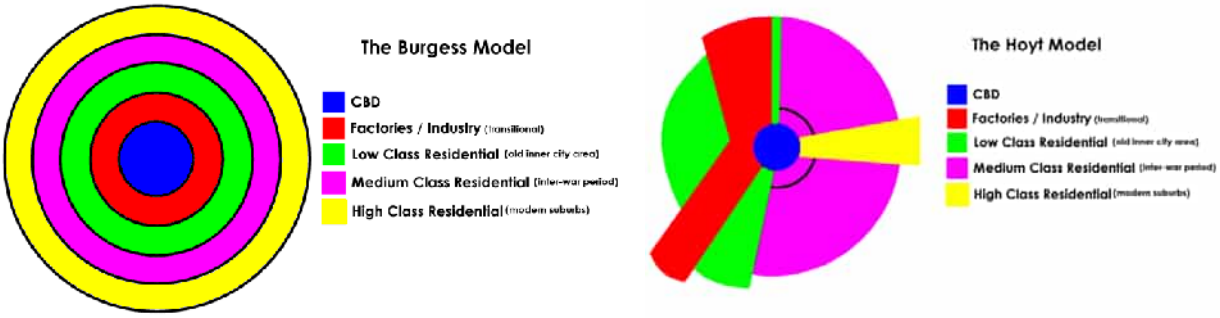


Figure 2.1 (left) The theoretical Burgess Model, named after Ernest Burgess, was developed in 1925 and illustrated concentric rings as simple way to envision the urban condition.

Figure 2.2 (right) The Hoyt Model developed in 1939 would replace Burgess with a modification of the concentric zone model of urban development. The benefits of the application of this model include the fact it allows for an outward progression of growth as envisioned by economist Homer Hoyt.

Yet where they both fall-apart, theoretically, is they look within a metropolitan area and assume that both income and amenities are constant—which is not true, nor easily quantifyable in reality. These early-model assumptions go further to imply that housing costs plus transport costs are constant across space. As Glaeser points out: this ''means that housing costs will decline as transport costs rise with distance to the city center.'' In the simplest case, everyone theoretically works at the center of the city and transport costs rise linearly with distance to that center, i.e. if costs equal “t” times distance, then housing costs must equal costs at the center minus “t” times distance.

The relationship is far from perfect. The objection to the Alonso-Muth-Mills model is that it is increasingly at odds with a world that is no longer monocentric. This realization more accurately mirrors the Hoyt Model where anomalies are identified

and pierce the purity of the circular geometry of the urban sphere of influence. **(Figure 2.2)**

What is absent in both the Burgess-Alonso allignment and the Hoyt-Alonso-Mills-Muth allignment are the peripheral rural sectors. At the core of this new urban-rural imbalance argument is not a question if rural economies really matter, it is a question of their trajectory and political power. The rural sector may not matter economically, yet it has enough political power to exacerbate the imbalance. Without offering some solutions, the polemic turns on a political economy argument that acknowledges if nothing is done to correct the imbalance, there will be a rural backlash. Such a popular uprising to upset the urban monopoly on the spatial-economic sphere isn't untenable. ''The worldwide reaction has, however, come from an unexpected source. In recent years, some of the places that 'don't matter' have increasingly used the ballot to rebel against feelings of being left behind, of lacking opportunities or future prospects.'' **(Rodríguez-Pose 2018).**

The urban-rural divide has increased while the rural sector has not fully recovered from the Great Recession. The table below illustrates the extent to which larger metropolitan areas have recovered better than smaller areas from the Great Recession, as reflected by three basic measures of labor market performance: (1) private employment, (2) real personal income, and (3) labor force participation—leading economic indicators. **Figure 3.1**

	Private Employment CAGR, 2009-2015	**Real Personal Income CAGR, 2009-2015**	**Labor Force Participation Change, 2009-2015**
Top 20 (n = 20)	1.9%	2.1%	-0.1%
Large Metros (n = 100)	1.8%	1.9%	-0.3%
Medium Metros (n = 100)	1.2%	1.7%	-0.8%
Small Metros (n = 182)	1.1%	1.7%	-0.9%
All Metros (n = 382)	1.7%	1.9%	-0.4%
United States	1.6%	1.8%	-0.6%

Figure 3.1 Note: Averages weighted by private employment (total employment minus the public sector); Large metros are all those in the national top 100, medium are ranked 100-200, and small are the remainder; Labor force participation includes workers aged 20-64

Source: Brookings's analysis of Moody's Analytics, U.S. Census, BEA, and BLS data

What is driving the rise of the big city and the decline of the small town are the powerful, ubiquitous forces of a technological agglomeration amplified by new innovation, which is generating growth in large metropolises—currently at the expense of smaller places. **(Muro and Whiton 2018)**

In certain affluent rural areas, it is not an issue of size, nor having a less educated demographic, rather, a significant conflict in values. **(LeClaire 2018)** Access to wildlife gaming, eco-tourism, sporting venues (activities such as skiing, hunting, mountain climbing) brings some wealth to the rural sector, yet what comes with this sharing of economies across divergent spatial arrangements are the potential

negative aspects of urbanization: the displacement of native populations and the loss of rural identity.

To add to this uphill challenge presented to the rural sector, is the apparent 'siphoning-off' of its home-spun genius-talent which it loses to the urban sector; a gravitational pull to the center of the urban vortex. In short, the large metropolitan areas have a productivity advantage in the United States. **(Parilla and Muro 2017)** The uncoupling of the urban from the rural economy has become more stark since the financial crisis. The divergence between big, medium, and small sized communities' growth is worsening: employment has surged in metroploitan areas while non-metro areas have witnessed a decline. **Figure 4.1 (Muro and Whiton 2018)**

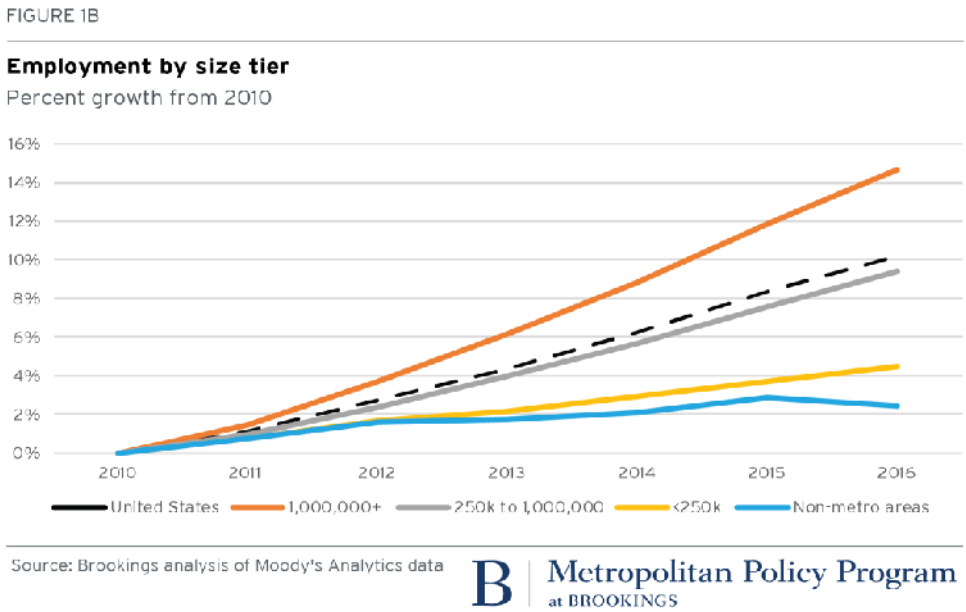


Figure 4.1 A Brookings analysis elucidates that economic activity is unevenly distributed across space.

This phenomenon in the US has been echoed in the UK which has implemented a regional policy of the European Union (EU), referred to as the ''Cohesion Policy, '' aimed at addressing this economic divergence, if not trying to stabilize it. The policy's aim is to improve the economic well-being of regions in the EU in an effort to smooth-over regional disparities. In other words, economic integration is unleashing forces benefiting core regions within countries, often to the detriment of the periphery (rural sector). **(Farole, Rodríguez-Pose and Storper 2011)**

What Muro and Whiton highlight in Figure 4.1 underscore the observations by Glaeser and Rodríguez-Pose: there is a near-state of emergency as the periphery becomes decimated by economic agglomeration—the spatial politics of economic power.

Arguably, too much regulation from the elite urban bureaucratic machine have created higher and higher costs for living in urban areas. Increasingly restrictive land-use regulations in the last half-century has greatly contributed to a price-value rift.

Typically, what appears to be several local housing crises is actually a much more alarming national crisis: Land-use restrictions are a significant drag on economic growth in the United States. **(Hsieh-Moretti 2017)** In jurisdictions where complex zoning regulations exist, we find a higher cost to build.

The great divide between urban and rural conditions is compounded by the agglomeration of technological advances that have unleashed unprecedented power to individuals. It is, in essence, why some economists refer to this imbalance shift as a 'people-based' movement, as opposed to 'place-based' inertia. **(Glaeser 2007)** According to Glaeser, the spatial equilibrium approach is given by:

Income + Amenities – Housing Costs – Transportation Costs

The results of this model reveal that income must be constant. If income is not constant, an imbalance is induced. The new housing supply offered in the suburban domain is offset—or is mitigated by—the high cost of urban development in many American cities. **(Glaeser 2007)**

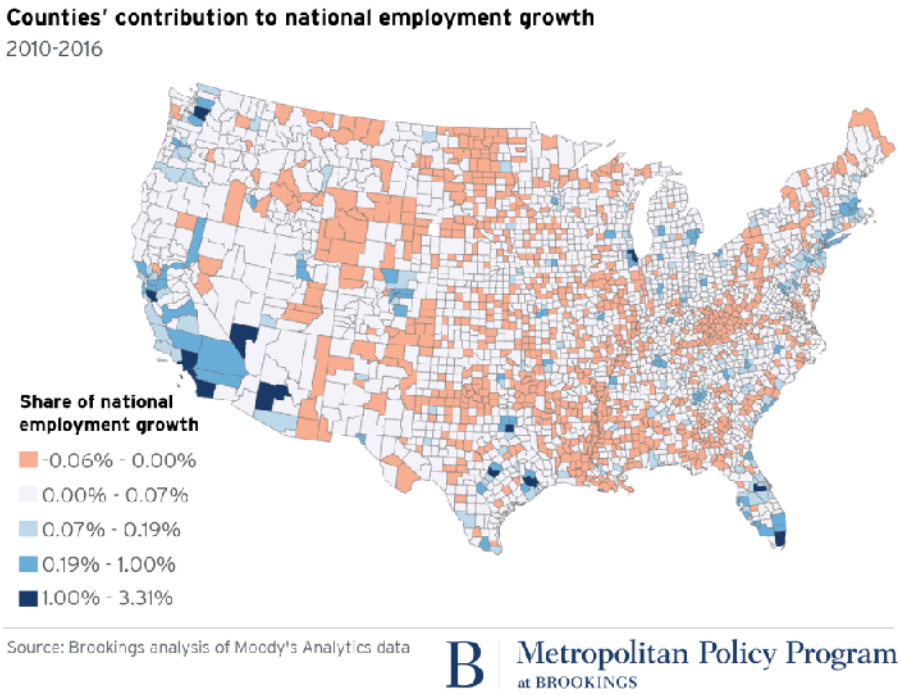


Figure 5.1 Illustrates smaller metropolitan areas (less than 250,000 people—representing 9 percent of the nation's population)—have a negative contribution (-6.5) percent to the growth in the United States.

The current imbalance found in the United States, raises implications for practice—addressed in the following chapter—that is, the manner in which we shape our cities and rural areas in the future, will be determined by what degree local municipalities embrance change.

5 Implications for Practice

Policies that reflect the dynamic, moving, condition of rapid change in our urban-rural sectors will be catalytic for our built environment. The spatial imprint of these changes will have profound impact on both urban and rural built environments. The new energies unleashed out onto the landscape will shape a new hybrid of 'rural-urbanism'—a condition most affecting the cities that are impacted by built environments that are ''in-between,'' niether rural nor urban. **(Pachecano, 2010)**

Continued rezonings, coupled with land scarcity in urban areas, are also triggering interesting land-grabs by industrial users. The lack of open-acreage in the urban areas has created a niche-demand, resulting in industrial owners and tenants to turn their search for land outside the city. **(Murdocco 2018)** This recent market indicator is among the top factors contributing to the heated market sector in the suburbs—a counterpoint undermining cities trying to attain optimal sustainability.

The function of the local zoning board is to represent the interests of the community as it pertains to land use. In its traditional role, its guidance has been limited to use and bulk of a specific property; it has not been the local zoning board's imprimatur to guide the community through economic transitions. **(Mandelker, Merriam, et.al, 2011)** However, this may be changing. The new paradigm of the technological agglomeration suggests that if rural, suburban, exurban, urban boards representing their communities adopt technologies that enable efficient descision-making, positive changes might occur seemlessly across divergent densities. In this way, the lagging rural sector might benefit from urban-centric decisions in such a way as to bring about a cohesion approach to 'bridge the gap.'

For the rural sector to become relevant again, it must seek-out, or be given, the keys to modern mechanisms. It must find ways in practice to embrace the fertile newness of a 21st century spatial-economy. If it does not, then any particular small city in the rural sector will sonner or later loose its relevance. **(Krugman 2017)** In an effort to remain relevant, the rural sector must create new opportunities and develop regional strategies that stem from its inner resilience, vibrant traditions and collaborative spirit. “It is not natural for humans to simply dismiss eachother when they are in need. People genuinely want to care for one another and for others whom they do not know. The future is grounded in this vision, not fear.” **(Cooper 2018)**

6 Outlook

Meanwhile, rural communities across the globe are hanging on and seeing promise in a sustainable future by being centers of production for bio-fuels, renewable wind energy production, and collective solar farming where 100millionMW (1e+14) of power can be achieved. We need cities, yet we cannot live without the countryside. **(Pachecano 2010)** The rural sector will embrace certain elements of urbanism while retaining its local roots. A new term, ‘rural-urbanism’ will come to describe a new era in the spatial arrangement of uses bought together in ways once separated as illustrated in **Figure 6.1**

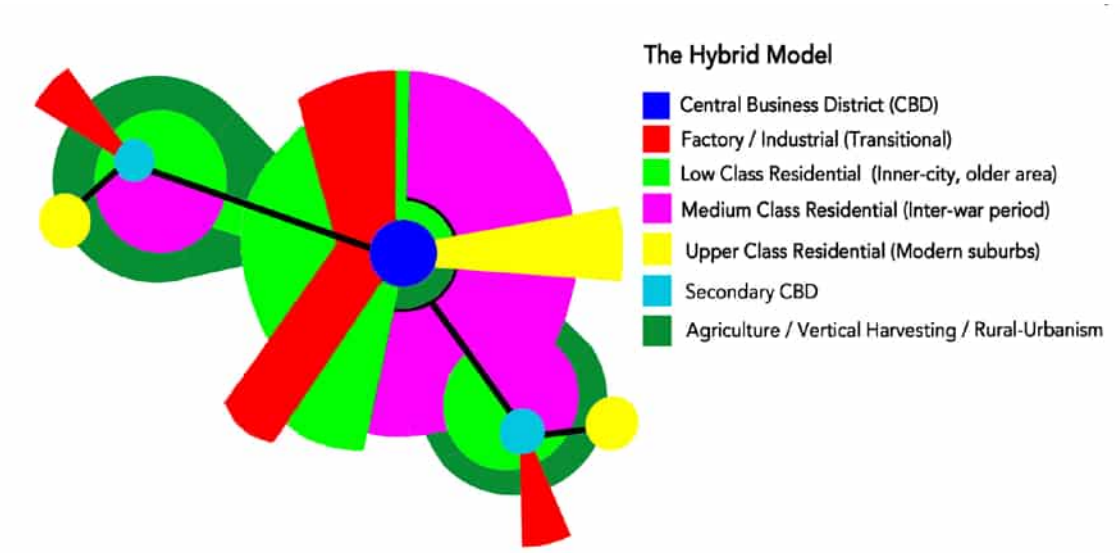


Figure 6.1 Illustrates the re-emergence of agriculture in, and adjoining, urban space. In metropolitan areas where increasing population has occured, a new demand for "farm-to-market" produce has forced a significant change to the Burgess-Hoyt model, yielding a new hybrid "rural-urbanism" spatial arrangment. **(Pachecano 2010)**

"The current challenge of architecture is to understand the rural world," as recounted by noted Dutch architect Rem Koolhaas. This is a large void being ignored by architects and the schools of education who have focused much of their efforts on cities. "Koolhaas appeals to us to change this perspective and understand that the future is in intervening in 'bare, semi-abandoned, sparsely populated, sometimes badly connected spaces,' since this is where we as architects are seeing accelerated processes of change, of which we must take the lead." **(Amaro 2018)**

With the urban constraint on development brought-on by increasing regulation, it is conjectured that the rural and suburban spatial-economies will begin to show increases. The adoption of more stringent regulation in economically vibrant cities is increasing in scope and impact, and thus driving up the cost to build. This has not stopped the swelling of cities. The Wharton Residential Land Use Regulatory Index indicates that America's strongest economies are also those where it is most difficult to build new housing. **(Gyourko, Saiz, Summers 2007)**

There continues to be a debate in Washington DC about the costs of regulations for economic growth. Exclusionary land-use regulations in our most dynamic labor markets impose demonstrable high costs on our nation's economic well-being. **(Hsieh-Moretti 2017)**

In addition, the call for "hyper-dense" cities does not appear realistic given the severity of the unevenness of the spatial-economies. While altruistic in its aim, the super-dense metropolis envisioned by city-planners runs counter to the humanist tendency to seek-out open space and, more importantly, would adversely alienate the rural sector. With or without green technologies, suburban and exurban

development is less sustainable than compact cities. **(Chakrabarti 2013)** Yet, to construct a meaningful balance with the rural sector will require significant investment in infrastructure, technology, and connectivity.

Solutions to remedy the urban-rural imbalance fully range from US federal government intervention to laissez-faire economics. Either way, spatially-balanced growth should be a non-partisan priority. Governments at all levels: federal, state and local—should strive to achieve economic cohesion. **(Liu and Muro 2017)**

Additional approaches to finding remedies may be found in these emerging technology sectors that overlap the rural sector:

- Renewable Energy—Wind turbine generation and maintence will provide a needed rural investment as this sector expands in the future. Wind power is expected to account for 14 per cent of electricity consumed within the EU by 2020. At the close of 2014, the EU produced 134,000 Mega-Watts of wind-power, the US 78,000MW, and Asia142,000MW. The world total of wind production was 370,000MW. **(GWEC 2015)**

- New Agriculture—The adoption of drone-farming, vertical harvesting, hydroponics and organic methods of pest control. Agricultural (rural) producers must embrace revolutionary strategies for producing food, increasing productivity, and making sustainability a priority. **(Mazur 2016)** There lays before the rural sector a broad, wide-open future for technology adoption that will allow delivery of fresh produce to urban areas within 24 hours of harvest.
- Cyber Offense—The era of disruption has unleashed enormous resources directed at cyber defense with the urban sector currently housing much of the cyberspace hardware to operate the Internet. Yet, the future of this industry is in cyber offense and the rural sector promises to be an ideal recipient for roaming hardware as part of a cyber security domain. Due to the vast nature of cyber activity, much of this occurs in the private sector, and “the military should not have any business operating in most of cyberspace.” **(Crowther 2017)** Yet, the dynamics of a cyber offensive strategy may change this view.
- Infrastructure (high-speed rail, transmission lines from solar farms, wind-turbines, geo-thermal), is undoubtedly linked to agriculture and rural development and agriculture is the largest user of freight transportation. The future path to expanding the rural sector’s spatial-economy is partly a function of increasing its infrastructure capacity. **(Scott 2016)** High Speed Rail provides another venue for deployment of investments that would benefit the rural-sector. Options for developing high speed rail service are two: (i) upgrade existing track, or (ii) build new lines. **(Peterman, et.al., 2013)**
- Adoption of ''internal investment'' programs as exemplified by those implented by the EU under its Cohesion Program. **(Farole, Rodríguez-Pose and Storper 2011)**

- Use of Data for Mapping: The creation of a cognitive mapping tools via social media interfaces for the rural may provide a well-spring of new information about the lagging spatial-economies. This work is being pioneered with the urban sector using Twitter data. **(Plunz 2018)**

7 Conclusion

This paper elucidates the prominent disparity of our urban and rural environments and offers views on the implications to practice.

At no other time across the vast arc of human history has the state of our divergent urban and rural conditions threatened our existence on a global scale. Underlining the imbalance are numerous forces such as: overpopulation, overdensity, political and economic impotency, and a new technological agglomeration overtaking the globe. This trend is not an “amalgamation,” or healthy blending, of diverse breakthroughs. Rather, it is the taking of resources to amass and cluster influence.

The adoption of technology takes time, and we are now in the beginning of a century-long trend where automation with robotics and non-human interactions will replace human interactions. Ironically, the story of the rural sector’s decline belies its role as the first early-adopter of technology as it completes the past 100-year cycle. The rural sector's embrace of technologies such as renewable energy, new agriculture, cyber offense, infrastructure, internal investment, and newer methods of data mapping are bright areas for adoption. If urban areas seek to thrive, it must engage the rural sector and aid it its resurgence in the next 100-year cycle.

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TEACHING INTERIOR DESIGN METHODOLOGY - A CASE STUDY SHOPPING MALL DESIGN STUDIO PROJECT

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Abstract

Design is a complicated mental activity that involves detecting the possibilities of a given list of constrains and limitations. Interior design is a challenging multifaceted profession in which creativity and technical solutions have to be provided. These solutions must meet the physical and psychological needs of the occupants, in terms of functionality, improving the quality of life and health, responding to their cultural beliefs and also to be aesthetically attractive. The problem-solving technique that started recently in the artificial intelligence had a profound impact on the design process; it helped to systemize the models of design. This research aims to introduce some guidelines to the instructors, academics, researchers, programmers as well as relevant teaching institutions to create a frame work of thinking of interior design problems. The research methodology is based on data collection and integration of previous literature, analysis, interpretation and a case study as a practice-based model. The research starts with clarifying the design process structure. Then, the requirements for creating a successful interior design were overviewed. A case study of a design studio project which was supervised by the author is presented. Finally, the conclusion and recommendations were crystallized. Further studies to create a soft-ware based interior design model to help the designers and students in evaluating all the requirements, constraints and set priorities was recommended.

Keywords

Design process, Interior design, Shopping mall design, Design studio project.

1 Introduction

Approaching the study of interior design could be a dispiriting scope. Design problems in general are usually vaguely defined and open ended in nature, which means that they have more than one proper solution [1]. Multitude of information has to be collected, analysed, and synthesized to obtain a coherent design solution.

The obscurity of interior design procedure is mainly due to the complexity of embracing the ambitions of a designer, client, comfort and utility of purposed occupants and compliance with

a multitude of life-safety and legal regulations [2]. In addition, the design solutions must be aesthetically attractive and responding to the cultural beliefs of the inhabitants [3].

This research pursues providing some guidelines to teach the students the design methodology and providing an interior design studio project model. A case study as an evidence – based application is discussed. Furthermore, this research aims to contribute in helping the programmers to create a soft-ware based interior design model to assist in the decision- making and evaluating the design solutions in the form of a decision – matrix.

1 Design Process Structure

Design is an extremely manipulative process in which the designer has to constantly and jointly pay attention to, and balance, the many factors that touch and affect design [4]. Design activity happens over a period of time and demands a step by step methodology [1]. In the 1960s and 1970s, problem solving techniques that appeared in the domain of artificial intelligence has had a profound effect on Design Methodology. It helped to systemize the methods and models in problem solving in other areas. The intellectual problem-solving paradigm based on the conceptual frame that Herbert Simon, inserted in 1973 is still a prevailing model in the field [5]. With the view of prohibiting the entire process from being haphazard [6], following the consecutive steps of the design process helps the designers in obtaining comprehensive and creative designs that satisfy the client's requirements and meet the objectives of interior design [2]. As the main concern of this paper is teaching design studio project, the author is trying to frame the structure of such a process in the following framework, considering that build up a framework is in itself an open-ended problem. Design can be discussed from abundant approaches that go beyond the domain of this papers [5].

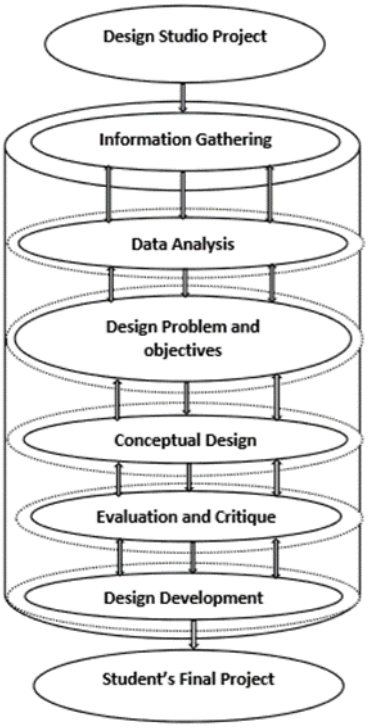

Figure 1 Interior design studio project model – prepared by the author based on previous literature [7], [2]

It could be picked up from the suggested model that the design process is an interactive and cyclic in nature. As the design is developing, the solution is subject to unexpected complications that may require interactions and backtracking [1]. Clarification of the said steps could be briefed in the following:

1.1 Design Studio Project

Since a creative work starts by integrating information on an existing work with previous ones [8], mostly an existing building is given to the student to be re-designed. The program and the area of the project could be the same or different from the existing building. The instructor may allow the students to modify the program depending on case studies.

1.2 Information Gathering Phase

The Students start the project by exploring opportunities and constrains from collecting pertinent data by scanning many different sources. Besides electronic information sources, the library is still none the less an essential source of data. Furthermore, as design action normally occurs in response to human needs, students have to understand and see such a need through interviews and site visits of the existing project [1]. Adopting the extramural educational approach of going beyond the institutional boarders and integrating with the real world, will enable the students to become active learners and to realize the local specificities and demands as real contributors in the design process [6]. A questionnaire that will be provided to the client - within this domain represented by the current users- , current users of the target building, have to be created by the students, directed and reviewed by the instructor. Furthermore, during the site visit, the students have to develop their personal observation, taking notes, sketches, measurements and photos [2].

1.3 Data Analysis Phase

The weaknesses and the problems of the existing design have to be defined based on the analysis and synthesis of all collected data. Establishing the needed design criteria must be formulated. Initial criteria has to be general to provide flexibility during the design process. The instructor has to help the students to apply value judgments of the said criteria that will help to set the priorities in design solutions [1].

1.4 Design Problem and objectives

The gap between the current situation and some positive future status defined as the problem space [9]. Formulating the problem in well-structured and obvious statement is the first step in the problem-solving procedure [1]. Generating the design objectives defines, what could be seen as opposite to what is existent [9].

1.5 Conceptual Design

The previous exploratory phases that happened at a conscious level, creative knowledge that accumulates in the unconscious level is targeted to be utilized at a conscious level [8].

Performing the interior Design requires thinking of the whole project as a series of integral and linked spaces. Accordingly, a proper common theme or style takes place throughout the

pursuit to harmonize and optimize the interior ambience [10]. Students have to brainstorm various ideas to come up with concepts specifying themes and create directions [11].

Preliminary three dimensional sketches attached with color scheme, references for fabrics materials and furniture will help to formulate the students' design proposal [2]. The student has to select three or four colors to be applied in a variety of shades throughout the project as a vital way to integrate the project's spaces [10]. Another substantial requirement during the same phase is studying the relationship between spaces to create an effective functional space planning. A bubble diagram or compatibility matrix has to be provided [2].

1.6 Critique and Evaluation

Training the students on selling their ideas, accepting modification, negotiating to arrive at the strongest group of the design aspects worthy of further development and iteration are vital targets of such a phase [9]. Since evaluating the alternative solutions is a highly subjective issue and should be made by experienced designers [1]. Consequently, students have to present their work to the instructor, other students, another instructor, and one or more expert from practice to get feedback from diverse perspectives and build consensus on potential design directions or worthy features [6].

By the end of the pinup critique session, each student should fully realize the scope and directions of the project [1].

1.7 Design Development

Students are encouraged to involve in another round of sketching, reinterpret and re-blend based on the received feed backs as well as concepts displayed by other student to reach a more solid concept and framework [9]. Each student starts to prepare a set of specified drawings by the instructor, students' design solutions should fulfill the requirements against the stated design criteria. Accumulated refinements have to be accomplished to compass efficient response to the functional, aesthetic, ergonomic, structural and technical requirement in a creative way [1]. Sometimes, the economic requirements are mostly not considered in this design studios to give a space for the innovative and luxurious designs

1.8 Final Project

By the end of the design development phase, a complete set of drawings have to be submitted which translate the design into a visual communication language; space planning, ceiling design and furniture configuration plan are expected to be refined. All the furniture pieces, finishes, lighting, fixtures, material board, and accessories have to be included. In addition, the design of doors, windows and stairs are expected to be detailed [2]. A model as an important tool for visualizing and translating the design concept in the three dimensional sense to the general public is an essential component of the final project [6]

3 Successful Interior Design Requirements

The National Council for Interior Design Qualification defined the domain of the interior design as follows:

> *Interior design is a multifaceted profession in which technical and creative solutions are applied within a structure to achieve a built interior environment. These solutions are functional, enhance the quality of life and culture of the occupants, and are aesthetically attractive [2].*

In other words, Interior Design is a creative process involves a unique blend of science and art that analyse and synthesise data, and the client's needs and wishes, sets a conceptual orientation, polishes the design direction and provides graphic communication and construction documents [10]. Furthermore, interior design could be defined as to provide a successful interior design, the created ambiance must promote the appropriateness and comfort of the end-users both psychologically and physically whereas considering the economic facts and a wider scope of sustainability issues [2]. Briefly, through the following points, the most significant design criteria of the interior design can be concluded as follows:

3.1 Functionality and Responding to Human Needs

A design solution that provides all the design criteria and does not function properly is a failure [1]. If the inhabitants cannot effectively perform the functions and activities required in the space, it means simply that the design is unsuccessful [3]. In addition, the designer should satisfy the particular needs of the users, including the elderly, children and people with special needs [2].

3.2 Anthropometrics and Ergonomics

People come in different sizes, the geometric features of 95% of the people is called anthropometric information. In addition the study of how people react with the built environment is called ergonomics [1]. Collecting the required data about the anthropometrics and ergonomics impacts the space planning and furniture design. It is an extremely valuable factor in providing the occupants with psychological and physical comfort [2].

3.3 Aesthetics Factors

Creating charming, attractive and a pleasant environment is a spirited factor in interior design. Promoting the sensitivity to the aesthetics of the interior ambiance is one of the essential aims of the interior design study. Pleasant and appealing environment has no ultimate formula; yet the felicitous utilize of aesthetic factors: harmony, balance, emphasis, rhythm, scale and proportion helps in decision making and enhances the final design outcome. Simplicity and Integrity are key words in quality design. Sensitivity to the user's cultural choices and taste aids the designer to provide the convenient design solution [2].

3.4 Safety and Health Issues

Providing safe and healthy environment is one of the interior designer's liabilities [1]. Designers should not compromise the users' safety or health by selecting potentially harmful items and materials to reduce the cost. Certain precautions should be considered in providing safe environment for children and elderly users [2].

3.5 Economic Considerations

Many good designs were never accepted because the cost surpassed the client's budget [1]. Responding to the willingness and needs of the customer should be limited by the proposed cost. The designer has an ethical commitment to report to the client with any expected excess of the original cost during the design process and taking his approval in advance [2].

3.6 Ethical Commitment for Sustainable and Green Design

Sustainability could be defined as an environmental science that draws attention to the feature of not being harmful to the environment or exhausting natural resources and accordingly supporting long-term ecological balance [12]. The designer has an ethical commitment to the earth and for his client's safety and health in selecting the designs' materials with all the relevant factors to green, eco, environmental and sustainable considerations [2].

4 CASE-STUDY: SHOPPING MALL INTERIOR DESIGN- DESIGN STUDIO PROJECT

A case study for a research demonstrates concepts and assumptions in evidence-based approach [13]. Shopping Malls are the social gathering and entertainment centres of the 21 century. Contemporary shopping malls, are the most prevalent structures worldwide. In the current days, shopping malls became a multifunctional beautifully attractive designed venue which provides the experience of shopping, recreation and catering with a proportion almost of 1/3 for every activity. Furthermore, the flourishing markets have a tangible influence on providing new jobs, encouraging the consumption and driving the production [14].

In the fall 2011-2012 the author was the supervisor of the graduation project. By the end of spring 2010-2011, a notification was sent to the students with the topic of the graduation project, "Shopping Centre" and a list of the requirements. The students were oriented to select one of the existing malls in Muscat to be re-designed considering no repeated selections. Letters were prepared to get the engineering drawings from the Muscat Municipality. The project program includes; competitive markets, cafes and restaurants, entertainment in various forms, lifestyle retail shops, children care centre, a meeting place, large car parks, landscape design, management offices, services and facilities with a total area of 3000 m^2. Nevertheless, the students were asked to provide customers orientation, security, dynamics of spaces, attraction, zooming efficiency, excitement, convenient ambience, distinguished lighting and suitable colour scheme. The selected case study for this paper is "Jawharat Al Shati Complex at Shati Al Qurm, prepared by the student Buthaina Al Farsi. With reference to the previous suggested model of the interior design studio project. (review figure 1)- for the limited paper size, some steps are merged into one- the steps of preparing the project were as follows:

4.1 Information Gathering, Data Analysis and Design Problem

The student started data search through the internet, Goggle map' and site visits. The mall is 7270 m2. It has a distinguished location surrounded by important touristic

destinations; Intercontinental Muscat (5 stars hotel) Al Qurm Resort (4 stars hotel), Shati Al Qurm Beach, and the Address Café.

4.2 Information Gathering, Data Analysis and Design Problem

The student prepared a questionnaire which was distributed to the visitors and staff with a sample size of 20. The participants concluded that the main design problems are; in spite of the remarkable location, the mall has a very low rate of visitors according to the following problems; no attractive theme 81%, no colour scheme 76.50%, no convenient services 76.50%, no adequate Lighting 66.5%, and not enough parking area 66.50%. Through personal observation, the students identified the following issues, No unifying design or colour theme; traditional Islamic elevation, Paranoiac columns 'design (Lotus capital) with a repeated cloud shape everywhere in an un designed superficial way besides the corridor's width is out of standards according to the Muscat building code

Figure 2. Existing design problem; no design theme, no colour scheme a repeated cloud shape in an un designed superficial way besides the corridor's width is out of standards

4.3 Conceptual Design

Based on data collection and analysis, the students determined their design objectives as follows; creating a charming attractive dynamic interior design to place the current mall on the top of the tourists' agenda. Furthermore, the students wanted to provide a contemporary shopping and an entertaining experience among the existing traditionally oriented shopping centres. Moreover, the use of eco-friendly materials was also targeted to provide a healthy and safe environment with a high indoor air quality and in a larger scale the earth welfare. The design concept was the "finger print" clarifying her concept as "the fingerprint is an impression left by the friction tops of the human finger. Everything - in the wider use of the term – has a finger print or a trace in the nature. Jawharat Al Shati complex needs a fingerprint in the Sultanate of Oman".

Information was gathered on the selected eco-friendly materials and relevant references to the students' concept of a variety of designs of furniture, lighting units, floors, walls, and ceilings. The color scheme was selected from the natural environment of Oman to create the sense of place. In addition, the student prepared a bubble diagram and zoning analysis besides a lot of sketches (figure 3)

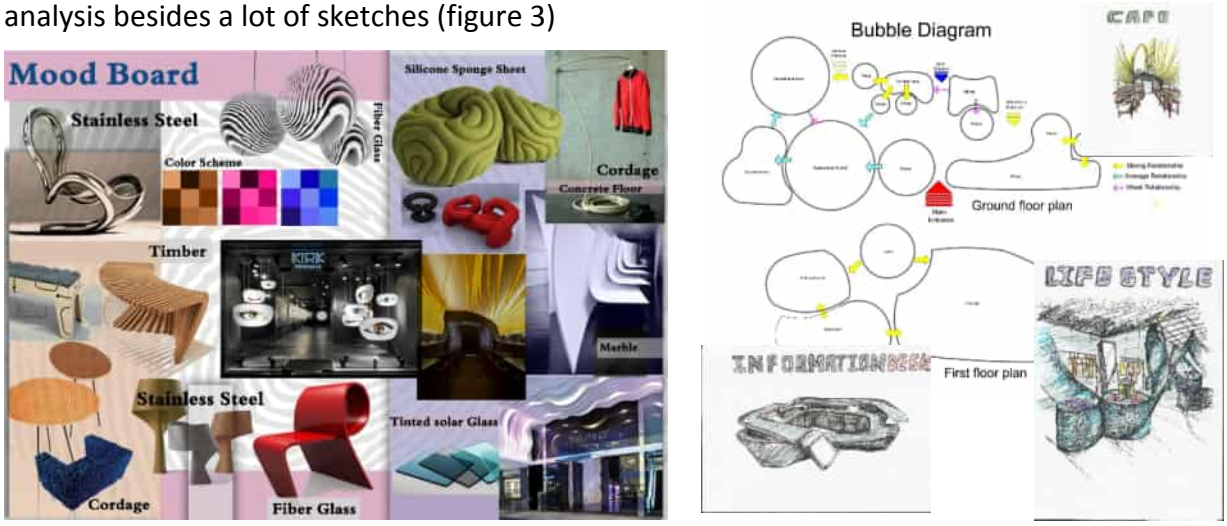

Figure 3. The design mood board, bubble diagram and sketches

4.4 Critique, Evaluation, and Design development

An interior design from the practice and another instructor were invited to a pinup critique. The student prepared a power point of all the collected data and analysis. Two options of a schematic design were discussed and criticized. During the following two months, a set of the whole required drawings and details were prepared and refined through a one to one critique with instructor and grouping critic. Sometime a back retreat needs to be done. The plan design development is shown in figure 4.

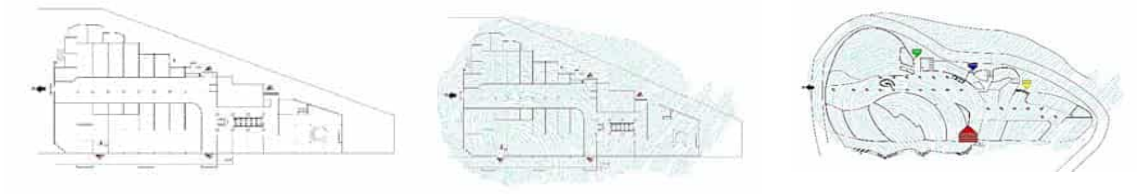

Figure 4. Design Devlopment

4.5 Final Project

By the end of the semester a complete set of drawings, diagrams and details were ready. Some main features of the project are shown in figure 5. External jurors were invited one academic, a consultant and a representative of Jawharat Al Shati Complex. The discussion during the jury was very inspiring, integrating the approaches of theory and practice with the owner's point of view who expressed his interest of such a creative and innovative design.

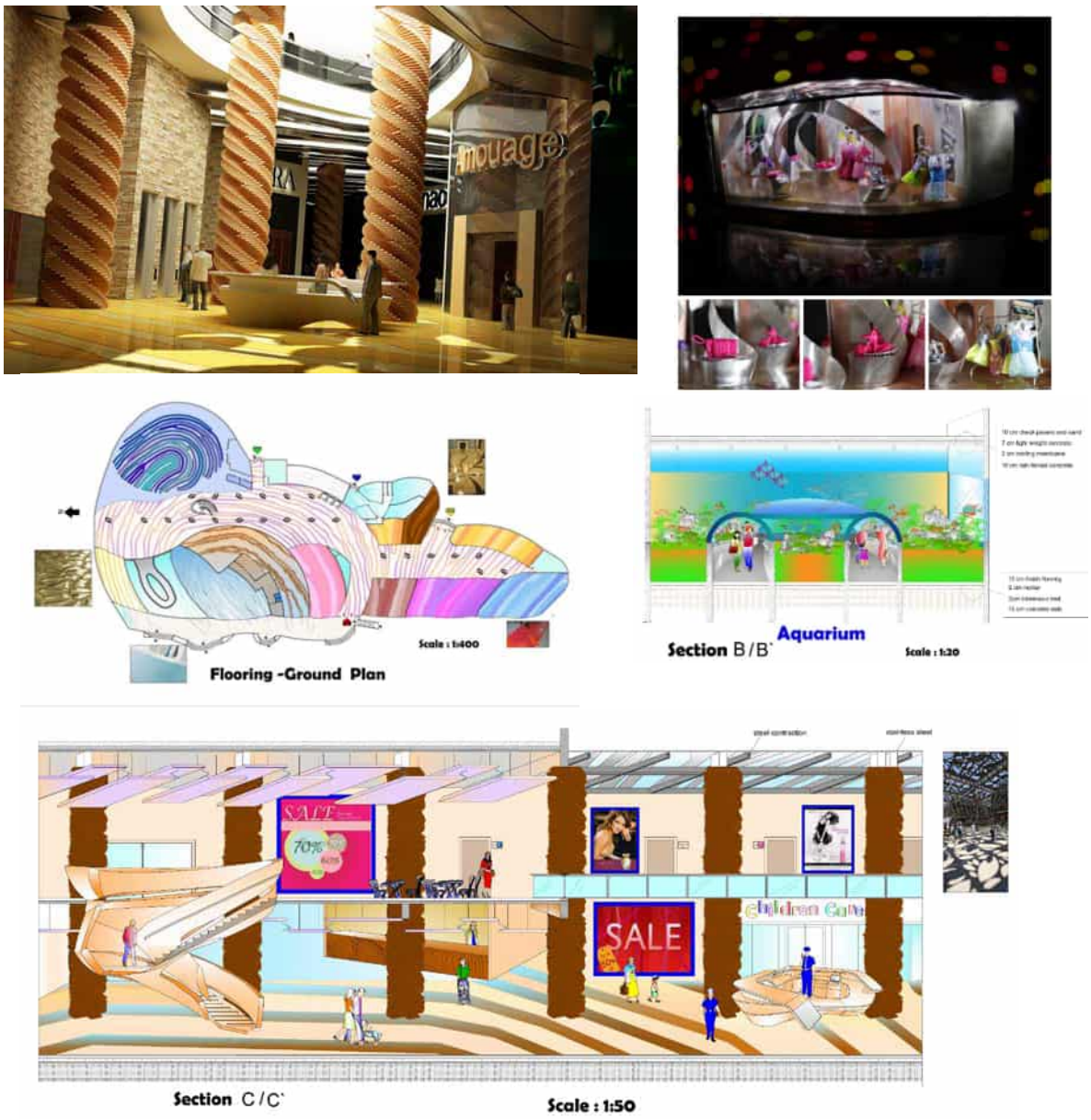

Figure 5. Some main features of the final project

5 CONCLUSION AND RECOMMENDATIONS

Since the interior design impacts the safety, health, and well-being of the people. The main targets of the interior design which are fulfilling the requirements of function, human needs, aesthetics, economics and ecology have to be considered in the thesis on education. Designing a convenient interior design ambiance necessitates following an interrelated disciplined and systematic methodology of research analysis, synthesis of data, and creating innovative designs through a retracting and cyclic process. Furthermore, linking the academic process with the global and environmental concerns like sustainability and ecology is an imperative current issue.

Finally, it is recommended for the future studies to generate computer models to help in the decision-making either in evaluating the weight of design criteria against the design

requirements or the design solutions against the project objectives at the form of decision matrix.

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PROMOTING GUERILLA ADVERTISEMENT IN PUBLIC SPACE

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Abstract

In the contemporary public space advertisement is part of everyday life of the modern society. Moreover, outdoor advertisement plays more and more an important role in shaping urban spaces. Aesthetic items are known as one of the most important factors in advertising, communication, social and cultural and even political, knowledge. During the past decades, especially in developed countries, unconventional and economic ways of so-called *Guerilla* advertisement gain popularity in the public spaces. Guerilla advertisement could be a meaningful tool to promote brands and also contribute to the image of the city and the urban space.


Source: https://i1.wp.com/blog.restaurantscanada.org/wp-content/uploads/2016/02/ChalkArt-Guerrilla-Marketing.jpg?resize=600%2C200

Source: https://i1.wp.com/blog.restaurantscanada.org/wp-content/uploads/2016/02/ChalkArt-Guerrilla-Marketing.jpg?resize=600%2C200

The aim of this article is: Firstly, to give an overview of existing literature about Guerilla advertisement and its effect on the image and brand of the urban space. Secondly, examples of Guerilla advertisement will be presented and evaluated according to their contribution to the urban space. Lastly, the city of Famagusta is going to be assessed in terms of Guerilla advertisement, its potentials and proposals will be suggested to promote the public urban spaces.

Keywords: Guerilla Advertising, Public Space, Famagusta, art and advertisement

Introduction

Urban spaces are one of the most important parts of social daily life. People spend time outside their houses in public spaces for many purposes such as gathering with friends, relaxing, watching other people etc. In an out of homes media such as outdoor advertising shape the city appearance and create the image of the city for the humans. (Iveson, K. 2011).

Apart from that advertisement even provide a platform for the human engagement. From this point of the view advertisement becomes important, even it contribute to improve the outdoor life quality. Therefore it can be stated, outdoor advertisement contributes to improve the urban quality and consequently enhance the Quality of Life (QOL). (Zamiri.M.2016) according to Kathleen Lloyd & Christopher Auld quality of life is multifaceted concepts that, through the “physical reality”, such as “the beauty of the environment and its components,” and “responding to the needs of humans”, develop into a person's mental state and become a pleasant experience. (Lloyd, K., & Auld, C. 2003)

It can be stated, the user satisfaction are place attractiveness. However, most of the researchers who study on the social issues and urban spaces believe that, the aesthetic of outdoor advertisement and effect of it on the public space engagement are not discussed. (Zamiri.M.2016) From this point of view, considering the aesthetics aspect and integrate with creativity from of advertisement in urban can draw attention from more user.

Apart from that, business owner can get benefit of advertisement to promote their product. Logically a creative advertisement could be more effective than the typical advertisement and even it can be persuade customer. There are different solutions available; however one way to attract customers is to give them memorable experience about the brands by using guerrilla advertising.

Guerrilla marketing is inspired by guerrilla warfare, which is characterized by irregular warfare based on small strategic tactics being carried out by armed civilians. The first time JC Conrad Levinson published a book titled "Partisan Marketing" in 1984, which he introduced the methodology, focusing on how a small company could compete with larger companies with low budgets. (Levinson, J. C. 2007). Guerrilla advertising is an unconventional approach in carrying out advertising activities based on a very low budget. In fact, Gorilla Marketing is an irregular advertising form to maximize results by employing minimal resources by innovating, breaking rules, and searching for alternative strategies for traditional marketing methods.

This article tries to give a briefly overview of existing literature about Guerrilla advertisement and its effect on the image and brand of the urban space. And in the next step give some examples of Guerrillas advertising will be presented and evaluated according to their contribution to the Famagusta as a university city.

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Urban design and outdoor advertising

Today, in most cities, you can see the trace of events and historical periods.Since the neighborhoods and contexts of a city have not had equal opportunities and growth factors over time, there are clear differences in the image of the city. While a healthy and developed city is a city that grows, develops and creates new spaces, establishes a logical and coherent connection between those spaces and maintains and strengthens the integrity and identity of the city.

Thus urban design is one of the topics discussed in this paper, is seen as a aesthetic process here. Urban design is not new process. There has been a lot of old-fashioned debate about the public space, and as soon as humans emerge from private space and put into public space, the presence of urban design begins in his life. The difficulty of predicting the future requires that urban design be flexible, adapt to movements and fluctuations and make decisions, modify and tolerate tolerance. (Carmona, M. 2010)

This development is a dynamic and continuous process in which the physical limits of the city and its physical spaces increase in terms of quantity and quality in vertical and horizontal directions. Of course, if this is a fast and unplanned process, it will not lead to a proper physical mix of urban spaces and will put urban systems in difficulty. (Iveson, K. 2011, p.3)

Carmona says in his book that “An important distinction is between urban design as direct design (place making) and urban design as indirect design (place design) or, more grandly, as political economy.” (Carmona, M. 2010. P, 5) and then adds that “urban design maybe concerned with first order design process”. Carmona, M. 2010. P, 6) But this paper try to fuscous on urban design as a second order design process (place design).

The title "urban landscaping" is used in urban design about the historical, intellectual and practical flow that began in the late nineteenth century. (Relph, E. C. 1987) In the first designs of urban aesthetics, the visual and artistic quality of the urban environment was enhanced by the use of memorable elements and spaces. Today, beauty is the process of artistic creation and promotion of quality of life in the urban space in which the artist exposed the culture, values, and beliefs of society to the public. In addition, the emphasis is on enhancing the quality of the environment and public spaces to facilitate social interaction and consolidate the city's physical identity and the social identity of the citizen. In this regard, the process of beauty is to organize, upgrade and restore places, passages, fields and historical and cultural reminders. From this point of view, various types of visual arts,

volumetric works, wall paintings, outdoor advertisements and furniture in urban spaces are used in addition to the expansion of citizens.

Guerrilla advertising

Raymond Williams in his book "Advertising: the magic system" explained which outdoor advertising is one of the most powerful and, at the same time, the oldest advertising methods and belongs to the traditional advertising group. (Williams, R. 2000) Based on my observation outdoor advertising uses physical elements to attract viewers such as billboards, bus stops etc. since these ads are installed mainly in crowded locations, and they take automatically the attention of the users of those spaces. Therefore, an appealing and innovative design approach can catch audience as well as create pleasant outdoor environment. With the help of attractive outdoor advertising, you can easily brand and present your products to the audience. By increasing the amount of exposure to these promotions, the sale of goods will also increase. Because targeted advertising encourages them to buy them by influencing their emotional decision-making. Therefore, it is possible to say that the more creative and attractive advertising it is possible to increase the sales of the desired product. (Aidan Kelly, Katrina Lawlor & Stephanie O'Donohoe, 2005)

Let say, each type of advertising that is performed outside of the home and informs about the products and services provided by a business is outdoor advertising. Outdoor advertising, due to the ability to get understanding of the subject for many audiences, allows the message more than once to attract the attention of many audiences. Have you ever heard of guerrilla advertising? Perhaps you have heard that some company did guerrilla advertising in town or country.

Today, if we talk with marketing and advertising advisers, they will tell us without a doubt that traditional advertising does not work well and it does not have to be effective. They will tell us that we should go to creative advertising, ads that attract the audience. Creative techniques in advertising are tools used to attract attention, create mental conflicts, and change people's attitudes and attitudes, in order to ultimately be able to convey their brand or product message to the audience. (Reinartz, W, &Saffert, P. 2013) The goal of guerrilla marketing is the same.

According to Megan Wanner Guerrilla advertising is defined as a "creative, non-traditional and many times interactive type of advertising that is typically a low-budget production."(Wanner, 2011, p. 104)Levinson in his book, Guerrilla Marketing: Secrets for Making Big Profits from Your Small Business. In other words, Guerilla advertisement could be a proper and cheap tool for small and emerging companies to get attention and even help them get branded. (Levinson, J. C. 1994)

As it is going with the Levinson, big companies are using this kind of marketing and are able to create completely different and creative ads with low cost.(*Figure,1*) Guerrilla advertising is in fact the art of attracting the attention of customers and consumers, without any conventional restrictions in advertising and through creative means. This kind of advertisement usually enters the place where the audience does not expect it to take the

audience. This style of advertising, using simple and flexible ideas, is aimed at attracting audiences into their hearts, in contrast to the traditional and traditional ones, and at the expense of the lowest cost, it is the most profitable to gain. (Levinson, J. C. 1994)

Figure, 1

According to this definition, such a strategy, above all else, requires creative artistic ideas to move in the direction of unknowns and abnormalities. Guerrilla advertising can be described as the most suitable marketing tool for small, medium and growing businesses in today's world. The reason for this is the speed of impact, the flexibility and low need for this kind of advertising to spend and invest. In simple terms, guerrilla marketing and guerrilla advertising, in the sense of the effective use of unusual, but accessible features, are available.

Levinson explained that Guerilla advertisement has to apply the following strategy:

1. In guerrilla marketing, it's very important to first identify the exact audience of the audience and advertise just for the community.
2. It must recognize the media and select the media that the community has access to. It's even suggested in guerrilla marketing, creating a new media
3. In guerrilla marketing, the goal is to attract the attention of the viewer and the advertiser so that the person is attracted to your organization.
4. In guerilla marketing, the basis is based on creativity, and the more creativity in marketing and advertising, the greater the chance of success.
5. In guerilla marketing, teamwork is much more influential, and in order to be able to offer creative advertising and marketing, you have to form teams and use the mental storm to get ideas from team members. (Levinson, J. C. 1994, p5, 40).

The more creative the ads are, the more the brand's brand-name survival will help the customer more. Since innovation is the guarantor of the success of this kind of marketing, we see a huge variety of guerrilla advertising campaigns.In this way, marketing is used irregularly, but with creativity and innovation. It is a surprise to the audience, leading to a costly shift to traditional marketing efforts and, of course, reducing advertising costs. In other words, this type of advertising is an effective use of unusual things.

Guerrilla advertising knows the main attraction of the audience, therefore, by carefully identifying its customers trying to find out about their behaviors and their desires. It also

focuses on the culture, lifestyle and specific behaviors of consumers. With knowing the exact requirements of customers can create guerrilla advertising. Although at the begging only small American companies turned to this advertising strategy, gradually industrial giants also realized the effectiveness of these ideas and low-cost activities. Today, the design and implementation of guerrilla advertising activities is a constant element in the annual planning of advertising at the level of small, medium and large companies. (Hutter, K., & Hoffmann, S. 2011).

Also location is an important part of organizing economic and social events. Creating a creative environment for the city's economic success is vital. "The focus of economic strategies and policy has been on what a city should have in order to be or to become 'creative'". (Comunian, 2011, p. 1157) For this purpose, it is also important to understand what each city's main activity focuses on, in other words, the field of consumption of each region. One of the important factors in creating the city's attractions is the public spaces, including urban furniture, urban green spaces, modern residential centers, amusement spaces, large shopping malls, museums and cultural and artistic centers, etc. The proper organization and development of urban spaces, the beautification of the public spaces of the city, the redevelopment of seemingly desolate and dead spaces, in order to revive the old aspects of the literal context.

Unbound of the specific place is one of the advantages of guerrilla advertising. For example, advertising on the bus is one of the most effective and attractive type of advertising. Due to its intrinsic qualities, exposing millions of eyes to buses is a good place for outdoor advertising, or they can be called mobile billboards. In this way, because the bus is constantly moving around the city, it covers a wide area of the city and millions of viewers are covered by outdoor advertising and covers a wide range of contacts from the north to the south of the city and from the east to the west. In the general, any location or device at the city level can be used for guerrilla advertising, but in unusual and creative way. Advertising will have a positive impact if it is unique, and it will advertise among other advertisements. Of course, there is a unique brand identity. In the opposite direction, you will lose your audiences.

Proposals for Famagusta, Salamis Road

"The urban landscape can be conceived as a palimpsest comprising identity elements specific of each historical eras, genuine heritage that transform this inheritance in urban system heritage" (Vâlceanu et al., 2014; Neacşu, 2009) "Scientific research on urban landscape and advertising was oriented towards analysis of urban image as a urban palimpsest and a key component of the residential environment quality"(Vâlceanu, et,al.2016) In order to create a positive impact on the customer, advertising must be designed and implemented in a correct and logical way.

(*Figure, 2*)

Famagusta (Gazimagusa) is a small coastal city in Northern Cyprus with a population of around 50 000 inhabitants (DPO, 2011). (*Figure, 2*)Even though it is a small city it gets attention as University City with the establishment of the Eastern Mediterranean University in 1979. With a student population of more than 18000 students, the university and the students are the major economic force as well as consumer in the region. Therefore, the students have to be considered especially in the use of outdoor spaces and advertisement. As Famagusta is a university city and the student population in this city is high, most of the companies are relatively small scaled. So, this article tries to suggest the guerrilla advertising as an influential way in advertising.

(*Figure, 3*)

Famagusta has a High Street Salamis Road along where those main economic activities are taking place. The High Street is the main artery connecting the university with the residential part and the other active spaces of the city. Currently, advertisement along the Salamis Road is very traditional and modest. (*Figure, 3*) In order to catch attention of the users the author has suggested some additions on specific locations in front of frequently used leisure and shopping facilities. One addition could be in front of a well known restaurant “coffee mania” and shop store ‘Access “where a low budget cost installation was constructed. (Figure, 4, 5)

Figure, 4, 5

Conclusion

In contemporary advertisement, guerilla advertisement is a popular way of out- door advertisement. On one side guerilla advertisement is a reasonable tool especially for small and new established companies to advertise their products with small budget and effort. The ads can be easily and fast changed. On the other side they are effective tools to be considered for enhancing and creating pleasant public spaces. Guerilla advertisement is especially an important tool to catch the attention of younger generations. The paper has addressed some examples of guerilla advertisement from diverse countries and locations. In more detail, it has chosen a busy street in the city of Famagusta to propose some installations in specific locations. The Salamis Road is an important street where most of the economic and social activities of the city are located and it is mainly frequented by students of the nearby university. It is believed that the proposed outdoor advertisement could enhance the space and also promote products at the same time.

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TRACING THE POTENTIAL OF SELF BUILD AND PREMODERN ORGANIZATIONAL LEGACIES ON THE NORWEGIAN WEST COAST.

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Abstract

The Norwegian state has pursued home ownership as a key cornerstone of its political agenda since WW2. In the premodern era as the early state formed, the rights of tenant rental farmers were very close to those of freeholders suggesting that resource inequalities have been extremely low for much of the past centuries. The absence of nobility or ruling class and the sale of Crown land in the 1660-70s redistributed much of the nation's useable land and its associated resource wealth before a middle class was established. In the past century ideological economic policies have secured a cheap money supply for housing loans throughout much of the past seven decades, and this has had the effect to inflate housing prices and steadily increase the debt threshold for first time buyers. Furthermore, aspirations to improve the technical performance of buildings in the past decade place further upward pressure on the cost of new dwelling construction. In this article we investigate the context and characteristics surrounding two generations of timber construction found in the West Coast of Norway, firstly in the premodern period through Grindbygg and Stav methods and in the 20th century to two examples from Depression and Post-war Self-build projects in Bergen. Discussion responds to the social, economic, urban and architectural contexts that emerged from these built forms and questions how these examples could be relevant in the contemporary search for new housing models that offer alternatives to the costly market for first time buyers.

Keywords: Self-build, housing, vernacular, property, first time buyers, home ownership

1 Introduction

My mother[1] was born in Bergen in 1955. Her first years she lived with her mother, father and two older sisters in a one bedroom flat in one of the many small wooden buildings that at the time formed the outskirts of the city centre. She and her sisters slept in the living room, the mother and father slept in the kitchen. A few years later, through considerable efforts from the state, the municipality, the local community and my grandfather and grandmother, the family lived in a rather spacious row house in one of the new suburbs in the city, Landås. A

[1] The family mentioned in the text is the family of Joakim Skajaa, one of the authors.

house that was partly built by my grandfather and their future neighbours themselves. Many years later these houses that once were part of a concerted effort to give the residents a chance to move out of the tight living quarters of the inner city are now part of a leafy and attractive neighbourhood where houses are selling for record prices, converting that initial physical labour to considerable assets.

In this article we are investigating firstly the circumstances and history around this small development of row houses. Through looking at the original writings of the architects developing the self-build houses, the current public discussion as well as placing them in a historical economical political perspective buy examining the housing politics through social and humanist sciences. Secondly we look back to the formation of the early Norwegian state and the tenant and freehold farmers in terms of their rights and the construction methods that were prevalent in the West Coast. Thirdly we are discussing the potential of Self build and its relevance in the contemporary housing crisis. In the article we make use of contemporary sources such as building application, archive documents, newspapers and other magazines as well as research into the history and specific economy of the Norwegian housing market.

Figure 1. Dense housing area in Bergen, 1957

2 Self-build houses during the depression in Bergen

Leif Grung, a well-known contemporary architect in Bergen at in the early 1900s. writes about self-build. In his text about how the self-build system is being used in Bergen [1] he writes that not long ago most people would be able to build their own houses. He then goes on to note how in current time, this is written in 1924, this man that is able to build his own house is lost to a more educated man in a more specialized and in his view authoritarian system. He still lauds the development of a special self-build system in Bergen, led by the *Self-build committee.* The idea of the model, described by Grung is that the future resident use the

promise of his own labour as a deposit on the house as well as reducing both the need for capital and the overall cost of the project. The work done by the future resident is given an agreed value that in this case was set to 1600 kroner [2] which would amount to about 38000 in today's value. The residents would also pay a one-time fee of 1500 (38000, 2017 NOK) The rest of the 13.600 NOK (325.000, 2017 NOK) would be given as a long time loan from the municipality.

Figure 2. Self-build colony at Nymark. Leif Grung, architect.

Grung continues [3] to write about how the houses where planned as simple, barrack like, buildings where the interior was left for the residents to complete themselves and variation was to be provided by the use of different door types and colours. After a cooperative effort on foundations and main construction work the residents themselves finished the houses. The work done by the residents themselves included interior walls, floors, ceilings, interior doors and painting as well as exterior levelling, fences and gates. Grung devised a strict plan based on two types of houses, one measuring 5x8 metres and one measuring 5x10 metres. He also proposed to build the houses using timber frame construction to let the resident not only build the interior but also decide the placement of the interior walls and consequently the planning of the house. At the time a solid wood construction was more typical in Bergen and the municipal building committee initially opposed using this construction method. In a later description of the project [4] he talks about how the residents have changed the composition of the houses for single family houses two houses with two apartments, giving the owner income for letting out one of the apartments. Showing how this flexibility is not only related to plan type but also the resident's economy.

In 1924 Peter Sæterdal, head of the self-build committee, writes in a report to the housing director [5] that the houses has become more expensive than expected but that it's not a problem since they are able to provide cheap loans for the residents. He goes on to describe the joy and hard work among the residents and notes how also the women take part in the building process. His only concern is that to keep building they are dependent on loans from the housing bank and he asks the housing director to set heaven and earth in motion to give the bank the necessary funds to finance self-build initiatives.

Figure 3. One of the row houses

In 1934 there is an open letter in the newspaper [6] claiming that the houses in the end was much more expensive than promised, that the cellars are leaking and the chairman of the self-build committee is corruptly filling his own pockets.

In 2017 one of the row houses in the self-build colony was put on the market for 3.790.000 NOK. [7] Many families feel the original house where to small and the have been extended to attics and basements and towards the rear gardens.

Figure 3. Row houses in 2017 with changed appearance due to changes and additions.

3 Political economical background of self-owning and self-building

Norway is unique in its housing history, and in extension why the self-build was a part of the architectural culture and heritage in Norway. In the premodern era in the 1600s and 1700s Norway was unique in a Scandinavian and North European setting due to the percentage of farmers owning their own land and especially owning their own house. 90% of the Norwegian population lived in their own house sometime during their lifespan in the 17th and 18th century. Several factors contributed to the land being self-owned. The topography, geography and climate made it inefficient to create larger agricultural entities. The fact that it was a vassal state to Sweden or Denmark made the aristocracy very small. In spite of the high mobility in the Norwegian society there were almost no building built to lease or rent during the same time period, creating a very specific tradition and culture for owning your own house in the Norwegian society. Many of these houses were also self-built or self-rebuilt at different sites as much of the built fabric at the time.[8] Grung, in his text also alludes to this shared knowledge of house building.

During the urbanization due to the industrialization the Norwegian cities started to grow. As the rest of Scandinavia this urbanisation happened later than the rest of Europe. For the first time in Norwegian history a substantial part of the urban population became renters instead of owners of their own house. Several philanthropic projects for housing started very early in this urbanisation in the 1850s and housing became a political issue both because of

sanitary concerns and concerns of productivity. It was also a reaction to the political turmoil in the rest of Europe 1848. The first philanthropic housing projects became institutionalized in coops later during the 19th century. Coops that became models for self-building-coops later during the 20th century. In the period in-between the two world wars there was a shortage of housing in the cities that was partly mitigated by private developers and a very small part of the housing was built by the coops. [9]

The foundation for the self-building was established after the second world war. The social democratic government early announced that all Norwegians should own their own house. Several policies were developed to facilitate this. First a state owned housing bank was established in 1946 - Husbanken. This bank gave mortgages to all citizens to buy or build their own house. The municipalities were allowed to buy farmland close to the cities and zone the plots for housing, the municipalities was also allowed to sell the plots to subsidized prices (or donate them) to housing-coops. The different housing coops both small and big, professionally building or self-building was the big providers of new housing during the 50s-70s in the cities. Outside the cities it was more common with detached housing funded by the Husbanken and self-built. [10]

In the cities parts of the buildings could be funded by the Husbank, a part of the house had to be financed by the buyer. By self-building one could put in hours instead of financing it with monetary funds. This agreement with the Husbank and the municipality functioned until the late 1970s early 1980s when the market was deregulated and Norway became the one of the most liberalized housing markets in the world.[11] This liberalization together with an increase of wealth in Norway have created a commodified housing market were the buyer could be seen as detached from the housing. [12]

4 Early State, Rights and Simple Log Construction

"...the underdevelopment of Feudalism, and especially the absence of personal serfdom of the peasants were the causes of the early liquidation of large landownership in Norway (earlier than in the majority of European countries). There was no need for a bourgeois revolution in order for transition to a state and social system of the modern type to take place." [13]

The peripheral location at one edge of the European continent, a weakly resourced Monarchy, alongside an inhospitable geography that dispersed settlements around a seemingly endless coastline secured key freedoms for the inhabitants of the early state. Gurevich (quoted above) notes that the geography being so challenging meant the subsequent rulers, whether Norwegian or Danish Kings were limited in authority and the establishment of nobility or other class systems that are typically formed in the transition to a mature state were mostly absent. In light of this we would claim that the low level of inequality began very early in the history of the people.

Sars (1858-1865) identified that in the 12th century 25% of those working on the land were freeholders and the remaining 75% tenants.[14] Holmsen questions the face value of these figures as even at this point concessions pertaining to leases for life, inheritability, and taxation often entitled the tenants to similar set of concessions to the freeholder. The hybrid structure of the early land management with often part ownership. [15]

Retracing further factors that effect to inequality, is the moment of the sale of Crown lands. The Crown sale around 1660-70 saw vast swathes of land properties sold at prices related to old tariffs paid by the inhabitant tenant. As the productive quality of the land and associated resources were considerably higher this could be considered as a redistribution of wealth in landed property to the broader population. Gurevich notes that in Western Norway the percentage of peasant freeholders increased dramatically following the land sale between 1661 and 1835, from a range of between 15-35% to 55-75%. He adds that these figures are representative of all the surveyed regions aside from Northern Norway and the Earldom of Larvik where levels high of indebtedness and the interests of aristocracy made ownership unappealing or impossible.

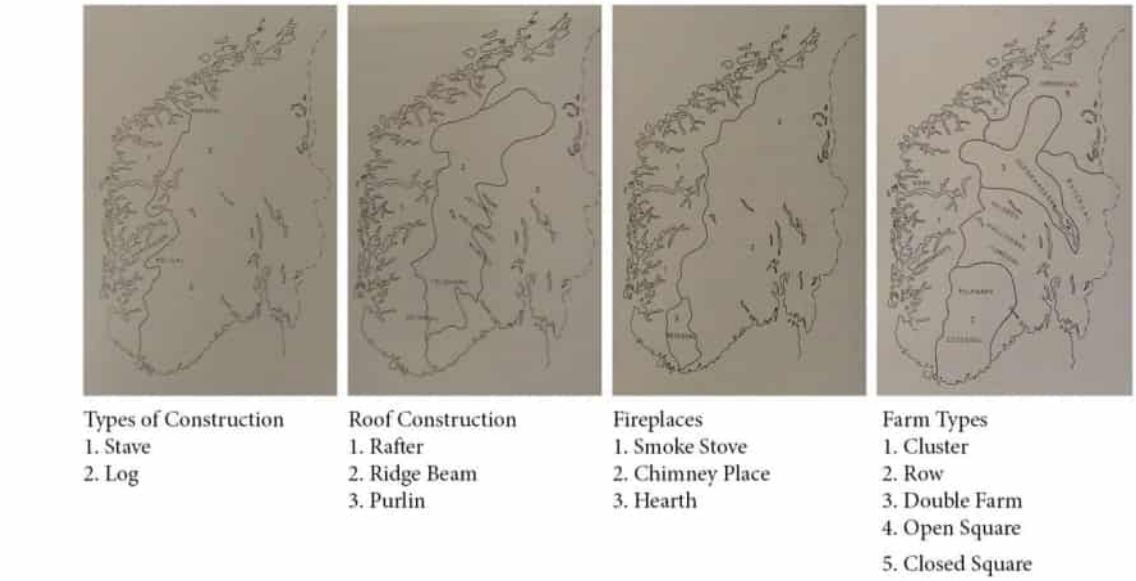
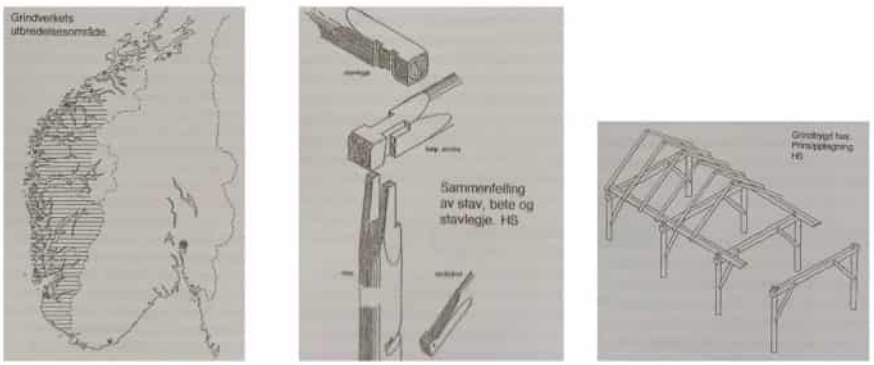


Figure 4. Maps showing construction types, roofs, fireplaces and farm types..

Regional variations of built form persisted throughout the centuries evolving locally and hint at both iterative evolutions but also that these were also adaptations to local conditions where buildings were situated. [16] Our discussion focusses on the Western regions and the research mappings of Bugge and Norberg-Schulz identify four important configuration variables. Our West Coast field of interest holds that the dominant form of production as Stav construction that utilises Purlin roofs and Smoke Stoves for fire. Similarly the constellation of Tun settlements (groups of smallholdings often sharing resources) were in Cluster formations that appears in response to the challenging fjord conditions where space was very limited. It would not be until the 18th century that industrial production of building materials would reach Norway, following their introduction they quickly supplanted the earlier production of hand made, and locally sourced forms.



Grinbygde Locations

Construction Joint
Post with Double Pin
Notched Beams
Cross Support

Typical Construction
of Trestle Frames

Source: Stav og laft., Norberg-Schulz, Bugge.

Figure 5. Diagrams showing Grindbygg locations and construction principles.

Similarly to the Stav constructions, another important subcategory of solid lumber structure is Grindbygg, a simpler type of trestle log frame that uses a post with a two pinned joint to lock together three log elements in three axis. Schjelderup estimates that constructions have used this method in the West Coast for 3500 years and they bare close likeness to the structures longhouses archaeologists have unearthed. [17] The simple construction has been used for various building typologies, but within the past century occasional examples of new housing continues to be built utilising this structural framework. In both the case of the Stav and Grindbygg constructions we note that the base of the structure is resting on vertical posts. Considering the extremely damp climate the ability to create overhangs and keep water off the structure makes it a more suitable choice than horizontally orientated log or Laft timber structures often found elsewhere in the country. In any case, the ability to fashion the often locally sourced lumber directly with basic hand tools is pertinent and identifies a long lineage of self-building.

Self-building at Landås

Figure 6. A group of self-builders taking a break.

Sometime in the early fifties my grandmother received a letter in the mail from the government informing her that she had been selected to be part of a self-build association at Landås. [18] The story of the letter is part of the family history, but difficult to corroborate, but through our research we know that there was a selection process for the new areas based on individual's needs. Until the end my grandmother always used to say that it was the Gerhardsen, the important post-was Labour prime minister that made the move possible.

The area of Landås was long planned to be a development area for the city. After the first world war the land was bought by real estate developers, planning to build housing in the area. It was only their later bankruptcy that put the area in the hands of the municipality and made it an important area for socially oriented housing development in Bergen. [19] The lower parts of the area – that is the south facing part of a mountain – is dominated by larger housing developments built by the municipality and larger housing cooperatives. It was decided that the upper area was to be developed by self-build groups It was at the time undeveloped and without roads. The area was developed by building a range of single family houses, row-houses and spilt houses.

The selection of families was based on criteria such as lack of proper bathing and toilet facilities. My grandmother went to an office in the city, paid a small sum, and was part of the association. As she told it the association was deliberately put together to include people with a wide range of skills from carpenters and electrician to engineers and solicitors. Providing for the neighbourhood the added advantage of a certain social mix. Most of the future residents were ordinary workers, like my grandfather, who was a printer. The future residents contributed to the building in the weekends and the value of their work were subtracted from the cost of the house.

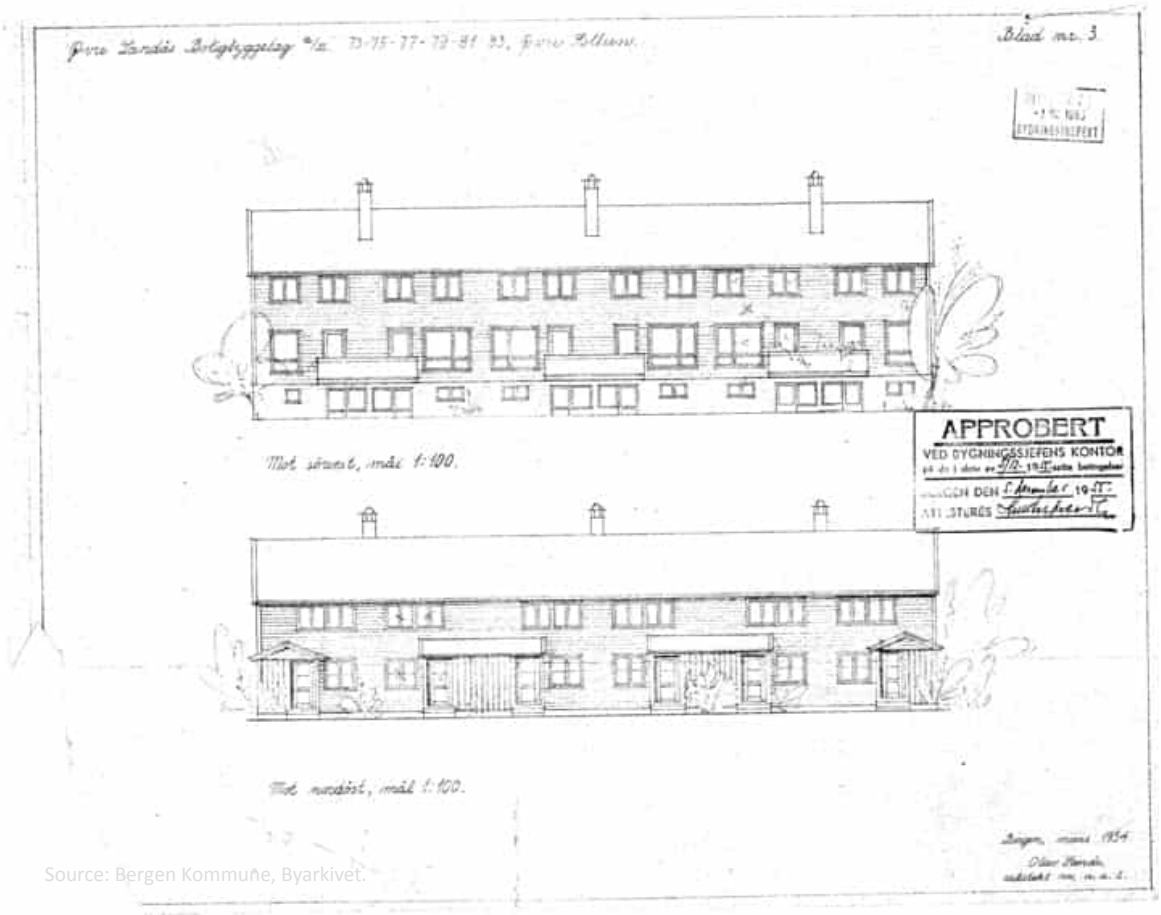


Figure 7. Øvre Sollien 73 -83, elevations.

The whole area was set up as a self-build area with a mix of row houses and two-family houses. While the right to take part and build was granted on an individual basis there were also areas where groups of workers from one business worked and built together.[20] A map in a local history book [21] lists 30 self-build associations in the area with groups ranging from police and military to bank workers and architects.

Workers from the local brewery, Hansa, built one row of houses and their efforts are well documented through their own company newspaper, Hansa-posten. [22-23] In several articles in the magazine the efforts of the builders, the new houses and the community they become part of are described in glowing terms. It is interesting that several of the articles mention so strongly the idea of the collective that is being created, but also the need for privacy. One of the groups were supposed to develop also the garden together, but as they say, after two years working together they decided to do the gardens by themselves. The Hansa houses were supposed to be owned collectively by the association but in the end was owned by the individuals. This was the model for many of these developments – a collective effort, supported by the municipality and government through the housing bank to develop and build, followed by a private ownership model.

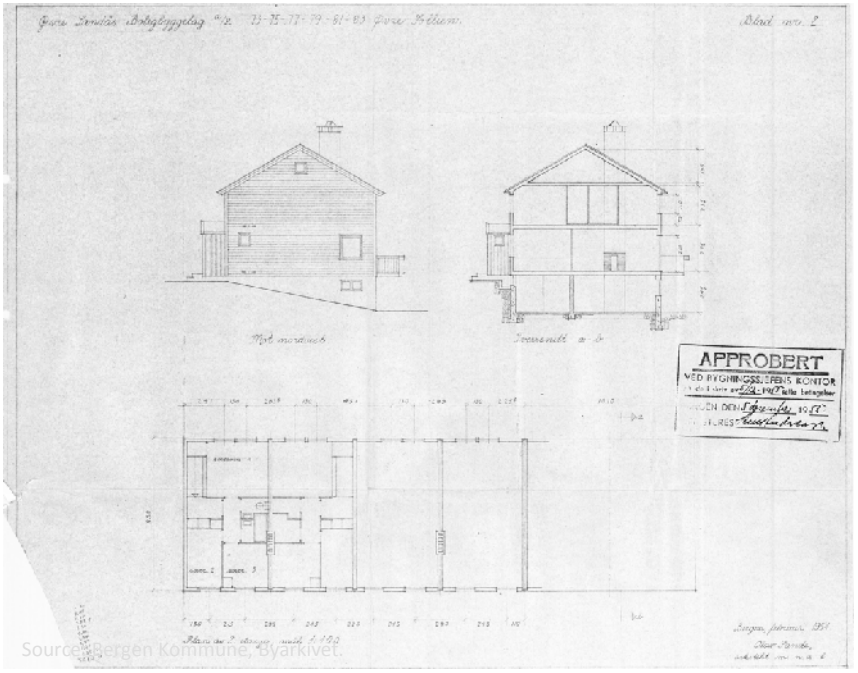


Figure 8. Øvre Sollien 73 -83, plan and section

5 Relevance for our time

It is clear from our studies that self-building, has a strong historical precedent on the west coast of Norway founded on a mix of historical, technological and economic contexts. It's interesting to see how, in the depression era and post-war era the idea of self-build as a method was used in a series of attempts to alleviate housing shortage and giving a more diverse group of residents access to the housing market at the time.

It is interesting to note how already at the time there was a fear that advances in construction technology, the need for safety and regulations as well as the move away from a society based on manual labor to a society based on knowledge would make self-build initiatives redundant. It is also interesting to note how contemporary writing on the projects describes the strong communities that form based on the collective efforts of the self-build housing areas.

Ideas of self-building and other cooperative models have gained a certain traction in recent years resulting in a range of built and unbuilt projects in Europe. In Norway there has been some interest few results. In a discussion of the possibility of self-build in Norway it is therefore interesting to discuss if we could, in addition to international examples, learn from our own precedents. From looking at the projects in Bergen we have found three key issues that we think need to be considered and where insight can be gathered from the historical precedents.

The first issue is that of technology. Construction technology and the more and more complex regulations that govern building in Norway make self-build projects challenging. But as we have noted, this issue is not new and was already central in the developments of the projects in Bergen. Different strategies was developed to bridge the gap between a complex construction process and a less experienced self-builder. Strategies such as the inclusion of skilled laborers in the projects that functioned both a type of foremen in the coop, division of work between more complex and critical work and work that could be done by the resident him or herself and as in the case of Nymark the development of construction technology that makes it easier for un-skilled labor to take part in the process.

The second issue is that of economy. It is interesting to note that the self-build model in Bergen did not have cooperative or shared housing as it product. In both the projects we looked at the work started as a collective effort but in the end, and often prior to the completion of the houses, the properties were divided into individual lots so that the self-builders was owners not only of a home or possessors of a right to live, but also owned the land the house stood on. In some instances the land was divided and there were given individual land leases from the municipality. We have also noted how a key element in the model was that the self-builders effort was given a pre-set value that could be counted as an investment in the building. This means that the self-builders effort is not only a way towards a cheaper building in the end but also provide a way to cross the most challenging hurdle for those on the outside of the Norwegian self-own housing market. That of the need for capital. We think it is a relevant question if a Norwegian self-build model should align more closely with the self-own housing economy.

Another issue related to the historical precedents is that of community. It is clear from the sources that strong communities where formed during the construction process. Many of the residents in the projects we have been looking at was, gently, moved from their current neighborhoods because they were deemed unsafe and unsanitary. In many cases this type of move would generate a host of problems but this doesn't seem to be the case in this instance. We could hypothesize that new and strong communal bonds were formed during the construction process that stuck in the new neighborhood.

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SPACE PEDAGOGY
- RESPONSIVE ENVIRONMENTS FOR LEARNING -

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Abstract

The generational changes in the 21st century rapidly cause fundamental shifts in pedagogy, therefore in the built structures designed for learning too. A wider variety on the range of open/communal and closed/personal spaces has been introduced in school designs all over the world, nevertheless there is a strong conflict between the lifespan on the built frames of education and the almost continuously changing pedagogical methods.

The paper introduces the widening range of school architecture, with the critical analysis of new typologies in the recent past. The research focuses on new learning space strategies, where spatial perception and construction as learning tools widen the school environment into urban scale. The built and virtual environment gradually become alternative educational platforms models, which are integrated in the frequently renewed curricula, resulting in a need for new design approaches to achieve responsive environments in school architecture.

Keywords

Design, Learning Environment, School, Space

1 School and Community

Due to the pedagogic revival of the past decades, schools have started to develop into urban centres that operate way beyond learning [1]. Instead of the workplace-like technology which has been separated from everyday life, they have moved towards their students' organic integration and prosperity in life again.

Based on the widely accepted *re-scolarisation* tendencies, futurology predicts the dominance of the *"under one roof"* principle, which states that "the educational, cultural, leisure and sport functions would be under one roof; therefore the school would host activities people pursue outside their apartments from the age of three until their death." [2] One early example of these trends is Oulunsalo-talo in Finland, where the new secondary school had been designed to integrate certain urban functions (e.g. auditorium, cinema), which are available for the students during the day. The terms "open school" and "educational centre" represent these schools as public spaces that appear as real alternatives to the economically unsustainable institutions of general cultural centres.

Figure 1. Oulunsalo-talo (or Oulunsalo lukio), Oulu, Finland, 1993 by Ilpo Väisänen (photos: Sampo Anttila, Creative Commons)

Over the course of history, learning individually and within the family was the basic pattern [3]. School already worked as a transitional space between family and adulthood, where parents transferred their responsibility of raising their children [4]. The birth of public popular school was initiated by the founder of the Piarist Order, St. Joseph Calasanz at the turn of the 16th century. The privileged situation of the educated ceased to exist, the so called "Pious School" (*Scoule Pie*) developed skills of all social classes and became the fundamental institution of European education.

A significant milestone of returning to Calasanzian roots is reflected in the dual school model of the Danish polyhistor, N. F. S. Grundtvig in the beginning of the 1800s [5]. Functioning in parallel to the academic system, the fundamental goal of his so-called *"Skolen for livet"* (School for life) education idea was the preparation for life in the community and the family. The folk high schools operate typically as the cultural centres of their community and open their doors for local citizens for both school or city events as a receiving institute. This mentality is progressive not only as a social model, but also has an important role concerning the sustainability of the institute. Considerable sums derive from the rent of different functions (sport, auditorium, restaurant) and contribute to the economic operation of such schools. The fact that the pupils can come to a school which is an integral part of urban life and not only for their classes and extra-curricular activities allows that they are less exposed to the non-realistic abstraction of learning, the almost virtual space of school, which has become generally accepted, becoming out of touch with everyday life.

As a next step of spatial structures, following the pedagogical evolution of the last century, one can see radical changes in the architecture of schools as community centres. A significant segment of this revival derives from global social motivation. In the settlements of the developing world, western willingness to help appears through healthcare and education. Schools are built here to involve the entire community and serve its holidays and everyday life. These buildings are places to meet at social occasions, they operate as the animating heart of the community – and this model slowly finds its way over to European thinking, which also turns towards the respect and honour of each other after the conflicts of the 20th century.

The Pani Community Centre, a small-scale building complex in Bangladesh serves as a good example of transitional spaces and the application of a wide range of intimacy, while the spatial structure is easily decoded by the different user groups. The shop and warehouse organised around the agora-like open court serves every inhabitant; the adjacent semi-covered spaces for various purposes organically connect to the workshop rooms for smaller groups. The closed world of classrooms is in a separate mass, together with their service rooms. Rich versatility appears both functionally (private/intimate spaces – rather private/intimate spaces – rather community spaces – community spaces) and spatially (closed

spaces - in-between spaces - open spaces) in this building, accepting everybody and acceptable to everybody.

Figure 2. Pani Community Centre, Rajarhat, Bangladesh, 2014 by SchilderScholte Architecten (photos: SchilderScholte Architecten)

In parallel to the spread of examples of social architecture, sustainability efforts of the western world have shifted the preferences of decision-makers and architects of educational buildings towards similar solutions. In case of universities, it has not been unusual for a long time to open certain special spaces (library, canteen, hall, exhibition space) and invite the public into their buildings, but this has appeared at all levels of education by today. Moreover, the names of educational institutions have also started to reflected these changes, such as in the Finnish Kastelli Community Centre, which involves a primary and secondary school, a library and a sports centre.

Figure 3. Kastellin Monitoimitalo, Oulu, Finnország, 2014 by Lahdelma & Mahlamäki (plan: Lahdelma & Mahlamäki, photos: KUVIO, Pekka Agarth)

2 Development and Interaction of Pedagogy and School Space

In the domain of education all over the world, the recent decades have seen the focus of pedagogy shift towards approaches that support the entirety of life and holistic approaches, currently approaching the desired process of complex personal development through interdisciplinarity. In consequence of the extreme technological development, everybody can have access to lexical knowledge through a device in the pocket, which brings skills that enable us to independently organise and assess this set of data into the front. Development of a realistic image of the self, the ability to cooperate in social relationships and in the community, active citizenship, fundamental social and cultural awareness and environmental awareness are the priority development tasks to facilitate individuals who are capable of orientating, forming their own opinion and acting independently.

Architecture - while it served actual needs over the course of history - can be interpreted as a spatial model of the different cultures and periods. Educational buildings faithfully reflect the expectations of society from educational institutions starting from the Greek *gymnasion*'s spatial structure with its yard, church and theatre for physical, spiritual and intellectual

education. The European schools of the 19th century met the demands of a society created by the industrial revolution: preparation for industrial work. These buildings were used to teach precision, discipline and working ability and consisted only of the classrooms and a long, narrow corridor that connected them [6]. Regardless of the radical social changes, this spatial model of a 'good school' has survived until now. The beginning of the 20th century saw the emergence of pedagogical ambitions discontinuing to treat children as miniature adults, but the efforts to apply modern learning methods in modern spaces and make the school an integral part of life appeared only in the later eras of reform pedagogy. The classrooms had been opened and became similar to workshops, and the silent 45 minutes spent sitting, as required by frontal education, has been replaced with learning that is active both physically and mentally, based on experimentation and doing. However, such efforts have not transformed mass education yet, and it still follows its two hundred years traditions.

In the 1960s and 1970s, due to the third phase of reform pedagogy, one could expect significant changes in the built environment for learning all around the world. Architectural journals of the time were full of new school buildings [7]. These examples include schools that operate with the further-developed versions of circulation areas, but also solutions that demonstrate a path of development parallel to international school architecture through the use of small private courts connecting to classrooms, volumes constructed on the basis of the modern examination of sunlight. In certain countries we can see more significant changes: school models with fused learning and community time emerge. The spread of single storey schools represents a new pedagogic approach which oversteps the walls of the house and uses the spaces of the yard as almost equivalent learning surfaces in harmony with the natural environment. The school of Hans Scharoun built in Marl is a spatial revolution reflecting pedagogical changes: each item of the clusters of classrooms organised as smaller schools, which demonstrate minor differences in each age group, functions as a small apartment with its own hall and court.

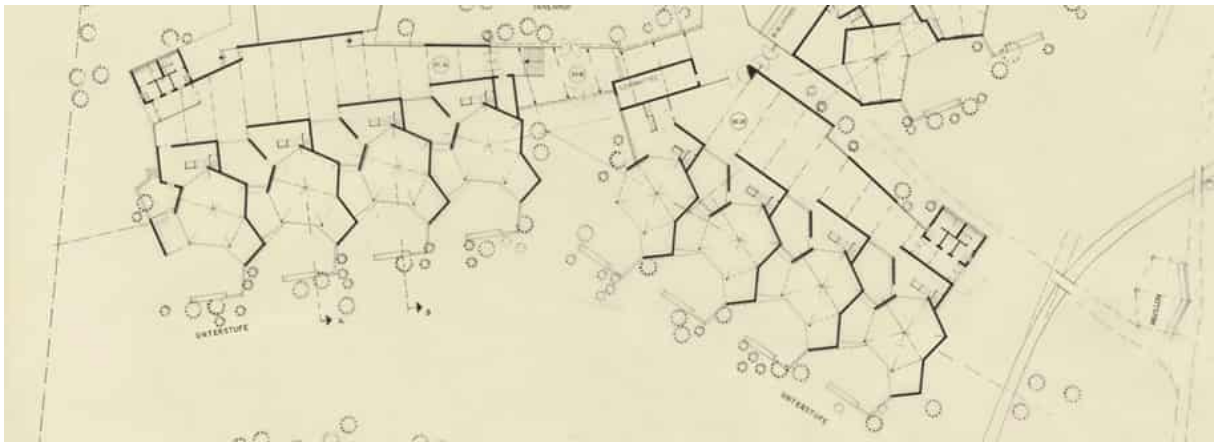

Figure 5. Haupt und Grundschule, Marl, Germany, 1960-1971 by Hans Scharoun (plan from *The Architectural Review*, 2012.10.)

Based on the development of the typology of "conventional schools with community circulation areas", Tibor Tánczos gives a detailed and accurate picture about the last century of school architecture in his doctoral dissertation [8]. He starts with the first changes by the broadening of the hallways and touches upon the appearance of a social core due to the expanded hallways, the principle of "school in the school", applying a spatial structure broken down into smaller groups, typically age groups, the learning studio operating with complex

classroom units, the open-space school which is separated only by its furniture items and is a fabric of freely used spaces, the learning house based on the classroom but going beyond it. These characteristic spaces show a development that allows the perception of the dynamics of life within them and the pedagogical opportunities they offer, but one can also identify their limits: the more open and free any space is, the more inspiring children will find it and the harder it is to meet the conditions for a silent, focused and typically frontal education.

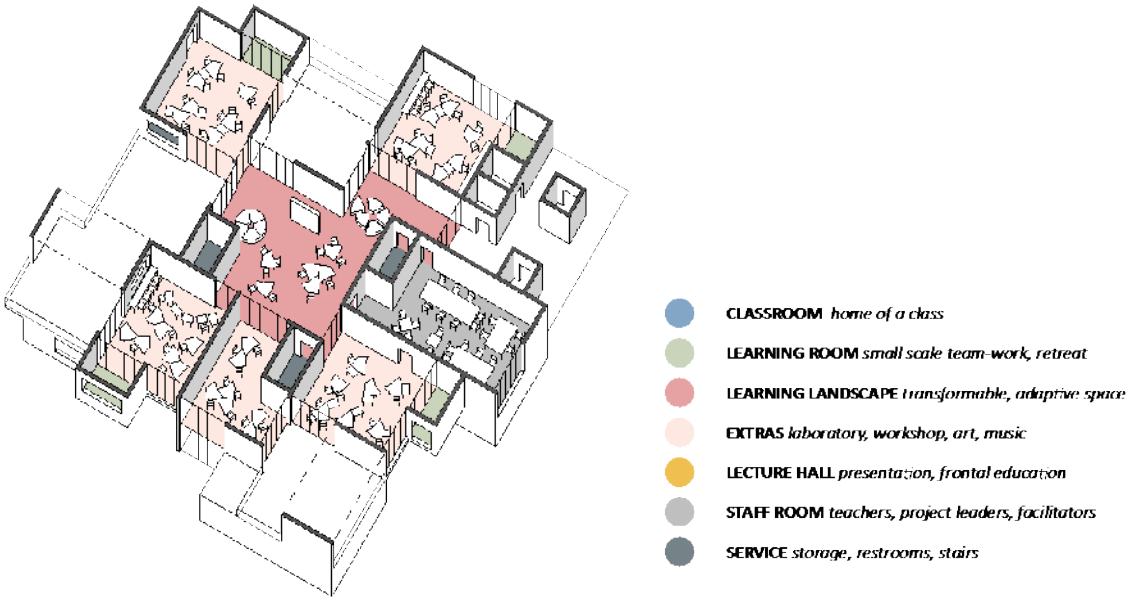

Figure 6. Bildungscampus Sonnwendviertel, Vienna, Austria, 2014 by PPAG Architects (axonometry by the Author at CAN Architects)

Nowadays there are further experiments focusing on the design of learning landscapes with their continuous, flowing spaces that are exploited day after day by teachers and students together. Such structures are typically used by the so-called democratic schools. The Danish Hellerup Skole is mentioned as one of the most significant examples [9], since it was built in 2002 and has already acquired more than a decade's experience on what works from its initiatives. Its pedagogical model has been functioning properly ever since - it includes a short instruction phase in the morning, after which students work for a longer time on their own, typically in groups, in spaces they can arrange with their mobile desks. The arrangement is most beneficial for the smallest children, until the age of 11, as an introduction to school. The next age group finds personal spaces for creating group identity important, so furnished corners appeared in the basic structure after a few years. The greatest disturbance for senior students is noise; therefore, laboratories similar to classrooms have been created with the subsequent installation of glass walls.

Figure 7. Hellerup Skole, Gentofte, Denmark, 2002 by Arkitema Architects (photos by AA)

"The geometry of thought echoes the geometry of the room." [10] The thoughts of Juhani Pallasmaa determine the development of educational spaces in the last two decades. Such spaces try to create such a rich spatial environment which supports the intellectual and emotional development of the child who uses it in every situation: in addition to reading and writing, it is also a venue for teamwork, debates, presentations, experimentation and playing together. Experience shows, however, that the availability of a classroom is very important for identity-building and a sense of safety, and either its convertibility or the diversity of spaces used for teaching outside the walls of it might ensure the necessary complexity.

3 Adaptive Spaces for Learning

During the 1980s and 90s, a need for multifunctionality has emerged in terms of community spaces, and the traditional Japanese family house with sliding walls, having become known all over the world during the era of modern architecture, appeared to be a promising solution for this. The toolset offered by the mobile walls, which are still used, allows for such extreme situations where everything is movable expect for the external walls of the building and the fixed cores of the service rooms. Another basic tool for diversity is the use of mobile furniture. The advantage of mobile walls lies in the fact that they create spaces which are similar to the ones we are used to, with visually previse borders and the necessary air and noise insulation, if necessary. Their disadvantage is that they are hard to move; therefore, they are less suitable for spatial structures that need to be transformed often. On the contrary, mobile furniture can offer customisability even in cases where change is almost constantly required, but they do not provide such a visual and acoustic barrier that would allow lives in the separated spaces by them to exist independently, without perceiving the other one.

Figure 8. Substrate Factory Ayase Community Centre, Kanagawa, Japan by Aki Hamada Architects (photos: Kenta Hasegawa)

Diverging from the previous decades, the experimental projects of contemporary school architecture focus on eliminating the obstacles the difficulties of moving set to the diverse use of school spaces. All this is to be achieved in a way that makes the different situations of teaching and learning best fit the spaces created, a prerequisite to which is that the pedagogical programme of the school contains the educational and extra-educational processes and situations that are necessary during the time spent here. Psychologists have been dealing with the importance of "inner coordination" [11] that goes beyond the reflex-like use of the environment in our everyday lives since the mid 20th century. In the holistic, demonstrative way of learning, experiencing the spaces of the built and natural environment has become important in the school: there are spaces which are ideal for acquiring material knowledge, developing the personality and the group identity, and there are other spaces which are ideal for developing social competences.

The Norwegian Rinkstabekk Skole, which applies a project-based, story-line method for teaching and abandoned subject-based education 40 years ago, offers a special opportunity

for studying the use of adaptive spaces in education. According to the national requirements, they group the annual store of learning into 6 educational units, and the children learn during these in smaller and larger groups with the involvement of several teachers. In addition to the community spaces, the spatial school of the school consists of three, nearly identical units, each of which has small team rooms and an auditorium for 60, these are unified by a central learning landscape, which is also the workplace of the teachers dealing with the team during the project. This space itself is also about discovering, as the students who learn in groups of 4 to 5 can find the best situation for each part of their assignment. The groups change periodically, where the homogeneity/heterogeneity of a team is determined according to the social background and skills of the students. The staff also co-operates while teaching different disciplines together and they jointly interpret each given topic and figure out the method to teach history, biology, mathematics and foreign languages at the same time.

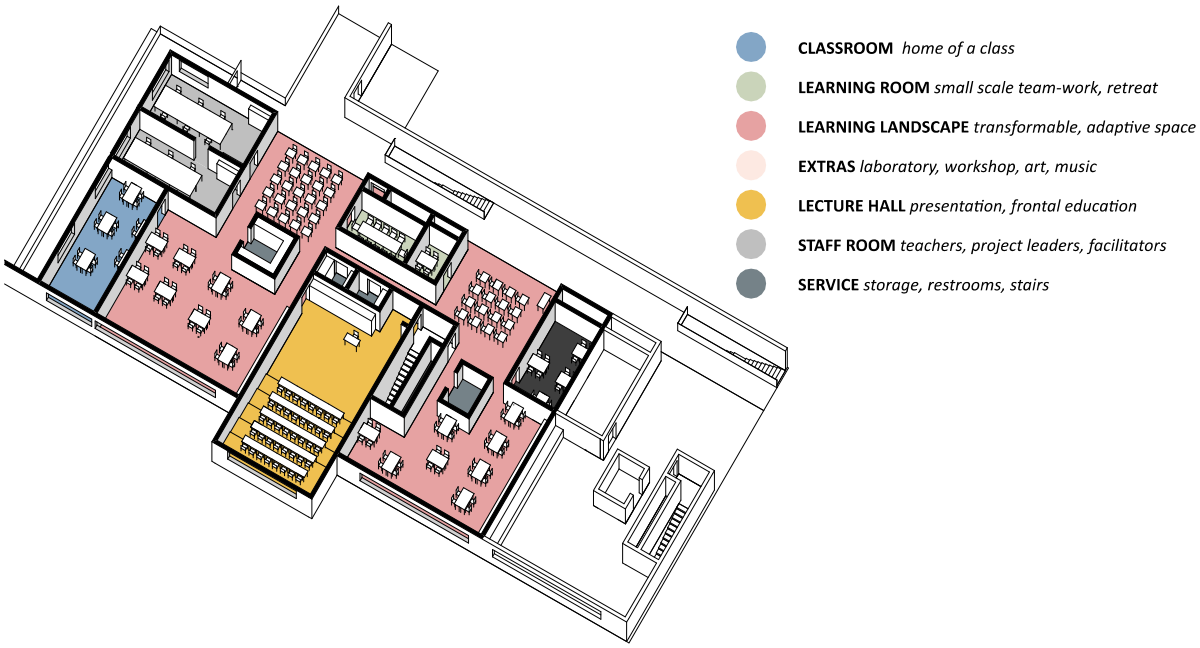

Figure 8. Ringstabekk School, Bærum, Norway, 2005 by div.A arkitekter (axonometry by the Author at CAN Architects)

The use of space does not change during one sixth of the academic year, but it pulsates according to the scheduling of each day as well: students accommodate the spaces for individual, small-group, large-group assignments, and such spaces produce a structure of space that is almost continuously maximally utilised in terms of floor area, function and the proportion of classrooms as well. In this case, customisation is less attributable to transformability, it is primarily the logistics made by the school management. Seeing the drawings and images, one can find that the building has spaces with strong characters, and these spaces give precise venues for teaching situations with different dramaturgy. The small lecture halls or the projection surfaces integrated into the walls of the learning landscape are suitable for frontal lectures and student presentations. Smaller, enclosed rooms or the groups of desks belonging to a comprehensive system in larger spaces or niches are ideal for teamwork. Regular use of the kitchen, work in the transitional and external spaces and at external venues (libraries, museums and in nature) are integral parts of the teaching process.

Autonomy, as a key competence needs the autonomous use of the space, as its pedagogical application is spreading, even in traditional disciplines. Giving a part or the whole of adaptive spaces to the students is a model which takes the key characteristics of learning-facilitating environments into account to a whole new level. Its basic data, which is regularly referred to, yet it has only been recently supported by research projects [12] , consist of 7 primary key components belonging to 3 groups (the percentage in brackets are their weighting ratios):

I. Naturalness - continuous perception of the external environment
   a. Light (21%) b. Air quality (16%) c. Temperature (12%)
II. Individualisation – on the level of person, group/class (and school community)
   d. Flexibility (17%) e. Ownership (11%)
III. Stimulation – continuous perception of the inner environment
   f. Complexity (12%) g. Colour (11%)

According to the above list, the generally known educational conditions (Group I) are responsible for less than 50 percent of the learning-facilitating environmental factors. The responsibility and possibility for facilitating learning is still with the teachers, in the right environment, however, they can get proper surfaces of use and they can pay more attention to the students.

4 Adaptive Structures

Even though the emphasis of spatial distribution in schools has clearly shifted towards shared spaces for meeting others in case of well-functioning institutions, adaptive space structures designed for a couple of years only have appeared in the structures of exhibition architecture. However, adaptivity on a structural level can also be found when architects are facing and transforming already existing buildings. Somehow these situations seem to free designer minds to take a few steps away from the usual list of school spaces and invent lively and open spaces for the schools community to use freely. These accommodated halls, such as the ones at Nantes University of Arts should serve as example to follow, or even more, as a theoretical basis to create even more flexible spaces in case of new school buildings: without the constraints set by existing structures. New adaptive volumes could be designed to optimally host future spaces for future learning methods, that we are not yet familiar with.

Figure 9. École Supérieure des Beaux-Arts, Nantes, Franciaország, 2011 by Franklin Azzi Architecture (photos: Franklin Azzi Architecture)

Possibly subconsciously, yet Corlaer College sets an example of an inspiring open space with a clear structure that suggests easy transformation and different inhabitation every few years, as its users follow the newest trends and disciplines in education. Its spaces were distributed

at the start as a fashionable, inventive school with a good balance of personal spaces for classes/smaller groups and larger multifunctional areas, yet its logical grid can easily be seen as the basis for either a much denser or an even more open spatial structure.

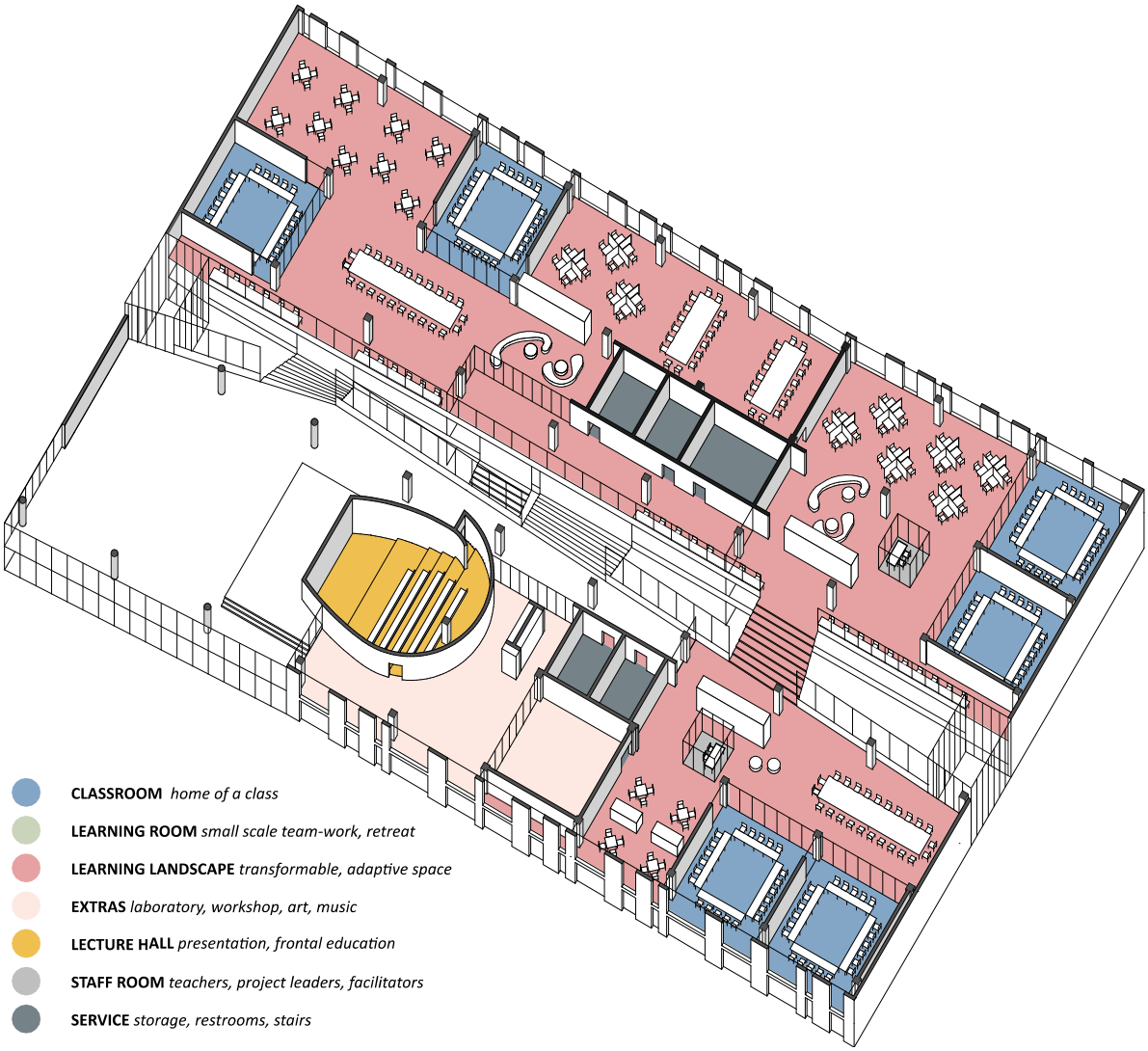

Figure 10. Corlaer College 2, Nijkerk, Netherlands, 2006 by Broekbakema (axonometry by the Author at CAN Architects)

5 Conclusion and initiative

The generational changes in the 21st century rapidly cause fundamental shifts in pedagogy, therefore in the built structures designed for learning. While a wider variety on the range of open/communal and closed/personal spaces has been introduced in school designs all over the world, there is a strong conflict between the lifespan on the built frames of education and the almost continuously changing pedagogical methods.

Humanity grew used to responsive environments both physically and virtually, yet most of the new school buildings, which are the locations for preparing for such a dynamic and challenging life, generally fell behind in keeping up with the radical changes and therefore are incapable of fulfilling their roles. However, the introduction of multiple layers of spatial complexity and

intimacy levels appeared not just on the basis of holistic pedagogical approaches, but also as answers to both social and sustainability issues around the world.

School architecture faces the challenge of designing appropriate spaces for educational models that will only emerge by the time the buildings will have been erected. Therefore, the reform of a the spatial and structural language in learning environments is inevitable. Adaptive spaces might become a solution in school design, if they are able to create patterns that provide basic diversity from their beginning to engage the new generations appetite for curiosity and also new architectural approaches, where the built structures allow a long-term and ever-changing ephemeral distribution of spaces according to the needs of the close community of schools and the wider urban environments they're continuously animating.

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SURREALISM & SURRATIONALISM AS CREATIVE METHOD

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Abstract

This paper explores how Surrealism, Surrationalism, and the writings of Gaston Bachelard play an important role in the design thinking of the architect Paul Lewis of Lewis Tsurumaki Lewis (LTL). Bachelard's Surrationalism becomes a means to re-think the inherent perversity, the irrationality of architectural production. Surrationalism is the jumping off point for LTL's design process — the complexity of imagination. The process exacerbates the logic of a given architectural design problem by illuminating what is already strange within it. Additionally, the process presses rational thought to the limits of rationality, a methodology that pushes the rational to the point of irrationality.

Keywords

Surrealism, Surrationalism, Design Methods, Creativity

During Paul Lewis's sojourn as a Fellow of the American Academy in Rome (1998) he was less interested in Rome's history as he was the paradox of Rome as a city built on its accumulation of history and centuries of building materials—a city that is simultaneously museum and active pleasure ground.[1] In the Academy library's archive Lewis discovered the Villa Girasole (1935, Verona), the idiosyncratic revolving house designed by engineer Angelo Invernizzi. The Villa Girasole illustrates both Surreal and Surrationalist thinking by employing the seemingly rational logic of maximizing the sun's health properties with a house that could rotate. Referencing a Surrealist parlor game, the Exquisite Corpse, Lewis also draws a parallel to the Villa Girasole's design process and construction.[2]

How do Surrealism and Surrationalism participate in the creative process? Although Surrationalism grew out of Surrealism, the two are not identical. Surrealism is anti-rational expression, whereas Surrationalism is excessive rationality. Surrealism grew out of the Dada movement as a reaction against bourgeoisie thought, values, and reasoning. Surrealism's reliance on Freud's theories of the unconscious is meant to contradict society's notions of coherence and stability. Although Surrealism began as a literary and philosophical movement, it is in the visual arts that we most associate imagery of Surrealism. To bridge the realms of the conscious and unconscious, Surrealists developed games or techniques to expand one's imagination through spontaneous, free form writing, drawing, and painting. These processes are not under conscious control, opening up the subconscious to free one's imagination (and

they also involved the element of chance). The French writer Andre Breton (1896-1966) developed a theory of 'psychic automatism' as exemplified by his Exquisite Corpse drawings (also called the Exquisite Cadaver).[3] In his parlor game a piece of paper is folded into three sections, corresponding to head, trunk, legs. The paper is passed around while each participant draws (or writes) on their portion while unable to see the other sections. When unfolded, the total image will contain juxtapositions and non- sequiturs of a random nature.[4]

In the 1930s, the French philosopher. Gaston Bachelard (1884-1962), posited that science could be as constructive as art in shaping the world. Bachelard wanted to super-charge science to be just as creative and experimental as art. He advocated experimental reason as a method to organize reality. Just as Surrealism sought to energize realism by playing upon the dream world and subconscious, Bachelard's Surrationalism would energize our understanding of the rational by emphasizing its complexity. Surrationalism was conceived as a non-linear thought process, emphasizing the complexity of a solution rather than its simplification. Bachelard showed that new scientific theories integrated old theories in new paradigms, changing the sense of concepts, e.g. non-Euclidean geometry did not contradict Euclidean geometry, but was integrated into a larger framework. To incorporate the unconscious in problem solving, Bachelard advocated structured daydreaming in seeking new solutions.[5]

Later, variations of techniques for free form association emerged among academics as models for creativity in the areas of literature and learning. Theories referred to as de-familiarization and conceptual displacement emerged. Victor Shklovsky (1893-1984), the Russian literary theorist, coined the phrase "de-familiarization", or making the familiar strange. In his essay, "Art as Technique" (1917), he proposed, "The purpose of art is to impart the sensation of things as they are perceived and not as they are known… art is to make objects unfamiliar…by making the familiar strange, we recover the sensation of life…art exists to make one feel things...".[6] The learning theorist Donald Shön (1930-97) proposed his theory of conceptual displacement in *Displacement of Concepts* (1963), which aims to juxtapose dissimilar concepts in order to create new perspectives through their synthesis. The underlying idea is that if one recalls similar concepts together—because they are already similar—their juxtaposition may not create new meanings or perspectives. However, putting dissimilar concepts together forces one to reconsider their order to find some meaningful connections. Both of these concepts involve moving away from the constraints of the ordinary, the usual, the conventional.[7]

While at the American Academy in Rome, Paul Lewis was fascinated with the library's extensive collection of pre-WWII Italian architecture magazines. Among the projects documented was the Villa Girasole, the rotating house near Verona. Situated in the rolling countryside of Italy's Veneto region, Villa Girasole stands as one of the most eccentric buildings of twentieth century architecture. Similar to the ubiquitous Italian sunflower it is named for, Villa Girasole moves to follow the sun's path. Built prior to World War II (1931-35), this revolving villa incorporated the owner-engineer's utopian vision for the future—a rotating house that takes full advantage of the healing properties of the sun. The idea of a heliocentric health house was part of the twentieth century's sun health culture. The building's design premise was straightforward—to follow the sun's movement throughout the day to optimize sunlight exposure. Through an excess of rationality and logic in the design process, the resulting building is an example of Surrational architecture.[8]

Villa Girasole's owner, Angelo Invernizzi, was a successful engineer with expertise in concrete construction. Invernizzi worked for Italy's State Railways early in his career and based his design on a modified railway turntable that allowed his country villa to revolve. Considering the project to be a collaborative one, Invernizzi teamed up with a mechanical engineer, an interior decorator, and an architect to complete the project. The resulting design is analogous to the Surrealists' Exquisite Corpse parlor game. Villa Girasole is composed of two elements - a stationary base and rotating living quarters above. The villa's base has a distinct Novocento design, a style that rejects most of the principles of modernism. The living quarters are from a different design aesthetic. The chevron shaped floor plan is a concrete frame clad in insulated panels. The exterior's aluminum panels extol Le Corbusier's machine aesthetic, light and sleek, as if influenced by aeronautical design. The base is a massive drum shaped masonry bunker built into the sloping hillside. The living area sits atop the concrete base's turntable and rotates on rails in a concentric pattern with train bogie wheels allowing the living section to revolve on the railroad tracks. Only two small motors are required to move the house on the rails at a few feet per hour. At the center of the platter is the cylindrical tower that holds the elevator and spiral stairs. Also built of concrete, the tower extends through the base to the central pivot built into the building's base. The tower and stair core spin with the upper living area. Of course this configuration creates complications. Plumbing, sewer and water, is accomplished by using holding tanks slung from the villa's underside. Normal relationships such as front, back, and side no longer apply. Fixed views do not exist—the landscape is a slow, continuous panorama. The sun can rise and fall in the same window. The overall appearance of the villa is that of an exquisite corpse exercise with sections completed by different designers. The villa's original rational objective, to rotate in order to follow the sun's path, produced a Surrational solution.[8]

In exploiting their Surrational design process, three of Lewis's design tactics stand out—creative speculation, invention sprawl, and catalyzing project constraints.

LTL begins their design process as creative speculation by asking the question, "what if…". In asking that question, the motivation is not to create the conventional, but to find the unusual in the architectural project's requirements and use that as a beginning point for their design trajectory. Lewis refers to this as searching for the "latent perversity of architecture".[10] This questioning harps back to the idea that surrationalism is the self-conscious examination of the rational, or rational thought pushed to the limits of rationality.[11]

Lewis used the Villa Girasole as an example of Bachelard's Surrationalsim that can be dissected as "invention sprawl". Invention sprawl involves the close examination of a subject in a non-linear process. In this process new areas of investigation are revealed and set in motion. A singular presumptive solution is suspended and cumulative knowledge presents unexpected, even paradoxical results.[12]

Catalyzing project constraints is the process of recasting limitations as a mechanism for design invention. Design principles of efficiency are most often related to budgetary and/or programmatic limitations. Lewis inverts those limitations so can be used to discover relationships in the project that are unexpected, whether in materials, programmatic requirements, or both. The process requires maneuvering within project boundaries to discover latent potential that can be "teased" out of inherent architectural restrictions. The following project, Xing Restaurant, exemplifies intensified efficiencies mainly through programmatic and materials solutions that involve constructing an interior skin in each space.[1]

As an example of the firm's Surrationalist design process, LTL completed Xing Restaurant (2005, NYC). The project was one of a series five restaurants completed during this time period. This 2,000 square foot project is based on elements of the Exquisite Corpse with three strategically different parts: entry, bar, and dining. Rather than hiding or disguising the distinct narrowness of the traditional New York restaurant, each section is accentuated in a manner unique to each space. Like the Exquisite Corpse, each area is distinct, yet interlocked. Hard surface areas are closest to the public entry evolving to soft wrapped materials in the private dining area at the rear. The materials used exemplify the exploitation of constraints through intensified efficiencies, maximizing impact through a minimum of means. "Catalyzing constraints requires a multiplicity of performance and repetition of materials from the banal to delightful."[14]

In conclusion, this method for enhancing creative imagination is an important tool for educators. As a professor of architecture, the most difficult problem of the beginning design studio is moving students away from acceptance of the conventional in their design thinking. Techniques for free form association such as de-familiarization and conceptual displacement can be used to encourage experimentation in design. It is exciting to see a firm like Lewis Tsurumaki Lewis formalizing theoretical experimentation through Surrationalist thinking as a mechanism for approaching problem solving. Lewis's ability to approach projects in a uniquely structured process is appealing to both students and professionals alike because in both the studio and office practice developing personal methods of creative imagination is of prime importance.

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MODERN ARCHITECTURE AND ENVIRONMENTALISM: DEVELOPMENT AND TRANSFORMATION OF NEW BELGRADE

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Abstract

New Belgrade area was built in the second half of the twentieth century, according to the principles of the Athens Charter and modern urbanism, with the strong ideological context of self-management socialism. The socialist system provided a systematic implementation of CIAM principles on a large urban scale, in contrast to capitalist countries where these principles are carried out on a smaller scale. Architecture became an important element in the criticism of non-ecological, domineering and exploitative attitude to environment, especially natural surroundings, within various initiatives and movements formed in the field of culture in Yugoslavia throughout the 1960s, 1970s and 1980s. Due to the transition process at the end of the 20th century, New Belgrade experienced significant spatial and functional transformation. Today, when New Belgrade is undergoing a post-socialist transition, the issues related to various city planning problems have arisen because of urban densification and open market economy processes. New Belgrade continuously presented a point of interest in terms of its future development and quality of life. This paper advocates the stance that rational action in the future urban development could be achieved by understanding conditions and planning strategies of the city throughout history.

Keywords

environmentalism, modern architecture, New Belgrade, self-management socialism, post-socialist transition

1 Introduction

The significance of the environmentalism was recognized in Yugoslavia as early as the 1960s. The awareness about the necessity of introducing environmental aspects in architecture originated as an echo of then already current global issues of environment pollution and oil crisis in the second half of the 20th century in Yugoslavia. Architecture became an important element in the criticism of non-ecological, domineering and exploitative attitudes to environment, especially natural environment, within various initiatives and movements formed in the field of culture in Yugoslavia throughout the 1960s, 1970s and 1980s. The balance between natural and built environment is particularly emphasized. Also, it is identified

that many of the "crises" in urbanism and architecture are the results of a disciplinary approach instead of the interdisciplinary tendency [1].

In the context of this topic, it is very important to emphasize that the constitution of the Socialist Federal Republic of Yugoslavia, adopted in 1974, included a regulation stating that "it is the duty of the socialist society to provide conditions for the preservation and development of natural and other values of the environment that are of interest to the healthy, safe and efficient life and work both of the present and the future generation" [2]. Keeping in mind that the Brundtland Report, which defines sustainable growth as growth that satisfies the needs of the present moment without compromising the potential of future generations to satisfy their own needs, was published in 1987, we may speak about the progressive nature of ecological attitudes of the socialist society in Yugoslavia.

New Belgrade area was built in the second half of the twentieth century, according to the principles of the Athens Charter and modern urbanism, with the strong ideological context of self-management socialism. The socialist system provided a systematic implementation of CIAM principles on a large urban scale, in contrast to capitalist countries where these principles are carried out on a smaller scale. The changes in the political system and dominant social goals, as well as redirection of the state production from agriculture to industry after the Second World War caused the radical transformations in urban life. Large migrations of working people employed in the state sector towards big administrative centres caused fast-growing population of the cities, as well as a large residential space deficit. These problems caused the transition to the new state housing policy and the introduction of the new concept of solving housing issues by moving to the large-scale construction of residential buildings. Jovanovic-Nenadovic states that the formation of new, socialist state in the post-war atmosphere of the collective spirit, supported by the desire for a better future and the real need for new living space brought about the adoption of the ideas of modernism as a mandatory content of the social reforms, logical "means of expression" at the moment. The principles of modernism – idealism and belief in the creation of a new world – were the main instigators of the socialist reforms [3]. New Belgrade and other locations on the outskirts of the city were very suitable for the construction of a large residential settlements in the conditions of standard equality, outside the limits of the traditional urban areas (Figure 1). New Belgrade urban planning was based on the concept of a series of competitions in the field of architecture and design, professional studies and urban plans, all as a product of the post-war spirit, enthusiasm, idealism and belief in the concept of creating a new world.

2 The modernist movement as an environmental architectural practice

In this paragraph, design principles of modernism in architecture set the framework for considering the relations between architectural design and the ideas and principles of environmentalism. The basic idea was that the principles of modernism in architecture assumed that architecture is an art, but also that it is at the same time an environmental practice. Modernist architecture was certainly focused on design and the idea of designing a habitat of higher quality for all people. In this sense, concern was clearly expressed about the alienation of people from nature, long daily trips to the workplace, pollution, unjust social stratification, lack of daylight and ventilation in most residential areas and, generally, overpopulation of the cities. Also, the relations between man and environment in terms of

comfort and well-being were largely the topic of research by one of the most famous modernists, Le Corbusier, although it was not intentionally directed to the necessity of environment protection. Regarding that, modernism and functionalism were linked to environmentalism from the aspect of the object function, i.e. partial modification of the climate with the aim of providing inner comfort. However, although all these aspects are of significance for the modernist principles of environmental design, the modernist movement was certainly largely preoccupied with architecture as art.

In Yugoslavia, modernism was primarily focused on the hygienic aspects of the environment. The ideology of the modernist movement in the newly designed Belgrade settlements was promoted through the vision of a new, clean and healthy city, as well as the application of novel, contemporary technologies. The basic structural model of the functional city concept in newly designed settlements was an open block with independent buildings surrounded by greenery. The traditional model of a street “creating noise, dust and harmful gas emission” [4] was abandoned. Such an approach was in accordance with the hygienic policies introduced by modernism, and they were also dominant in the first realizations of New Belgrade settlements. However, we can also recognize the “logic of dominance” over nature here, present in the modernism as well and promoted by Le Corbusier, mainly using human order, geometry and rules. The influence of such view of design principles is reflected in nature observation from the external field of architecture. This type of dominance became especially recognizable in the previously deserted field of Bezanija, where the accelerated metabolic transformation of nature is most visible, both in the physical form and in its social and ecological consequences (Figure 1).

Figure1. Transformation of nature into urban landscapes - construction of New Belgrade [5]

From the aspect of the relation between architecture and nature is also significant the attitude to open spaces. Modern movement in architecture advocated for vast open spaces. Under the influence of socialist philosophers and Marx and Engels's ideals of communism, egalitarian views of society and state property were promoted in Yugoslavia. The idea of high buildings and aesthetics equality in natural environment was also promoted. The focus was on healthier environment, rich in open space and opportunities for active recreation. In terms of recreation, newly built settlements in New Belgrade were considered to be of extremely high quality, with a possibility of uninterrupted movement around free areas, especially for the population sensitive to adverse traffic conditions (children, older people, the disabled), provided within the blocks with parks and possibilities for application and usage in passive as well as active recreation (Figure2).

Figure 2. Transformation of nature into urban landscapes - construction of New Belgrade [5]

In the academic community, the significance of ecology in design disciplines was stressed, as well as the fact that the process of directly involving ecology in planning and design was progressing very slowly due to the insufficient familiarity with the problem, academic attitude towards the environmental community and the insecurity of design disciplines about "what an ecologist may or may not do". In addition to the concept of ecology, the concept of environment became widely popular in the expert literature of the 1970s in Yugoslavia [6].

3 The restrictions of the Modernism

After the first decades, the first problems of living in the settlements of New Belgrade arose. Because of a universal view of nature, but also of the residents, these settlements were characterized as “monotonous and inhumane” by both its residents and architects soon after they were built. Numerous criticisms of the settlements built in New Belgrade in the spirit of modernism followed in the 1970s. At the first meeting of the Architects of the Federal Republic of Yugoslavia in Dubrovnik, Vladislav Ribnikar talked about how social realism had materialized into many ugly, gloomy and heavy buildings that looked like boxes [7]. Such views were in accordance with the current global criticism of settlements built in the modernist style. It was considered that “the places denied of its specific properties” – were created as the result of such views [8]. At the time, there was widespread criticism of the eminent positions of the Athens Charter from all over, and the modern functionalism concept started to lose support in the circles where it used to have the hardest stronghold.

There was also the awareness of the alienation from nature and the issue of natural elements design in urban environment. A modern city was criticized for its alienation [9]. Nature in the city was described as created, artificial, alien or strange, without the elements of “humanity”. Man has no need for it, he only adapts to nature. The awareness of the importance of nature and its beneficial effects on city life can be recognized in other texts dated from this period. Thus, for example, in the text “Environment protection” from 1978, the importance of greenery was emphasized, especially parks and botanical gardens, in the course of “environment creation and protection”. Their significance consists of the necessity of the biological and protective functions of greenery as living organism. The familiar influence of greenery on microclimate conditions were emphasized as well. In addition to that, positive aspects of sociology and psychology were emphasized, “in particular the influence on human psyche and condition” [10]. In his text “Sociological significance of English parks”, Dragutin Kiš emphasizes the need for considering then current issues of the nature creation in city spaces. In the text, he discusses the sociological aspects of the park spaces and nature on the environmental experience of the city population. In that context, Kiš points out that unlike Baroque park intended for presentation and ceremony, the English park is intended for relaxation [11].

Thinking about form independently of the traditional limited concept of function was particularly criticized in this period. According to that, the focus was largely placed on the characteristics of the local context, identity, and a reaffirmation of regional architecture. The characteristic of this period was a break with the International Congress of Modern Architecture (Congrès International d’Architecture Moderne - CIAM) and the Athens Charter. Accordingly, a desire was expressed to design a richer environment than the one advocated by the Athens Charter, although the environments designed by this generation of architects had also been described by residents as sterile.

However, although the views and discussions presented in this paper show that there is awareness about the importance of environmental issues, these views did not have great significance in design concepts. Nature was observed as universal, and according to that, local properties of the place were not given a great importance. Open spaces and greenery were most often designed according to pre-determined matrices and templates, without much importance for this aspect of environment. Deterministic view of the relation between the

environment and its users was also dominant, primarily from the aspect of representation, while the environmental properties of the place were kept behind.

Therefore, the relation between environmental architecture and modernism is somewhat paradoxical in its nature.

4 Transformation of modern urban space of New Belgrade in the conditions of the post-socialist transition

To the mid-eighties of the 20th century, New Belgrade planning was based on the principles of population growth and the economic development model. The changes of ideology conditions that ensued after the 1990s, because of both political system (from socialist to democratic society) and economy system transformation (from economic planning to market economy), conditioned specific transformation of the modern space of New Belgrade and put the future land use in question. The most obvious changes in physical, functional and spatial urban structure of New Belgrade were reflected in the construction of commercial and business zones through the green field private sector investments (Figure 3). The Master Plan of Belgrade up to 2021 proposes that the central zone of New Belgrade should become a new business, commercial, administrative and cultural center of both national and regional importance [12]. Such changes have had a significant impact on the very structure of the users and quality of life in New Belgrade, particularly in terms of the complementary functions that enables sustainable transport and the reduction of the space-time fragmentation of human needs (accommodation, work, free time) [13].

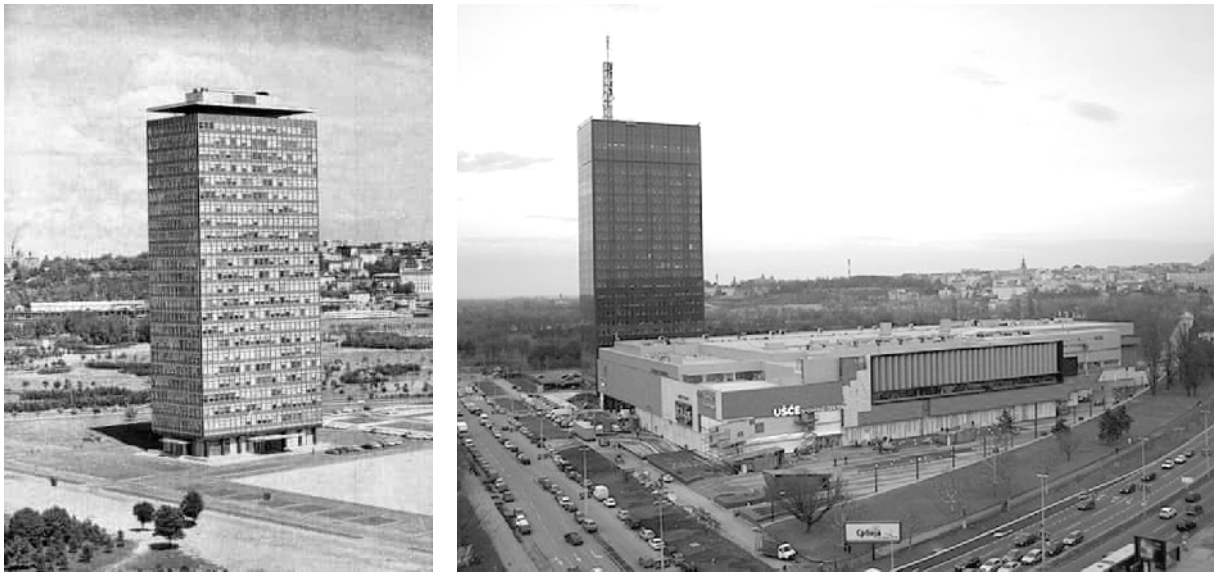

Figure 3. Left: Central Committee Building, New Belgrade, 1967 [14], Right: Central Committee Building (now Ušće Tower) with Ušće Shopping Center, New Belgrade, 2012 [15]

In this context, the question of the Modern Movement and Modernism heritage of New Belgrade and its preservation has been compromised. According to this, the space of New Belgrade that was divided into zones and functional wholes, is now given a more complex and more integrative structure, thus proving the sustainability of the modern city open plan.

5 Conclusion

The concept of environmentalism may relate to the ideas of modernism regarding the sustainable link between nature and the city. As mentioned above, this significance of nature in modernism was reflected in the desire to provide a healthy environment including sun, fresh air and greenery. However, modernism denied the specificities of the local context: its landscape, climate, topography, biosphere, weather conditions, etc. Therefore, nature had its value only as universal, and was thus regarded when designing objects. The fundamental theme of Modern movement was care about the character of open and closed space, and human experience in space sequences. Still, in addition to its functional role, space was equally considered as an object of artistic creation. The artistic component was certainly more dominant than the behaviorist one – the nature of experience of people using space (environment). However, the model of human experience was more implicit in the design process.

Finally, the restrictions of the Modernistic model of man and its views on human behavior became clear in an explicit or implicit way in the 1960s. Objects, neighbourhoods and settlements did simply not function in practice in the way they were imagined. Architecture had to meet the demands of more diversity and variety of approach in order to be able to respond to truly great diversity and affluence of human needs and personalities.

The research showed that there was a rich environmental history in the residential architecture of Belgrade as well as Yugoslavia because complex, hybrid forms of environment design approach developed due to the specific historical conditions. In order to preserve cultural identity of New Belgrade, as well as the concept of the modern city, its aesthetics and philosophy, it is not enough only to preserve the physical structure, but also to recognize the ways for further development of such space as a part of the continuous and sustainable planning process.

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HOPPER, ARCHITECTURE AND LIGHT OBSERVATIONS OF PERCEPTION

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Abstract

The work of Edward Hopper is used as a reference in a study of environmental performance in architecture, in order to provide a quantitative approach to the perceptions of space represented therein. With the support of a model and a smartphone as instruments, the idea is to test the possibility of establishing a connection between the sensory registers and the illuminance levels of an enclosure.

Keywords

Edward Hopper, Architecture, Natural Lighting, Perception.

1 Introduction

The scenes of daily life during early decades of the 20th century, depicted in Edward Hopper's paintings, often serve as references for various contemporary artistic expressions [1]. It is possible to recognize this influence in the sculptures of George Seagal, the engravings of Edward Ruscha, the photography of Joel Meyerowitz, and even in the film production of Gustav Deutsch (Fig. 1), among others. Within these works, compositional elements such as light, colours or perspectives, tend to favour the perception of different atmospheres, similar to those of Hopper. For architecture as an artistic discipline, the projection of spaces using these compositional elements is suitable, but it is also acceptable to consider user perceptions in the form of a design statement, as Peter Zumthor [2] declares with regards to the work of Hopper. In this way, a building conveys, on one hand, an explicit impression of space as imagined by its author and, on the other hand, phenomena that are only appreciable in physical form [3]. Also, a design concern, such as natural lighting, can determine the stimulation of particular sensory responses to a space [4]. These responses are defined as the recognition of the attributes of an enclosure, including its shape, openings and boundaries [5]. In scenes of Hopper, the incident light generates, among other effects, a distinction between the inside and outside environments, between human scale and nature [6]. Now, if these scenes were translated into tangible spaces, how could we quantify that incident light? What correspondence would this analysis have with our perceptions of the original image?

Figure 1. Scene from the movie “Shirley. Visions of Reality” (2013)
Based on Edward Hopper, Morning Sun. 1952. © Gustav Deutsch

A study of environmental performance in architecture approaches this discussion. The main objective is to evaluate the levels of natural light in the interior spaces represented by Edward Hopper, through instrumental monitoring of scale models, establishing a comparison between the perceptions attributed to the original scene, and a literal reinterpretation of it. This work is based on the fact that it is possible to equate real levels of illumination with those registered in a model [7], as natural lighting performance conditions the acknowledgment of physical attributes within a space.

Two relevant issues emerge from this assumption. The first refers to the perception of space, attributable to the incidence of light in various Hopper scenes. In this context, one of the observable facts is the contrast between the built and natural environment and, at the same time, between the intimate and public. In both cases, visible limits are determined by the management of lighting [8]. Among the effects related to the incidence of light, is recognition of the attributes of an enclosure, including its colour, shape and degree of openness. In the latter case, although the presence of windows indicates a relationship to the outside, in certain scenes the dimensions or omission of glass panels gives the impression that boundaries have dissolved [9]. Thus, the window, as an architectural element, takes on a substantial role in the perception of space (Fig. 2), since it also admits a deliberate management of natural light [10].

Figure 2. Edward Hopper, A Woman in the Sun. 1961. Source: Whitney Museum, Nueva York

However, the translation from painting to architectural space implies a change of condition, that is, the passage from the condition of a viewer, to that of an inhabitant [11], where environmental phenomena are sensitive, but also quantifiable. For this reason, another consideration is how light performance is understood, in this case, by calculating the factor of natural light in reinterpreted enclosures. This factor corresponds to the percentage of external illumination that encroaches upon an inner point, which is represented as a constant figure, i.e. independent of variations according to time or season. When calculating for several points in an enclosure, for example, an average value less than 2% indicates the perception of a dark space, with undefined attributes, and where the supplement of permanent artificial lighting is necessary.

On the other hand, a factor equal to or greater than 5% implies an enclosure is perceived as illuminated, with strong contrasts and a marked presence of natural light [12], or even an excess of light [13]. Such an effect can be associated with the location, quantity and dimension of windows. Similarly, the natural light factor increases when its registration considers interior points close to the windows, since the levels of external illumination can sometimes significantly impact lighting for even several meters beyond external borders [14].

In light of the aforementioned, the present study is organized in three stages. First, fourteen scenes by Edward Hopper, made between 1926 and 1965, are reinterpreted through the construction of a physical model at 1:10 scale. Each model considers a complete interior space as it appears in the original frame, including aspects such as proportion, use of colour and the provision of openings. These scenes not only show programmatic functions such as habitation, leisure or work; but also contain a series of relationships between an enclosure and lighting conditions provided by the outside environment, whether rural or urban. Some refer to a location in a rural context, for example, in Rooms by the sea (Fig. 3) two rooms are perceived, adjacent to a large outward plane of water; while Western motel (Fig. 4) shows hills in the background through the window of a room.

From the images apparently located in urban scenarios, Eleven AM (Fig. 5) and Hotel by a railroad (Fig. 6), among others, imply a single window to connect the living space with the external environment. However, there are certain scenes where the visual relationship with the outside decreases or is simply omitted, as in Hotel lobby (Fig. 7) and Office at night (Fig. 8); both cases demonstrate an exceptionally intuitive approach to lighting.

Figure 3. a) Edward Hopper, Rooms by the sea. 1951. Source: Yale University Art Gallery, New Haven; b) Studio model: M. Ilharreguy, J. Inostroza, L. Palma, E. Yáñez

Figure 4. a) Edward Hopper, Western motel. 1957. Fuente: Yale University Art Gallery, New Haven; b) Studio model: P. Cárdenas, C. Hernández, S. Leichtle, F. Paredes

Figure 5. a) Edward Hopper, Eleven AM. 1926. Source: Smithsonian American Art Museum, Washington D.C.; b) Studio model: L. Belliazzi, A. Cerda, I. Maldonado, P. Vega

Figure 6. a) Edward Hopper, Hotel by a railroad. 1952. Source: Smithsonian American Art Museum, Washington D.C.; b) Studio model: N. Delgado, V. Maripán, M. Montiel, D. Vera

Figure 7. a) Edward Hopper, Hotel lobby. 1943. Source: Indianapolis Museum of Art; b) Studio model: P. Olmedo, R. López, R. Nahuel

Figure 8. a) Edward Hopper, Office at night. 1940. Source: Walker Art Center, Minneapolis;

b) Studio model: S. Aguilar, S. Báez, P. Olearte, S. Ríos

In the next stage, the specific objective is to calculate the natural light factor for the reinterpreted enclosures. This calculation is based on recording levels of natural lighting or illuminance - measured in Lux -, performed by instrumental monitoring of the work models. It is necessary to indicate that the evaluation is performed outside, under conditions equivalent to a completely covered sky, without orientation or shadow projection, according to the standards required for this type of observation [15]. Illuminance is measured with a smartphone application, allowing instant visualization of data using the photometer built into most modern mobile devices (Fig. 9).

The 1:10 model scale facilitates the use of this tool in an analogous way, allowing the measurement of up to thirty points from a virtual grid plan.

Figure 9. Instrumental monitoring of study models

The final stage of the study contemplates the layout of a light mantle, that is, a three-dimensional grid that graphs the calculation of natural light factor, using the data obtained in the previous step. The mantle is constructed from the floor of an enclosure, where each vector is a point corresponding to the measuring grid. The objective is to incorporate this representation as an instrument to analyse the phenomena associated with the incidence of natural lighting perceived in the Hopper scenes. For example, for a permanent enclosure, as represented in Eleven AM (Fig. 10), an average factor above 1.5% is expected [16]; however, most points on the light mantle of this scene are below that threshold. Additionally, we can confirm a perception regarding the powerful role of the singular window, in relation to the external light environment. This relationship is evidenced by the area of the grid with a visibly greater height, coinciding with the location of the window, while the remaining space rests at a relatively homogeneous, penumbra level.

With an average natural light factor higher than the latter case, but still below the 2% threshold needed to overcome a dim appearance, scenes such as A Woman in the Sun, NY Office, Western Motel and Rooms by the Sea (Fig. 11) arise. Although the mantle of the latter work indicates a substantial incidence of light at the point of entry, this effect is soon diluted and gives way to a comparatively uniform level of illumination. The diagram confirms that the presence of the aperture closest to the position of the observer, establishes a difference in the light and spatial quality of the adjacent enclosures. Meanwhile, regarding the mantle of scenes such as Hotel by a railroad and Morning sun (Fig. 12), we observe an irregular distribution of the natural light factor, which ratifies the sensation of a space whose limits are configured with shadows and light contrasts. This is not only associated with the opening of the window, but also with the reflection of light seen on the background wall.

However, considering the average enclosure factor is in the ideal range of 2% to 5%, it is possible to state that, despite their contrasts, the boundaries of space remain visible as long as natural light is available, as in the original scene. Finally, we find cases such as Hotel lobby and Office at night (Fig. 13) where an exceptional reinterpretation of natural lighting has been proposed. Here, the mantle shows an incidence of light derived from the horizontal aperture above the level of the partition, which, combined with two other windows, evenly distributes a light factor of more than 5%, making it possible not only to perceive a naturally lit room; but also confirming the sensation of being in a place of high elevation, in proportion to its level dimensions.

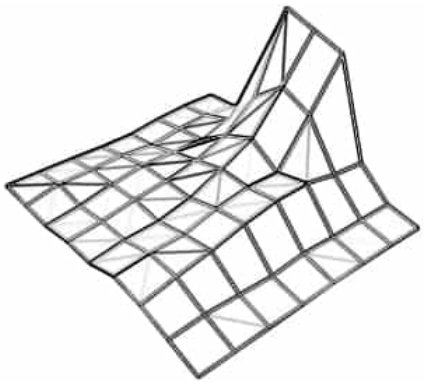

Figure 10. Eleven AM, light mantle. Source: L. Belliazzi, A. Cerda, I. Maldonado, P. Vega

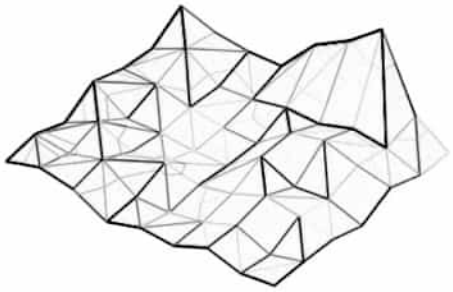

Figure 11. Rooms by the sea, light mantle. Source: M. Ilharreguy, J. Inostroza, L. Palma, E. Yáñez

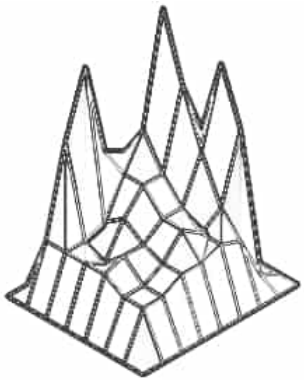

Figure 12. Morning sun, light mantle. Source: J. Maldonado, R. Mansilla, F. Rueda, B. Pavez

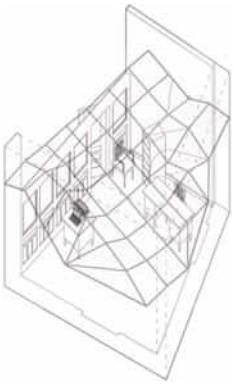

Figure 13. Office at night, isometric and light mantle. Source: S. Aguilar, S. Báez, P. Olearte, S. Ríos

We can now establish the feasibility of quantifying the incidental natural light depicted in the scenes of Edward Hopper's paintings, through instrumental monitoring of tangible models of such scenes. Similarly, it is possible to establish a correspondence between perceptions gained through the original images, and the associated understanding achieved by generating the light mantle. This perception deals with attributes of space related to their contours, openings and limits, which are affected by percentage of available light. Although this analysis is comparable to a digital simulation, from a certain point of view, the fact of working with a model to perform parallel measurements of illumination, coupled with the opportunity to mechanically construct a diagram representing the data obtained, allows a tangible approximation to the impressions given by the original scene, whether intentional, explicit, or spontaneously perceived by a circumstantial observer. Then, if we consider the above as an instrumentalization of perception, we can also consider this as a complementary methodology to the fields of, for example, design and criticism, linking perceptions with environmental behaviour in architecture and specifically, with natural lighting.

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DALIEH TO THE POWER OF NATURE: TOWARDS A MORE INCLUSIVE ARCHITECTURE

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Abstract

Dalieh[n] or Dalieh to the power of Nature is a design proposal for Dalieh, a very particular site on the Lebanese coast. This project is a response to a competition organized by the civil campaign to protect Dalieh from future private development. It won the first prize and was praised for its ecological approach. The project proposes biotic and artificial ecosystems to regulate and assist the evolution of marine and terrestrial species. The aim of this intervention is to foster the biodiversity both in water and on land, thus enhancing the human experience on site.

Through the case study of Dalieh[n] proposal, this paper will focus on the role and the responsibility of today's architect in shaping a better environment for humans. It argues that it is possible to provide a healthier and safer solution for humanity when primarily designing for occupants and systems that are not human. This project is an open call for more inclusive design strategies that are ecologically centered and aims at raising awareness about the new environmental challenges of today.

Keywords

Dalieh of Beirut, Biotic and Artificial ecosystems, Inclusive Architecture, Architecture for non-humans, The Role of the Architect

1 Lebanon Coast-Line or Coast-Less: The impact of human activities and interventions

The word coastline is generally attributed to the shape of the coast viewed from above or on a map. Irrespective of its shape and nature, the term coastline assumes that the coast is a continuous and uninterrupted stretch where the land meets the water. While it is simply represented as a line, the coastline is widely referred to as a space of interaction between two different environments, extending below and above the water level and including a wide variety of lives, natural habitats and ecosystems[1].

[1] Elizabeth H. Boak and Ian L. Turner, Shoreline Definition and Detection: A Review. Journal of Coastal Research: Volume 21, (2005), Issue 4: pp. 688 – 703.

The Lebanese coastline is a remarkable geographic feature of the country, stretching along the entire territory and providing the country with a wide exposure to the Mediterranean Sea. It is characterized by a diverse typology consisting of a series of headlands and bays, cliffs and creeks as well as sandy, rocky and gravel beaches catering for a rich biodiversity and a variety of ecosystems. Despite its richness, the biodiversity of the Lebanese coastal strip is highly vulnerable by nature and more so due to human activities and interaction with their environment[2]. The Lebanese constitution through its urban and building regulations (Order 144 / 1925) had relatively protected its seafront for decades, identifying it as an "inalienable maritime public domain" and prohibiting construction works in different zones along the coast[3]. With increased pressure from real estate developers, these regulations have been relaxed starting mid-1960s where consecutive legislation allowed for privatization of some areas of the maritime public domain and increasing their building coefficients[4].

Figure 1. A view of Jounieh Bay seen from the sea [Lebanese Ministry of Tourism]

2 Jala M., Hala C., Carine L., Holistic Conservation of bio-cultural diversity in Coastal Lebanon: A Landscape approach, Journal of Marine and Island Cultures, Volume 1, (2012), Issue 1: pp.27-37.

3 National Physical Master Plan of the Lebanese Territory, Final Report, Dar – IUARIF, Beirut, Lebanon, 2005

4 Revisiting Dalieh: Calling for Alternative Visions along the Beirut's Coast, Competition Brief, The Civil Campaign for the Protection of Dalieh, 2015. https://dalieh.org/files/CompetitionBrief.pdf

Figure 2. A view of Jounieh Bay seen from above [WhereLeb.com]

Today, the coastal zone represents 8% of the surface of the country where 70% of its population lives in urbanized areas along the coast and most of the country's economic activities are concentrated. The intensive human activities including but not limited to, maritime traffic, urbanization, tourism, industrialization, agriculture, fishing and unsustainable exploitation of natural resources have resulted in the physical erosions of the coastal zone, the destruction of its natural habitats and resources as well as the biodegradation of its terrestrial and marine species[5]. Under the pretext of promoting tourism and economic development, real estate owners, developers and agents backed up by the state governments have been systematically destroying natural ecosystems and archaeological sites, seizing public land and banning access to the water, as well as re-questioning the basic definition of the coastline being a continuous and uninterrupted stretch accessible to all.

2 Dalieh: A particular site on the Lebanese coast caught between public use and private property

Dalieh is a unique and beautiful site on the Lebanese coast, overlooking the emblematic Pigeon Rock (Sakhrit al-Rawche), a natural landmark dominating Beirut's waterfront and sunset views. Both Dalieh and the Pigeon Rock belong to the same geological formation that is quite visible, well preserved and testimony of the different types and processes that have historically shaped the Lebanese coast[6]. Dalieh is extremely rich in terms of its biodiversity including both marine and terrestrial species. The site is a wide expanse characterized by its

[5] MOE/IUCN. Proposed sites for protection. Beirut: Ministry of Environment. 2014.
[6] Copeland L., Wescombe P., Inventory of Stone-Age Sites in Lebanon: in mélange de l'Universite Saint Joseph 42, (1965), pp. 1-174

scenic landscape of green covers, sand dunes and rocks, and gently slopes down to meet the sea, earning its name as Beirut's "Dalieh". The word Dalieh in Arabic refers to the hanging plants typically grown on the roof terraces of old Lebanese houses where families and friends would gather at the end of the day[7].

Figure 3. The Pigeons Rock and Dalieh Land seen in an iconic view of Beirut's waterfront [tripatt.com]

[7] Revisiting Dalieh: Calling for Alternative Visions along the Beirut's Coast, Competition Brief, The Civil Campaign for the Protection of Dalieh, 2015. https://dalieh.org/files/CompetitionBrief.pdf

Figure 4. The Pigeons Rock and Dalieh to the left seen in an iconic view of the sunset [Mazyun.com]

For decades, Dalieh has been an active gathering place for city dwellers and visitors. Strategically located at the edge between the city and the water, Dalieh offers a natural destination at close proximity to the city center, suburbs as well as other touristic and public spaces in Beirut. The site rises 35-40 meters above the sea level and connects to the city sea front corniche from which people can access it by foot through an improvised entrance cut off from the corniche's balustrade. Cars were able to enter the site from the opposite side through an informal and untreated road. Dalieh has been appropriated by a wide variety of social groups and users. Some have frequented the site for entertainment purposes and during occasional events such as tourists, sea goers, lovers and other city dwellers, but others have been relying on it as a source of a sustainable living. Two fishermen ports have been operational on Dalieh since 1950, where 75 fishermen are registered with their boats[8]. These fishermen have also managed the site, organizing boat tours for tourists and running popular seafood restaurants catering for different social groups in addition to using the site for keeping their equipment in shacks built across the site where they sometimes lived with their families.

Dalieh has always operated as an open access shared space despite the fact that the land was privately owned by several Beiruti families. The ownership of the land did not affect the activities and practices on site, where management and organization have been achieved through informal arrangements[9].

[8] Revisiting Dalieh: Calling for Alternative Visions along the Beirut's Coast, Competition Brief, The Civil Campaign for the Protection of Dalieh, 2015. https://dalieh.org/files/CompetitionBrief.pdf
[9] Ibid.

The changing building codes and urban regulations did not really affect Dalieh because of the multiple ownership of small plots and the intricacy of the site which does not make any construction viable economically. However, in 1995, 3 large real estate corporations, owned by the same influential businessman, have started acquiring the small plots of land on Dalieh[10]. The suspicious land consolidation process strangely coincided with the issuance of Law 402/1995 enabling the owners of plots larger than 20,000 sqm to double their total land exploitation and quadruple their surface coverage in case a hotel is to be built[11]. In addition, a comparison between the old and new cadastral maps reveals that the private properties have illegally encroached over the land that was previously classified as a maritime public domain[12]. In summer 2014, Dalieh's activities have been abruptly interrupted by law enforcement forces; the fishermen were evicted and their temporary constructions demolished. Massive concrete blocks used as water breaks for sea resorts and marina projects were transported to the site which was also fenced to prohibit any access from the corniche to it and de-facto to the sea.

News leaked that star architect Rem Koolhaas has been commissioned to design a luxurious resort hotel on the Dalieh site and transform it into yet another exclusive development encroaching on public property and prohibiting access to the sea[13]. The news came as a shock for many who thought that Dalieh was publicly owned or protected by law as a natural reserve. The Civil Campaign for the Protection of Dalieh reacted immediately by organizing protests across the city and lectures to raise awareness about the natural and social importance of the site and its relevance to the city. In March 2015, the Campaign organized a press conference in which a competition to redesign Dalieh as a public place was launched under the slogan of Revisiting Dalieh: Calling for future visions along Beirut's Coast. During this event, a representative of the Ministry of Environment announced the first draft of a decree listing the rocky coast of Dalieh as a natural protected area. In line with the promised decree of the Ministry and the guidelines of the competition, a group of architects, planners and landscape designers submitted a proposal entitled: Dalieh^n or Dalieh to the power of Nature.

3 Revisiting Dalieh: Dalieh to the Power of Nature

Dalieh^n or Dalieh to the Power of Nature is a project proposed by A. Assaad, K. Bacha, R. El Khoury, L. Helou, F. Mansour, C. Naim and J. Nassar in response to the competition organized by the Civil Campaign for the Protection of Dalieh entitled "Revisiting Dalieh: Calling for future visions along Beirut's Coast". The project won the first prize of the competition and was highly praised for its ecological approach. The proposal puts forth 4 project directives to be carried through the project, a legal strategy to frame the implementation and potentially extend it beyond the boundaries of the site to cover the entire coastal stretch, a design strategy

[10] Revisiting Dalieh: Calling for Alternative Visions along the Beirut's Coast, Competition Brief, The Civil Campaign for the Protection of Dalieh, 2015. https://dalieh.org/files/CompetitionBrief.pdf
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including 3 interdependent systems and ends with a Manifesto[14]. This section will detail the 4 above stated components of the project based on the text and boards submitted for the competition entry.

3.1 Dalieh^n Directives

- Defining the Dalieh as an Urban Ecology. Cultivating a sustained ecological system that reinforces the protection of the biotic and artificial ecosystems that exist symbiotically within it.
- Utilizing both biotic and 'artificial' stratifications as the genesis of an objectified landscape form, and supporting their symbiosis but addressing them as presently disparate parts with a view to resolution, integration and continuous evaluation.
- Constructing a regulated public experience, within this terrain through temporal and spatial sequences rather through the landscape conventions of the scenic and the visual.
- Incorporating a part of that regulated public experience into the cityscape by allowing the Corniche to infiltrate a proportion of the site, effectively regenerating it as a space with an undisputed public character. The Corniche itself will begin to segment and frame within the site two distinct zones of engagement, a protected green space – curated via strategies of assisted natural regeneration, and the public rocky mounds that cascade from the headland of the pigeon rocks down to the sandy bay of the neighboring development where a Movenpick Hotel currently stands.

3.2 Dalieh^n Legal Strategies

The project calls for the reinstitution of Order 144/1925 (Inalienable maritime public Domain), Lebanon's first formal plan balancing environmental as well as developmental needs. It recognizes that Law 402/1995 was created to serve the private sector at the expense of the complex environmental systems of sustainable sprawl across the coastline of Beirut. It rejects Decree 169/1989 which effectively sets to adapt the existing legal structure to further the private sector's interests within the previously non-constructible area thus segmenting the geographical territory that extends from the neighbouring Ramlet El Bayda sandy beach up and over Dalieh and the headland formation which breaks up into the Pigeons Rocks.

The project proposes a public-private joint venture and the inception of a Governmental Project Agency called Beirut Coastal Project under the umbrella of the Ministry of the Environment, charting a different direction to that of dominant legislative and urban monitor systems. The directives of the project will come to describe the strategies and programs that Beirut, and Lebanon, would come to adopt to maintain a quality urban living environment without inhibiting economic prosperity and market growth. It is a viable and sustainable reality for a city that beckons for a new legislative environmental process to regulate urban growth. This venture will address different stakeholders such as the existing Dalieh stakeholders, the proposed stakeholders of the new project, the potential funding agencies and the potential supporting social groups.

[14] Ali A.., Karim B., Roula K., Lea H., Fadi M., Candice N., Jane N., Dalieh to the power of Nature: Revisiting Dalieh: Calling for future visions along the coast: Competition entry. 2015. https://dalieh.org/en/campaign

Table 1. Dalieh^n: Beirut Coastal Project proposed constitution

Governmental entities (75%)	**Land Owners (25%)**
- Ministry Of Environment - Municipality of Beirut - Directorate General of Urbanism - Ministry of Transportation - Ministry of Public Works	- Approx. 90% Real Estate Companies* - Approx. 10% shareholders families

*Specifically the Real Estate companies which purchased the plots of Dalieh in 1995

This venture will ensure the compensation of the land owner's through tax alleviation and fund raising to the agency. The shareholders will be relieved from the company once completely compensated.

3.3 Dalieh^n Design Strategies

By creating a palimpsest of readings across a spectrum of spatial and ecological conditions on site, Daliehn manifests as a non-hierarchical, overlapping series of moments experienced formally through the extension of the Corniche promenade on site, and identifying spatial systems that allow for future expansion and re-appropriation. The emphasis on the process of the site notwithstanding, the 'soft space' approach is described within three interdependent temporal systems contextualized within the institutional framework set up by the legal strategy.

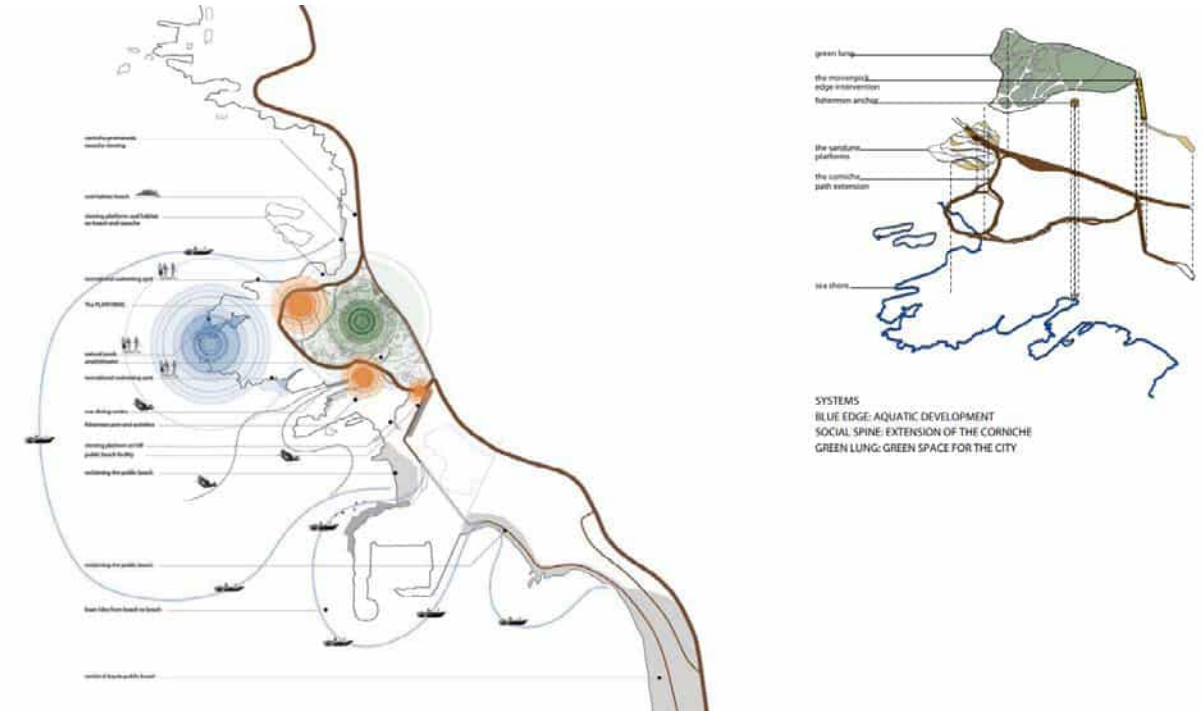

Figure 5. Dalieh^n: Design Strategy for Dalieh^n project. Green, Blue and Orange colors refer to systems represented on the 3 competition boards.

3.3.1. Green Coastal Geology and Wildlife Conservation and Management

Dalieh^{n} proposes to designate the Dalieh/Raouche geological organization as a legally conserved and protected zone. By recognizing that the Dalieh geological formation is concomitant to the offshore rock formations of the Raouche, they are dually designated as a single environmentally protected terrain. The project also proposes to designate the existing lung as a conserved wild flower habitat and to naturally assist its regeneration. The resilience and diversity of the existing floral matrix suggests a strategy where the wild ecology is managed, monitored but minimally maintained. Minimal bioengineering of steep slopes with primary successional species to stabilize slopes around loose hardscaping, rebuild soil profiles and augment planting in existing patches, adding seedlings where necessary.

Figure 6. Dalieh^{n}: Wild Life Conservation system and adapted species selection and blooming periods

Furthermore, a continued archaeological and geological investigation documentation is recommended within a dialogue between archaeological expeditions and environmental monitors set as requisite points within their respective agendas, as excavations could be detrimental to existing floral ecosystems.

3.3.2. Blue: Marine Ecology Rehabilitation and Management

On the water front, Dalieh^{n} proposes to establish a sustainable fishing practice through the designation of fishing and protection zones. This designation does not have to be applied to the informal practices of individual recreational fishing along the shoreline, but on the long term its objective will be to establish operational community-level regulation that can encourage the existing fishing industry and promote its sustainable growth. Specific protection laws with regards to specific threatened species will need to be set up for population management. In addition, the project calls for sustaining the Dalieh as an embarking point for boat tours around the coast of West Beirut by regulating the existing tour practices and developing knowledge programs for guides which will incorporate accurate data relating to the geology and morphology of the Karst formations straddling the corniche.

The project also proposes a rehabilitative artificial reef system as an integral part of the intervention in Dalieh. The proposal seeks to re-introduce coral culture, and with them marine populations that can become crucial to the livelihood of certain communities. This will establish a managed complexity within the existing reef ecosystems that will fortify them as more effective wave breakers and nurture their capacity to provide nursery habitats for juvenile fish populations. The existing concrete structure at the apex of the fisherman's docks would be adaptively reused to house a future aquatic monitor/diving visitor center and cater to the marine related programs.

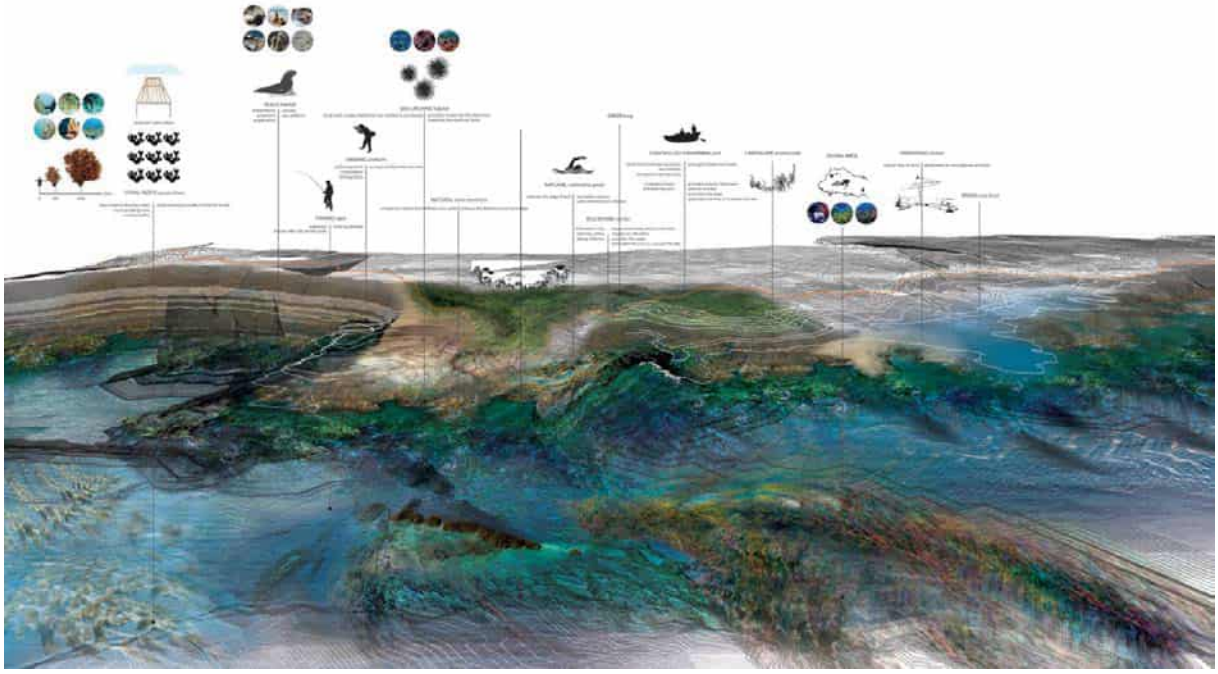

Figure 7. Dalieh^{n}: Enhanced marine ecology and projected marine related programs

3.3.3. Orange: Cultural and Civic Management

By critically investigating existing occupancy practices and visitor circulation patterns, Dalieh^{n} manages a new development of users, programming activities intrinsically tied with Dalieh's historical and social significance. The extension of the Corniche into the site restores the currently fenced and challenging access points to the Dalieh, and comes to symbolize the renewal of the site. The promotion of cultural exchange by establishing the existing plateau as an informal space for organized use will reinstitute the role of Dalieh as a site for performance, celebration, socio-cultural gatherings and urban promenade. Organizing an annual performing and musical arts festival hosted on the Dalieh plateau with the emblematic Pigeon Rocks as a backdrop can start to generate further funds for the management and maintenance of the site.

The project propose a participatory commune to appropriate the structural skeleton of the existing concrete building within the port into a multi-purpose working space for fishermen and other relevant users to restore the fishing port, market and eatery as a prototype for communal development. Sustaining the existing fishing industry becomes an important symbol for community participation, and becomes emblematic of empowerment at the social

level. Functionally it is paired with provisional structures that can begin to act as a platform of engagement with this community level industry, offering a market space and eatery. These formal provisions begin to break social boundaries and establish a more empowered and recognized role for the women in this industry, who historically have been descaling fish prior to its sale, allowing them to become the face of a sustainable 'fisher-family to consumer' market experience.

Finally, by bringing people back to Dalieh, Dalieh^{n} seeks to reclaim the public beach, unlawfully appropriated and privatized by the neighbouring Movenpick hotel.

3.4 Dalieh^{n} Manifesto

"…The materiality of urban 'process' dictates that process must end in product. The only escape is if the state declares otherwise, and allows process to survive in spaces devoted to closing the loop of habitation at the scale of the city…
We choose to interpret the Dalieh as a temporal medium, choose to privilege its process over product, and propose incompleteness as a given in our 'finished' proposal. This landscape is as much, if not more, about the grown as the inert, and is constituted of living, shifting, materials forces and practices to such a great extent, that it cannot help but change over time. This change must be sustained, and allowance in that space must be made for it!

Figure 8. Dalieh^{n}: Proposed Vision for the site

… What we are proposing is more than a public theatre of environmental spectacle within an urban context. It is a considered, albeit radical, socio-environmental strategy that reflects upon the fragility of the Dalieh's condition as a site of geological heritage that archaeological excavations has suggested to long be a playground of exchange between the human element and nature. Our ecological system interventions seek to explore the relationship that we have had to this landscape and the potential future contribution we can make to its preservation.
As a prototype for conscientious environmental engagement for the city, what becomes intrinsically tangible with the aesthetic experience of moving across this landscape, is the increased awareness of the environmental implications and wonder of the Dalieh, and the potential it could offer as a shared common space for Beirut.
The physical terrain in itself already plots a series of interactions, movements, and engagements with the environment- the forces of which would literally move its visitors, just as it can shape the changing boundary between land and sea. We choose to sustain this movement, nurture it and empower it."

4 Architecture for Non-Humans: Towards a more inclusive Architecture

Through the introduction of sustainable biotic and artificial ecosystems that will regulate and assist the evolution of plants and animals on the site, Dalieh^{n} promises to deliver a better environment for humans and an improved experience on site[15]. The project takes as a client the ensemble of species and ecosystems that have no voice to communicate their needs and concerns and are currently endangered. It commits to protect this ecology through a set of guidelines and recommendations that will enhance its development and regulate its interaction with human visitors.

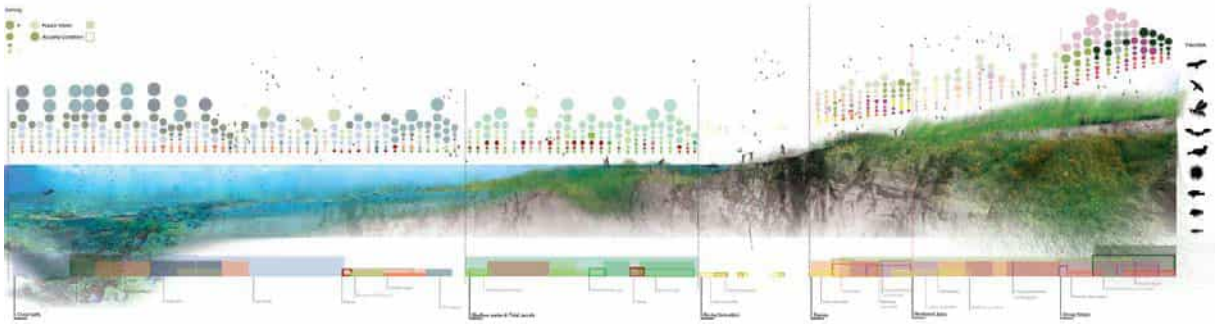

Figure 9. Dalieh^{n}: Cross Section illustrating the evolution of species above and under the water

The project is conceived as a pilot whose principles could be extended on the entire Lebanese coastal stretch and whose parameters can be fine-tuned to address the particularities (species and geomorphology) of different sites on the shoreline. Using Dalieh^{n} as a case study, we can extend the role of the architect to address non-human inhabitants and systems to provide a safer, healthier and more inclusive environment for humans. Addressing the non-human or the ecosystem as a client raises the issue of an ethical responsibility for the architect towards the environment and calls for more inclusive strategies considering the inter relations between all living organisms.

The growing consequences of and concerns about climate change have been shaping the discipline of architecture for at least the past two decades[16]. New building technologies, systems and material have developed in order to promote a more sustainable environment and less carbon emissions. Some have even claimed that the greenest building is the one that is already built[17] and other are arguing that it would be the one that will never be. The assumption that architects primarily design new or old buildings have already been challenged; however, we are yet to accept that humans are not necessarily the primary

[15] Ali A.., Karim B., Roula K., Lea H., Fadi M., Candice N., Jane N., Dalieh to the power of Nature: Revisiting Dalieh: Calling for future visions along the coast: Competition entry. 2015. https://dalieh.org/en/campaign
[16] Mark P., Adaptation to climate change: from resilience to transformation, Taylor & Francis, New York, USA, (2011).
[17] Carl E., The Greenest Building is… One this already built, Forum Journal, Volume 27, Number1, Fall 2012, pp. 62-72

inhabitants of our designs and to learn how to address that.

Architects have been historically involved in animals and plants centered projects for which they developed particular typologies, such as: the zoos, botanical gardens, aquaria, veterinarian facilities and the wildlife rehabilitation and conservation centers. These typologies have become the basis for conventional animal and plant architecture, either standing out as an iconic architecture or taking part of an "imperial nation-building", "modernization" or urban revitalization project[18]. Very often these projects are speculative in nature and reiterate the role of architecture as merely a branding strategy rather than a sustainable or responsible discipline to design for animals, plants and the environment at large.

A wide range of literature and research attempts to bridge the gap between architecture, design and art with human-animals or human-plants studies, in some cases, extending the field of study to cover non-living objects or things. I would like to stop at Bruno Latour's theory of "we have never been modern" in which he argues that there is no clear distinction between nature and society and where he poses the question of who is to write the full "Constitution" of such a hybrid world we live in.[19]

Landscape urbanism might be in a privileged position to apply lessons from ecology, complex system theory and landscape design which would be a starting point for humans, animals and plants inclusive projects[20]. In fact, when taking a quick look at some milestones projects in the history of landscape design development, we can recognize a turning point in the 70's, with the landscape garden movement, where the non-human figure was repositioned at the heart of the landscape, probably the result of an increased awareness about the endangered species and the importance of biodiversity[21]. Later, as technology drastically affected the scale of projects and the materials and techniques of constructions, landscape urbanism could make sense of infrastructure projects, large urban connectivity schemes and habitat restoration and protection, not only to keep nature balanced but also to optimize energetic flows and sometimes integrating food-production.[22]

In a rapidly transforming world, the architecture discipline needs to be re-evaluated and the role of the architect redefined. For centuries, architects have planned, designed and built town and cities, set visions for countries and empires, built the most complex structures as well as the "manmade extension of nature"[23]. With the emergence of many fields of specializations and trending building technologies, the architect's role has been restricted to punctual projects as well as the application of ready-made design solutions while other disciplines have found their vocation and thrived. This paper is a call to reclaim the role of the

[18] Jennifer W., Marcus O., Animals in Contemporary Architecture and Design, Journal of animal/human interface study, Volume 8, Number 2, Spring 2017

[19] Bruno L., We have never been modern. Translated by Catherine Porter. Cambridge, Massachusetts: Harvard University Press. (1993).

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[21] Jennifer W., Marcus O., Animals in Contemporary Architecture and Design, Journal of animal/human interface study, Volume 8, Number 2, Spring 2017

[22] Ibid.

[23] Aalto, A., 1925a. Architecture in the Landscape of Central Finland. In: G. Schildt, ed. 1997. Alvar Aalto in his own words. New York: Rizzoli. pp. 21-22

architect in envisioning a better living environment on earth by genuinely bringing back the land with all its inhabitants and products into the equation and saving the "place that remains"[24]. It is also a call to revise the architectural programs accordingly by preparing the architects of the future to become more responsible rather than becoming a pure commodity for the market and the new trends.

Acknowledgements

I would like to thank my colleagues Ali Al Assaad, Karim Bacha, Lea Helou, Fadi Mansour, Candice Naim and Jane Nassar for their valuable contribution to the Dalieh to the power of nature project and without whom this work could not be completed.

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[24] The Place that remains is the name of an international conference held at the Lebanese American University in March 2018. In line with Free-space, the theme of the upcoming 16th International Architecture Exhibition in Venice, the aim of the conference was to reflect on the un-built spaces in the Lebanese territory, their histories and their potential.

[10] Carl E., The Greenest Building is… One this already built, Forum Journal, Volume 27, Number 1, Fall 2012, pp. 62-72.

[11] Jennifer W., Marcus O., Animals in Contemporary Architecture and Design, Journal of animal/human interface study, Volume 8, Number 2, Spring 2017.

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LIVING WALL ECOLOGY

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Abstract

The design and implementation of an extensive west facing living wall on the University of Texas Austin campus appropriates an ecological view of the natural world; seeing a wall as opportunity to serve as a connected, interdependent whole to its urban context and environment. Every module, or cell, in this wall negotiates plant appropriateness and water conservation. With inclusion of ecological habitats and intelligent data gathering technologies, the living system activates an alternative approach toward synchronizing and creating atmospheres of digital information. Collaborative research on suitability of plants indicates that there are suites of regional plant species, tolerant of high root temperatures and limited water availability, especially critical in the hot and dry climate of this application. Analysis of useful data associated with water usage, plant growth and behavioural interaction assesses the environmental effects of the wall's location in relation to the selection and maintenance of the plants within. The post-installation analysis identifies the possibility of expanding its ecological goals, heightening the biological species living in the wall and better yet transforming its microclimatic environment.

Keywords

Living wall, ecology, habitats, BIM, green infrastructure

1 Introduction

A move toward a holistic built environment requires a fortitude of ecological concept, execution and measure. To address this intention, façade greenery is suggestive of an alternative approach—one in service mainly to ecological enhancement. Such façade greenery has become (in recent years) a commercial trend, often with a sole focus on aesthetics with the application unsustainable plant and water expenditure [1]. If however, appropriate hardy plants are aggregated across a city, such ecological concepts hold pervasive potential to leave a lasting, "human induced" improvement to the planet.

The design of an extensive west facing living wall on the School of Architecture at the University of Texas at Austin (UTSOA) appropriates an ecological view of the natural world. Under this pretence, a wall serves as an opportunity to be a connected, interdependent whole,

whereby current views on landscape that ascribe the human contrived Anthropocene era extend from cultivation, reflection, utilitarian and ecological [2]. Every fabricated, ecological module in this instance negotiates a relationship between the built and natural world. Besides the regionally driven plant list, inclusion of habitats and intelligent recording technologies activate the living system as a novel approach toward measuring, synchronizing and creating an environment and atmosphere of digital information.

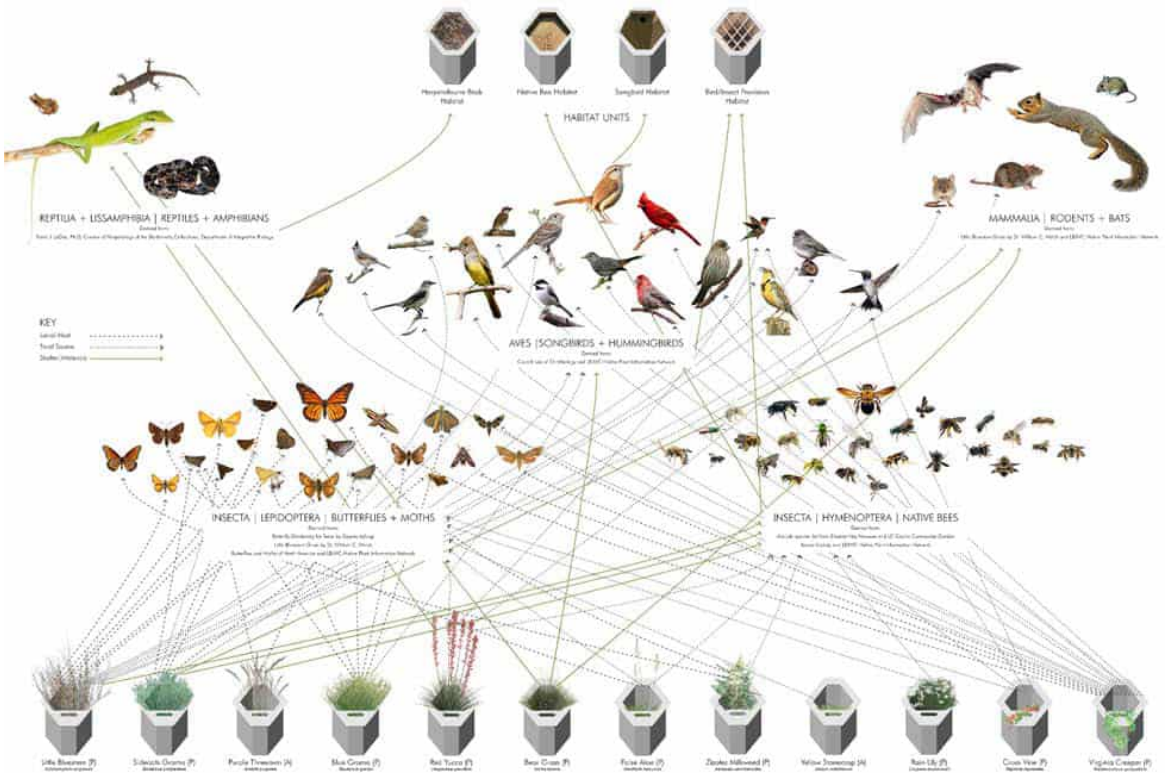

Figure 1. Selected plant species & habitat cells aligned with ecological network (Michelle Bright, Lady Bird Johnson Wildflower Center)

The project comments on human impact on biodiversity as one that celebrates a constructed artificial ecology. The walls stands 609.6cm length x 365.76cm height x 30.48cm deep in scale. Each of the 104 hexagonal CNC extruded cells are gravity supported in a steel frame that supports the load of flora and fauna integration. Larger soil volume per plant is necessary to reduce thermal load of plant root networks, as well as the eco-habit requirements and data capturing devices. In its hot and dry climate, this prefabricated system is alive with plant diversity, varied eco-habitats and customized data feeds that record (in real time) any user proximity, daily water distribution and local temperature values.

Collaborative research between UTSOA and the Lady Bird Johnson Wildflower Research Center (LBJWRC) on suitability of plants indicates that there are suites of regional plant species, tolerant of high root temperatures and limited water availability. This development is especially critical in the hot and dry climate of this application. Triannual monitoring of plant growth and behavioural interaction assesses the environmental effects of the wall's location in relation to the selection and maintenance of the plants within by the LBJWRC team under direction of Dr Mark Simmons and Environmental Designer, Michelle Bright. Collection of

useful data associated with water usage is also in conjunction with the UT Smart Water Initiative under supervision of Program Coordinator - Irrigation and Water Conservation Marcus Hogue.

While the concept of "set it and forget it" might work well for cooking techniques or possibly the stock market, it is no longer tolerable for the built environment. This research promotes a post-installation analysis that identifies ways in which the project, under direction of UTSOA Research Scientist Associate II Benjamin Rice, expands its ecological goals and extends the life of the design process, heightening the biological species living in the wall and better yet transforming its microclimatic environment.

Figure 2. Living wall with embedded habitat cells (credit Briscoe)

2 Smart Cells

The wall is comprised of native plants rooted in suspended growing media. It contains seventy-nine uniform prefabricated hexagonal cells formed from marine grade thermos-plastic. More importantly, the size and geometry of the containers provide greater soil volume for each plant and habitat species. Components angle down at 60 degrees to be gravity supported upon installation, which results in a self-shading state in the intensity of the west facing solar condition.

2.1 Plant

The living wall consists of vegetation from three main ecoregions, the Texas Blackland Prairies, Edwards Plateau and Chihuahuan Desert. Due to the context of the project and hotter urban conditions, some of the vegetation was selected from areas in ecoregions west of the

Austin. The research in plant selection considered vegetation requirements, height and spread of species, and flower color when laying out the plants in the living wall; creating subtle pattern alongside ecologically promoting relationships.

Table 1: Regional Vegetation Observations

condition	location	Plant example
limestone cliff	Balcones Canyonlands (Level IV)	Beargrass (*Nolina texana*)
granite rock	Llano Uplift ecoregion (Level IV)	Yellow stonecrop (*Sedum nuttallianum*)
climbing species	Registration deadline for Authors	Cross vine (*Bignonia capreolata*)

The soil media used in the Living Wall is a patent pending mix, SkySystem™ developed at the LBJWRC from over a decade of research [3]. The ecology team designed the media specifically for planting on structure, such as green roofs, walls and elevated planters, and for semi-arid, and sub-tropical climates. Larger soil volume per plant is necessary to reduce thermal load and to regulate soil temperatures, protecting the plant rhizosphere from the excessive heat. The micro-particulates in the media retains water to ensure verdant growth with minimal irrigation post establishment. In addition, the mixture is composed of 100% recycled material sourced regionally, when possible.

Figure 3. Plant selection with physical characteristics comparison
(Michelle Bright, Lady Bird Johnson Wildflower Center)

2.2 Habitat

One of the project's primary innovation (in comparison to the standard living walls) is the integration of bio-habitats for beneficial fauna. Design specificity (embedded in several cells) targets the particular needs of pollinators (for example hummingbirds and butterflies), songbirds and raptors (like owls or hawks), and arachnids and herbivores. One cell, for example, holds the birdhouse for the Carolina Wren species, one of many from the Central Bird Flyway, a migration path stretches along the entire length of the Americas and that use this location as a stopping point along this long journey.

The habitat requires placement approximately 1-2 meters above ground with box dimensions of 12.7cm x 16.51cm and an opening diameter of 2.8575cm to deter non-native, European species such as starlings and house sparrows from entering. The potential ecological networks afforded by these plant to plant placements and plant to habitat combinations hold an expectation to increase biodiversity and ecological rejuvenation. More so, the plant and habitat combinations offer an inevitable natural and effective air purifying system, removing particulate matter (O3, VOC and CO2) as it passes through or across the wall.

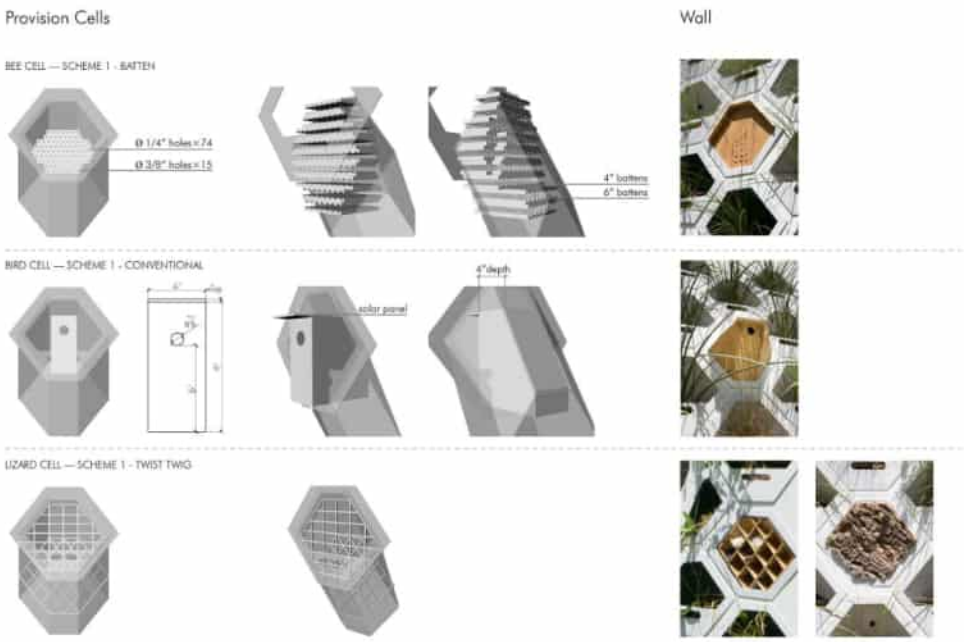

Figure 4. Habitat Provision Cell Design specificity and constructed module on wall

2.3 Data

With shared folders, open - source information, and around the clock Wi-Fi connectivity, humans are increasingly in technological synchronicity. This space of concurrence could be more than connectivity of ourselves but include that of flora and fauna, to promote the local ecologies and provide for congruity with other species [4]. This research suggests information modelling is arguably an effective manner to support innovation in the design process, as well as promote collaboration between ecology and architectural disciplines.

Building Information Modelling (BIM) is the formative software platform for the synthesis of the digital workflow. Advanced use of material take-off for scheduling plants and

species characteristics and specific needs develops plant patterning through Autodesk Revit/Dynamo visual programming. Quantification and selection of plants from ecologist to landscape maintenance team allowed for legibility of this information through color-coding and pattern [5].

In addition, designated cells contain 'Arduino Uno' boards that connect sensors with custom-designed 3D-printed attachments. Data values (captured and recorded in real time) are temperature, light, sound, and user proximity. The recorded values are translated into units (degrees Fahrenheit, lux, decibels, and inches, respectively) using standard parametric software plugins and are exported at specified intervals, allowing the data to be tracked over time. The diurnal swings of light and temperature and the seasonal changes of these swings allow for monitoring of the endurance of the plant species within the wall through varying weather conditions. When collected at frequent intervals, the sound and proximity sensors in the habitat can give a sense of wildlife and user interactions with the living wall, while data from the light and temperature sensors collected at longer intervals is more useful for determining average values of weather conditions across the wall. Data measurements are evaluating whether this green wall is cooling the west facing building surface it sits in front of, the interior space between living wall and building and even reduce ambient air temperature around the building – then helping to mitigate the urban heat-island effect. The system monitors and controls daily plant requirements through single cell, drip irrigation lines and drainage.

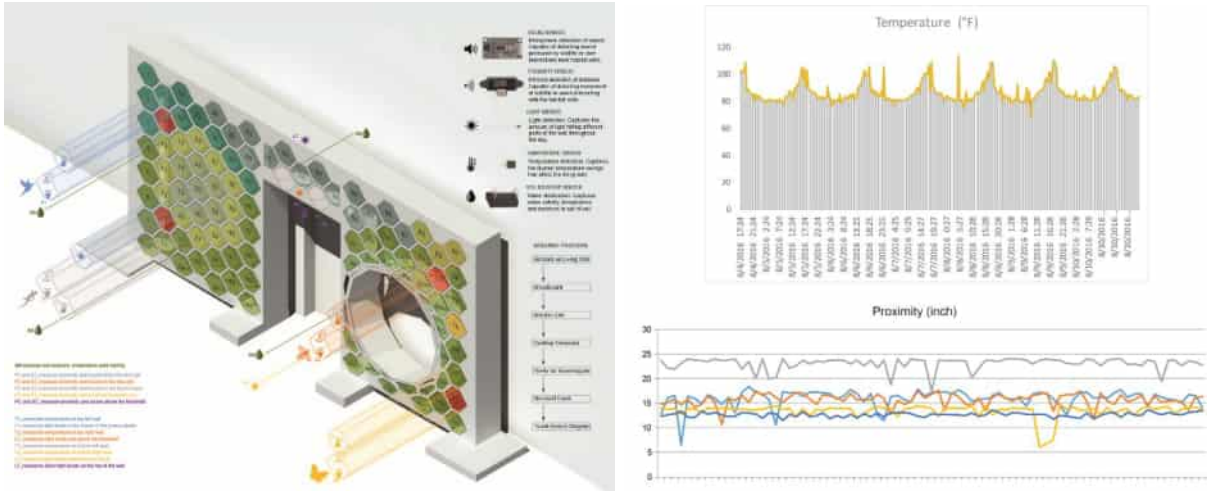

Figure 5. Data collection map with Arduino hardware and multi-day period Readings

The University of Texas Irrigation and Water Conservation team, led by Marcus Hogue, evaluate soil moisture and water supply through four integrated Toro monitoring devices imbedded in those strategic cells. Monitors also track water usage for each plant cell through individually fed lines. The data values track the percolation of water through the soil medium. This research demonstrates the low water usage of the wall in comparison to other horizontal landscape plots of this scale on the UT campus. As well, the team analyzes temperature differences throughout the year and the day by way of thermal readings captured by a drone. Data capture images demonstrate how the building itself is allowing heat to escape and door and circular surface but living wall acts as a thermal buffer.

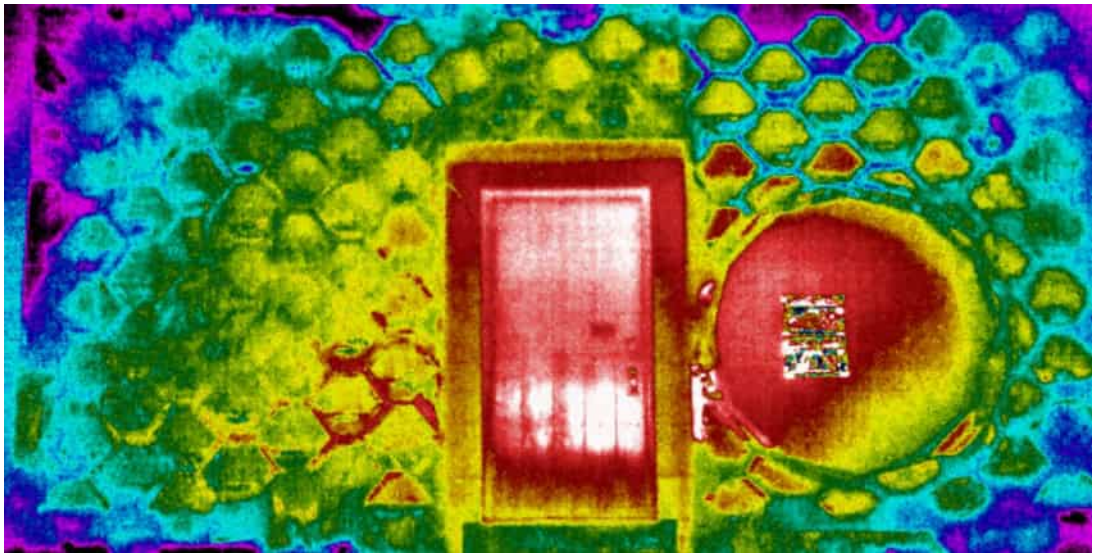

Figure 6. Image taken at 9:45 am in February 2018 (credit: University of Texas Landscape Services - Markus Hogue)

3 Process of Collaboration

Can the “age of humans” catch up to the inherent intelligence of nature’s cooperation? A logical and positive extension of the project is the abundant technologically driven, disciplinary collaboration. As well, volunteers at the LBJWRC planted prefabricated cells during prime seasonal period and stacked flat efficiently for growth and observation.

Figure 7. Plant cells grown and stacked at Lady Bird Johnson Wildflower Center prior to installation day on UT campus (left), Installation day volunteer students and Facilities Maintenance team (right)

A pedagogical “Plant the Wall Day” joined students from architecture, landscape and planning disciplines to work with facilities maintenance teams from three sectors of the university. This gives multiple stakeholders invested interest in the process and collaborative nature of future construction endeavours.

4 Post Construction

The post-installation workflow monitors the biological species living in or passing by the wall. Plant and root growth are evaluated and maintained every three months by the LBJWRC team. As stated previously, the wall records in real time the temperature, light, sound and proximity data into quantifiable values, allowing the data to track over time for the past year. Through a QR code, the wall serves as an interactive, educational experience to visitors. To complement the pedagogical dissemination of the data collection, the QR links to a novel Dashboard that allows access to the plant and analysis information. If you click on a cell, the URL will take you to corresponding data files of the collaborating ecology center and website content. By hovering over a graphic display cell, the plant definition, an image of that plant and current data metrics displays. Photos of the habitats and plant material information appear when interacting with this live information model.

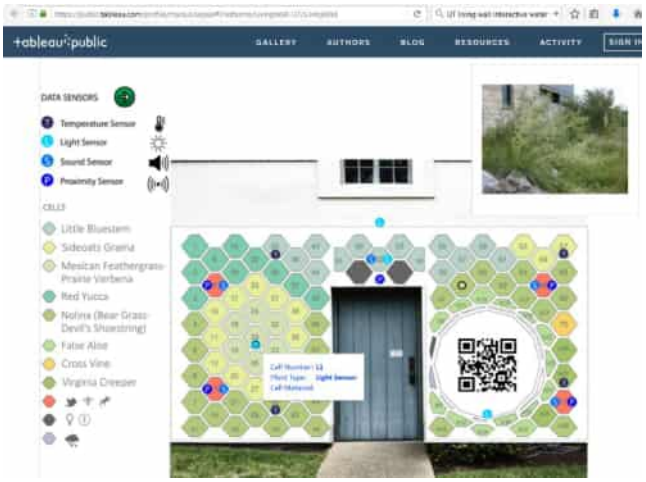

Figure 8. One cell contains a QR code links to the Lady Bird Johnson Website that allows for further education and understanding of the walls content, process and progress.

5 Conclusions

The architecture discipline now has a responsibility to be geological in scope, climatically motivated and furthermore driven by an advanced computational collaborative mainframe to share space with ecology. The project ultimately manifests a new approach to facade, design research and pedagogy through a fabricated natural domain and fully integrates flora and fauna to define a new environment. These formats of overlapping computational sovereignty establish an ongoing virtual environment for the project with a checks and balance system of performance. The wall has facilitated a successful disciplinary effort across the architecture, engineering, computer science, integrative biology and ecology disciplines of the university and has initiated the integration of robotic incremental cold forming for fabrication within the

school of architecture. This ubiquitous sensing can and should now underlie all building envelopes, especially the ecological ones. The smallest of architectural interventions can pose a new way of experiencing and understanding a constructed environment that is inherently ecological. Far from simply a green wall's aesthetic appeal, lies its functionality to biodiversity. Might there be a moment in the Anthropocene where human intervention legibly preserves in the earth a positive cause of a better planet.

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MULTI-LAYERED SPATIAL EXPERIENCE MAPPING: DECODING AIRPORT PASSENGER TERMINALS

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Abstract

This study focuses on the methodological research and developments on the subjective spatial experience of airport passenger terminals as strict programmed buildings which derived from master thesis "Spatial Experience Mapping of Airport Passenger Terminals: One Journey, Two Airports" [1]

The "scene" as a place that enables events and activities, the spatial coding of the mind, movement, spatiotemporal relation, transiently assigned attributes to the place and emotions of the user caused by the place seen as important layers in the spatial experience on airport passenger terminals. With regard to the transfer of these layers, a metaphor is created "Read the experience as if the timeline had been shifted in a voice recording" to express the relationship between the space and the subject and the fluidity of the coding in the mind. Multi-layered maps are generated by using this metaphor.

The outline of this method is based on the literature review, the passenger-oriented values of designers as well as the qualifications that the passengers focus on; but with the information gained during the case studies, the transfer process constantly improved and became clear as "multi-layered spatial experience mapping". So the article includes the process of the methodological research as well as the method explanations using implemented case studies.

Keywords

spatial experience, experience map, airport passenger terminal, decoding space.

1 Introduction

Airport passenger terminals are structures with complex systems and multiple inputs. During the terminal design, the position of the designer is right between the user and the management, a point where both are balanced. While at passenger terminals the architect creates a balance with the values he deals with and provides institutional objectives and technical needs, he must also set up a design that takes the user needs into account.

For passengers, however, airport terminals are the structural expressions of being on the road and the first or last impression of a city. Regardless of what is missing, each structure serves

the user by creating a system with its own balance. Each airport has different effects and meanings in the user's experience within the original system it creates.

However, it has been noticed that subjective evaluations of the user experience are not included in design studies and that the layers that make up the user experience are not clearly presented in this respect.

Trying to make sense of all layers of the subjective relation between user and structure and revealing how being on the road fits into the spatial experience, put forward the idea that inputs, which have been tested for efficiency, are generated for future designs. Seeking answers to questions about what the layers, which create different focuses in the user and differentiate their experience at airports, are although the features such as movement restrictions, mandatory tracks and procedures are similar, constitute the basic motivation of the methodology creation and developments.

The mapping method to demonstrate spatial experience at airport passenger terminals have been developed using three basic sources of information. These are a literature review, the passenger-oriented values balance of the designers and the qualifications that the passengers focus on; but with the information gained during the case-study, the transfer process constantly changed and became clear.

2 Determination of Issues Affecting Spatial Experience

For the identification of the items forming the spatial experience in airport passenger terminals, it has been researched how spatial experience is addressed in the literature, which passenger-focused values are included in the terminal design and through a social media research, which qualities users focus on. This way, the layers to be used in the spatial experience map were determined and appropriate visualization methods for transferring these layers were discussed.

2.1 Literature Review: Spatial Experience and Representation Methods

Spatial experience is multi-layered and often difficult to convey. In regard to this, many designers and researchers use various spatial decryption methods and thus moved passed standard presentation methods and started to search for innovative ways to express the structural environment and its relations that make up the experience. These studies give us two different information: What are the elements that affect spatial experience and how can these elements be transferred in a meaningful way?

The architectural layout covers three relations: transformational sequence, spatial sequence, and program sequence. The transformational sequence is about the process and is similar to montage and mixing in filmmaking. In “The Manhattan Transcripts” each square is connected by means such as compression, rotation, addition, multiplication, merging, repetition, inversion, substitution, twist, and overlay. These conversion tools allow infinite possibilities for manipulation of the sequence and can be applied independently for each space, event, and movement. [2] In this sense, it can be said that Tschumi lays importance on temporal-spatial relations and completes the layers of events and spaces and their transformations in flow diagrams where momentary sections come together.

Spatial experience is often handled together with 'movement'. According to Ponty, space consists of different layers and dimensions. These dimensions and layers lead to certain changes in bodies moving in space. [3] The body forms relations with the movement in the space and spatial experience emerges through movement. Therefore, via the movement of the person experiencing the space, a path can be created about the spatial relations. These relations, that are formed depending on the movement and space gather a place in the mind and form the experience. Lynch mentions people using these 'mind maps' to find directions in the city. The image of the city consists of five elements in the mind: streets, intersections, symbols, borders, and districts. [4] Large-scale buildings may also be coded like how cities coding in the mind. Stea & Downs [5], by the way, define cognition maps as a process in which a series of psychological transformations take place. In this process, the individual acquires knowledge related to the surrounding environment, codes it, stores it, recalls it, deciphers it and links it with his daily structural environment. According to them, the main component of human adaptation are cognition maps and while establishing environmental relations, the individual solves two fundamental questions about where an individual's valuable objects are and how to reach them in the most efficient way.

The movement's representation is meaningful in this sense along with what is coded in the mind. These codes are never static. Lynch & Appleyard [6] bring a time-motion-based viewpoint to experience and representation: In large-scale architecture, the perception of the sequence is similar to that of music and cinema due to its continuity and continuous temporal flow. These kinaesthetic senses are rarely very violent, but they feel like we're dancing or like we are in an amusement park. In other words, the built environment we perceive (and encode) in large-scale spaces takes place in the mind with a continuous flow and movement. Lynch and Appleyard (1965) describe the movement and the choreography of flow in their work and reveal the visible and non-visible face of a city with all its layers.

The boundaries of the space, which we perceived and coded in the mind, are not only physical but also any emotional stimulus perceived by the body. Heylighen [7], also includes physical perception and emotion that occurs in the subject, depending on it, into the design and says that architecture is not structure designed for the eye, not a technical box but an experienced process. According to this, the emotion that arises from the subject/experience will also be an important layer in the transfer of spatial experience. While Peter Zumthor [8] describes the concept of "atmosphere", on which he focuses on in his design process, through a space experience that he lived in, he starts from the experience in the space and the emotional movement arising from this perception and says that the event, called spatial atmosphere, has a very important effect on the subject. He also says that the intensity of emotion that space arises in the user, which is most important in design, is the atmosphere of the space and the image of space in the mind of the subject.

The intuitive drawings Kulper creates while designing are a good example of the transfer of these feelings and space components. In an interview, Kulper describes the formation of this heuristic approach, which is beyond standard notations. "I was worried about how to express things that could not be expressed in metric or tools. This, in turn, allowed me to move away from the predominant official approaches and I started to think relationally and began to understand the different components that form space. This has allowed me to experiment with different visualization, imaging and drawing methods that would be much more useful in revealing conceptual and architectural possibilities." [9] Therefore; The "scene" as a place that enables events and activities, the coding of the mind, movement, which provides the

establishment of the subject-space relationship, time-space relation as a component of movement and emotions of the user caused by the place should be addressed as important layers in the spatial experience as a sum.

2.2 Passenger-Focused Architectural Values in Terminal Design

One of the most important issues in the complex system of airports that the architect should have to deal with is balancing the passenger and airport needs.

The airport designer must provide two separate but parallel qualities. Airport authorities and passengers. In the past, design guidelines turned to a functional solution like technical and functional issues such as direction finding, visual transparency, short walk routes and security instead of aesthetic solutions.

As these technical and functional situations gained solutions, designers have begun to focus on different values. Requests that designers must primarily deal with are according to Blow [10]; security, traffic intensity, shopping, airline traffic in different sizes (airplanes of different sizes), government policies (customs and control operations). Innovation in design and other values with passenger focus may only gain importance after fulfilling these requirements. This delicate balance created by the architect will directly affect the user's experience. Edwards [11], however, defines key qualities in passenger terminals as functional qualifications, space qualities, and architectural image. Functionality is what terminal needs to do and it can be measured how well it is done. Space qualifications and qualities are important for passengers that spend long periods at airports. Architecture is the most important factor that influences the material and the structure and the spatial experience. Nowadays, besides the functional and operational basic features of airports, user differences have also started to be included in the design criteria. The awareness of this distinction in user-focused approaches directly affects the user's experience, who has different needs and expectations.

2.3 Qualities that the passenger focuses on in terminals

Based on the values that the designers set up with passenger focus, it was tried to identify the user focuses on social media that can refer to these values. This way, it was aimed to make sense of the point of view of the experiencer during the spatial experience. The functional, technical and formal values that are architectural values in design and used as design inputs have been evaluated through social media. This way it has been revealed on which common qualities the passengers with different needs and expectations focus on.

By analyzing the individual items such as space design, access, transportation, architectural style, volumetric decisions, routing tables, transparency, natural ventilation, parking organization, program, organizational and technical requirements, they are met at certain levels and mature into one. On the passenger side, each of these items is evaluated as a whole and influences the overall experience of the passenger. Potentially certain deficiencies or values can be created in each item, including organizational structuring. Therefore, even if each item is assessed momentarily and separately, the balance it creates as a whole must always be considered. The study was conducted with a focus on domestic terminals. Since different spatial inputs created by passenger flow differences between domestic and international flights need to be processed together in common terminal uses, it has been decided to select examples of terminal systems with separate structures, where these

decisions can be read more clearly from these airports. The purpose of use in social media comments on these airports is clearer to read and it is clearly understood if a domestic or international flight has been taken place or not. Accordingly, four examples were selected with the help of the stratification in the space design and the results of visualization in Turkey, and evaluation was carried out with social media tools based on the location. [1]

Looking at the data gathered from the passengers, functional characteristics of the structure can be categorized as access to the airport, the sufficiency of service areas, orientation and comprehensibility, access inside the airport, and airport passenger capacity. Formal characteristics are airports image, visual connectivity and transparency and the technical characteristics are lightings, air-conditioning.

3 Layers of Experience Affecting the Passenger in Terminals

It's been determined a total of six layers in regard to literature, in which the spatial resources make up the spatial experience, the passenger-oriented architectural values by the designers and the social media research, which are related to each other.

3.1 Space as "scene"

Space as a scene that allows event and action also a founding element of the experience layers. Space can be seen as a set up with a variety of vertical and horizontal planes at airports terminals. It is basically an introduction to the definition of surfaces at airports and their place and coding in the mind. When these founding elements are placed on the plan, they form the first notations that will later be associated with the movement of the subject. Because airports are strictly programmed constructions, they own spatial organizations with visible borders, passages, and areas. According to this, it can be said that there are five characteristic types of surfaces in airports. These are; Opaque surface, perceivable from only one side (movement border/ visual border), Opaque surface, perceivable from both sides (visual boundary separating two volumes/ accessible), Transparent surfaces (movement border/ visual freedom), Function loaded borders (cannot be accessed but is used; passenger acceptance, kiosk), Ceiling height change (level change on horizontal surfaces).

The distances between these surfaces and the spaces they define shape the volumetric perception. Apart from this, the controlled passages are another prominent element of the airport plan. Only those users who have been identified can pass through these controlled passages. This is not a spatial but a programmatic border. These are; one-way free passage, two-way free passage, one way controlled passage, controlled passage/ free passage (can be exited freely), the regions defined by these programmatic boundaries define the access surfaces of the users. According to this, defined regions are; all users (physical and visual access), passengers with tickets (physical and visual access), and only visual access area.

After a passenger has completed certain procedures he may use one of the areas, to which he had only visual access before. For example, while he could only access the apron visually from the separated waiting hall, he is able to access that area after the last ticket control.

3.2 Passenger flow and movement

The movement that provides the establishment of the subject-space relation is both a layer of spatial experience and can be used as a trail for the expression of these relations.

The flow in terminals goes basically from the land side to the air side and from the air side to the land side. This allows us to talk about the existence of a one-way route in the space, just like being on the road. The notations about the space, the nature of the movement and the spatial components of the relation can be shown through this route.

Spatial components associated with the subject, such as boundaries, passages, and program surfaces, carry the movement and movement trace. At the same time, the movement, as the founder of these relations, also carries the space-subject and event-space elements. Time-space relation, however, as a component of movement in terminals, can be placed in the flow of experience with the speed of movement.

While there are different criteria used to define the movement speed at airports, the basic definition used is the number of movements (passenger, baggage or vehicle movement) that occur at the time of the unit, depending on the time unit and the specific application [12], However, in the experiencing space, the speed is not limited to the movement that occurs at the unit time. The sensed time flow slows down time perception and effects the spatial perception especially in transitions between areas and where procedure flows are blocked. For example, long waiting times can cause narrowing of the perception of space.

In this sense, the movement is a convenient path but when the elements of speed and space are put into relation with the event and spatial perception, it becomes a significant layer.

3.3 Event-space elements

Event-space elements are intertwined issued at airports. Because during the movement, the mind of the individual moves from place to the event and from event to place. This is especially the case when it relates to programmed surfaces. In the experience of the individual, the event-space elements instantly gain an image, they are connected to each other and within a flow of motion tracking. In this way, they take place in the mind with a holistic flow of snapshots.

3.4 Time-space crossing

Locations programmed in the space draw spatial and operational boundaries. No matter how much one is aware of these boundaries, depending on the movement and spatial relations, these regions are diversified in the mind and overflow or set new boundaries within the specified ones. The zones formed by motion, transitions and spatial relationships in the mind are fluid. They don't have strict beginnings or ends. For example, while spatial conditions such as altitude change or entering a narrow area bring along the definition of "transition area", the environment of control points are also defined as the transition area. Although control points are a transition in spite of being a procedural boundary, their effects can change instantly. That is, the waiting line that one enters to pass through the control extends the transition area up to the point, where the subject stands in line. In this case, there is a definition caused by both movement and space. Therefore, these zones are intuitive and can change with time, movement and space and can thus refer to as "time-space crossing".

According to this time-space crossings are; free movement area (areas where spatial relations are concentrated), transition area (Intermediate regions that separate two areas and vary according to location and motion), function area (areas in which event elements are highlighted), terminal effect area (events and space elements "outside" the terminal).

The terminal effect area can be seen as effect extensions of the airport. It starts with the journey towards the terminal and ends with the arrival in the plane. These conceptual extensions are situations that actually affect experience but do not involve event-space objects that are directly related to the terminal. The most effective source for this is the time the passenger needs to arrive at the airport, modes of transportation and what happens until he arrives.

3.5 Qualities assigned to space

Qualities assigned to space are formed by a process of the experienced space but they are instantaneous and "blinking" status determinations. Like all the coding the individual makes about space, he attributes qualities to the parts of the space he is experiencing. These judgments, which become evident in the user, have a huge impact on the entire spatial experience. Because, like the complementary parts of a story, there are summary results of certain regions. These qualities become a meaningful layer together with the process that enables them to be formed.

According to the conclusions made through literature research and user focuses, the qualities assigned to space are as follows; Access: Potential transport possibilities and the selected mode of transport; metro, bus, airport service, private vehicle or taxi/rental vehicle. Functional qualities: Shopping, sufficient cafés/kiosks/toilets. Direction and intelligibility: mixed, orientation through signs and orientation through the structure. Walking distance: Long walking, normal walking, short walking. Capacity/ perception of fullness: Secluded, normal, full, over capacity. Architectural image: disturbing, ordinary, impressive. Visual connectivity: not visible, limited vision, completely visible. Temperature: Low, normal, high. Lighting: Sufficient natural lighting, insufficient natural lighting, sufficient artificial lighting, insufficient artificial lighting.

3.6 Emotional status

Just as Heylighen and Zumthor emphasize, one of the most important layers of experience is the emotions that the place evokes on the subject. Emotions are not processed in the majority of spatial analyzes and visualizations. The most important reason for this is the inability to obtain this subjective knowledge through observation. But this important layer, in the map of an experience created by the subject itself, adds a much deeper meaning, i.e. atmosphere/aura, to the relation of space and subject and to all mental coding.

Emotional state fluctuations are both a thrust of the whole movement, event and space relations and a result. It accompanies the body moving in almost all spatial, cognitive, and social experiences. It is fluent, constant and flexible.

The emotional situation in airports is included in the spatial experience as both a source and a result of the spatial experience, and it is thought that the experience can be demonstrated by the deeper meanings of the atmosphere of the space.

4 Demonstration of the Spatial Experience Map

A metaphor has been created for the processing of six layers, which are thought to influence the passenger's experience: Reading the experience as if the timeline had been shifted in a voice recording. In other words, the transfer of both instant and holistic information with all its layers. This metaphor is well suited to the continuous relation of space with the subject and the sequence of coding in the mind.

Accordingly, the movement/route is given on a track, which also shows the relationships. However, before this track can be established, it is necessary to understand the codes that are transferred from the physical world to the mind.

For a complete understanding of spatial references and for showing the relationships between physical boundaries and space-time crossing, a plan of the space was obtained before the experience (Figure 1). This creates a base on which surfaces, transitions, and defined regions can be processed. The codes for the perceived surfaces, transitions and regions during the experience are transferred to their places on the plan. If a surface has not been detected at all, in other words, if it doesn't own visual/physical or emotional place in the space-subject relationship, it hasn't been drawn.

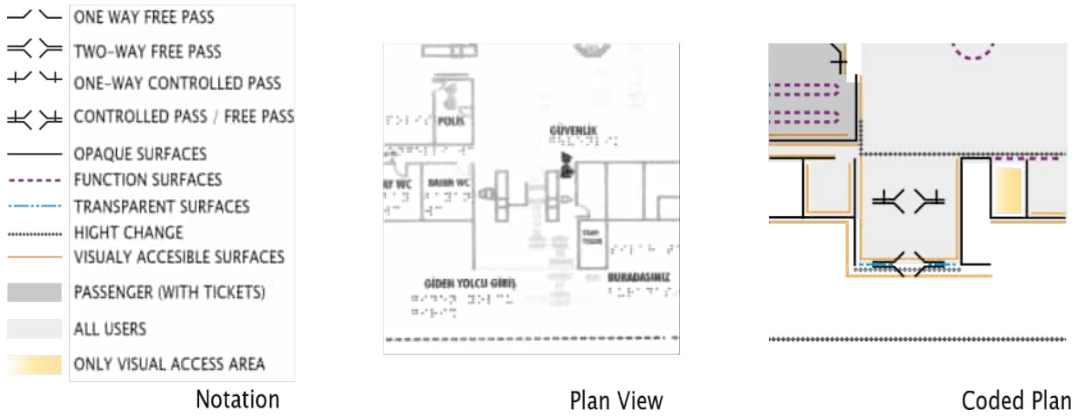

Figure 1. Notation on the plan level

On the coding, where the spatial objects are processed into their actual places, the movement trace is located with the points referring to the event-space elements. The time-space crossing areas that appear during the experience can be seen in the plan view (Figure 2). These regions are intuitive area scans that simply cross each other in the plan view, expressing coverage. Even though the relationship to the movement causes situations such as elongation and trespassing into each other etc., the fluid boundaries are processed on the basis of space and relationship. In other words, the traces are not the effects on the subject such as boundaries of the areas, the dominance of the area or the intensity of the feeling, they are the traces that cannot be seen in the real world but drawn in the mind. While plan representations carry these areas according to their physical boundaries, the effects of the areas on the subject can be seen when the experience line is opened. This difference will be better understood in the representation of the experience flow in the second stage.

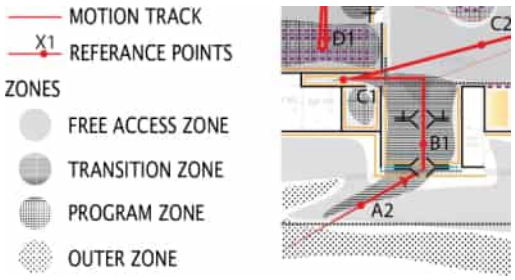

Figure 2. Zones arising from motion and time-space crossing on the coded plan.

At airports, where plan notations have been completed, the motion traces expressed in the static world drawn by physical boundaries have been opened in a single line to create a track that will carry the layers of experience. The reference points become a vertical reference, which will form a section to the moments of the experience layers.

Thus, the added layers do not lose their physical references. Spatial notations encoded by the mind, like the transitions and ceiling height changes, have been processed on the opened track/route. Speed, however, is crucial in establishing a relationship with time on this route (Figure 3). This line of notations about space and speed is still two-dimensional. But the motion that opens up to a single line, along with the notations it carries, allows the transition to perceptual dimensions of the experience layers.

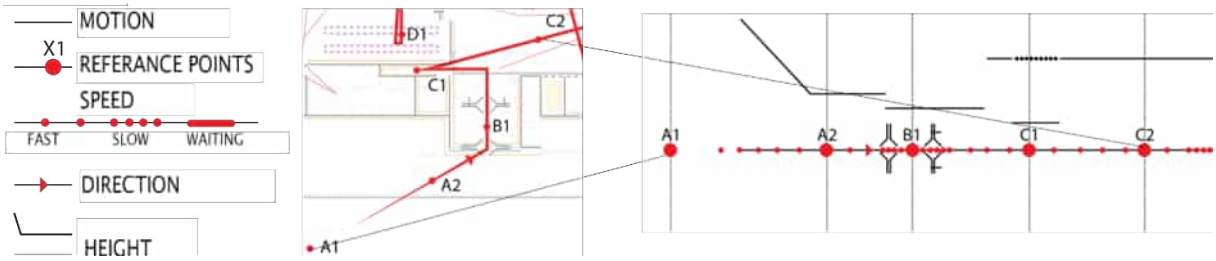

Figure 3. Opening in a way as to create an experience track.

The relationship established by the vertical and horizontal surfaces opened to the experience line refers to the volumetric perception so that it is no longer linear but a spatial expression. While the length shows the affected area of motion, height refers to the volumetric width. This volumetric perception can be narrowed and expanded not only with space but also with time and motion-related effects.

Event-space objects have, as mentioned earlier, momentary images in mind but they are also holistic because they are always flowing. In this regard, it has been decided that the event-space elements, which follow the route on the experience map, are instantaneously significant but that there must be a holistic image. The regions arising from time-space crossings can only be expressed in the flow after the processing of the layers described up to this point. The need for these layers, even in the research for ways of expressing, shows just how holistic the expressions of these zonings are in spatial experience.

These intuitive areas that reference both event-space flow and spatial notations, express with their length in the experience line their sphere of influence and with their widths their effect power. The diversity of these areas and the ways in which they relate to one another are a crossing of the events, space, time and speed (Figure 4). Examination of such relations through given examples will help to understand this layer in the experience maps. It can be seen that the only dominant region in the example of the figure is that it loses all its other meanings in space and only gives the feeling of 'transition'. This indicates that between point B1 and the

point C1, the presence of the control points and the feeling of volumetric narrowing cause the subject to identify a dominant transitional region in the field. The subject passing from C2 to C3 experiences a crowded event. The movement speed decreased and the feeling of volumetric narrowing increased. Thus, it can be seen that the function area (in this case passenger acceptance) has started the feel of volumetric narrowing of the activity area and moved it up to the first point where the speed drops. Between points A2 and B1, the subject directly entered the transition zone from the so-called outer terminal zone. However, the subject is also feeling the free access zone surrounding this area, etc.

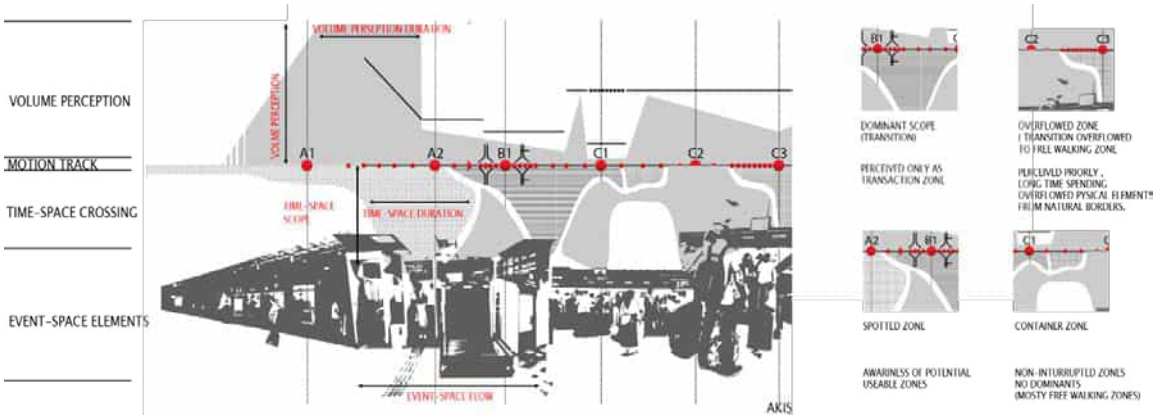

Figure 4. Volumetric perception, time-space crossing, and event-space elements

One of the advantages of transferring a subjective space experience is that the emotional state can be treated as a layer of experience. By using the emotional state color scale in Figure 5. the felt emotions have been processed.

The emotional state is both a source and a result of the spatial experience and refers to the atmosphere of the space. The idea was that this fluid, continuous and variable situation could best be expressed with the help of colors. It was decided that the place of this expression is on the event-place elements, where the most significant relations can be formed.

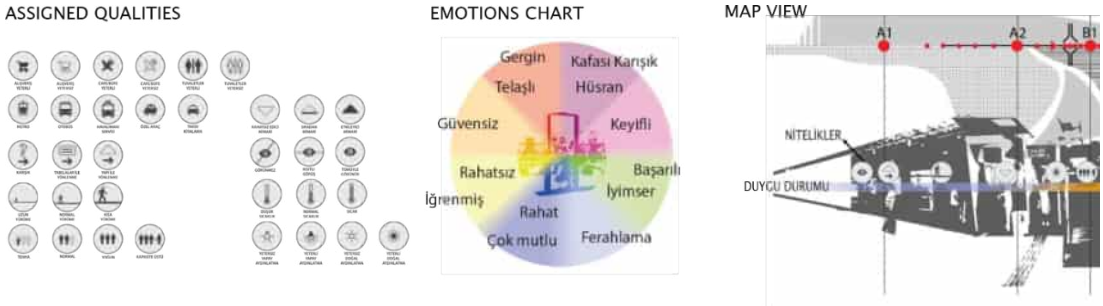

Figure 5. Qualities and emotional state color chart in the experience map

The blinking qualities are highly subjective, although partly more measurable. A chart was developed to cover the qualities that designers focus on and the qualities that passengers state through their own experiences. The reasons for expressing qualities in these charts with icons is the fact that they are created as a result of a process, but they carry instant judgments about the place. That is why the qualifications are processed at the point where the judgment has been made. But that doesn't mean that the source of this situation belongs to that moment. The reason that is the source of judgment can only be understood by examining the layers of experience before it. Since these judgments are generally related to the event-space

elements and to the emotional state, the qualifications are embodied in this field. The map has been completed by all these layers combine. (Figure 6)

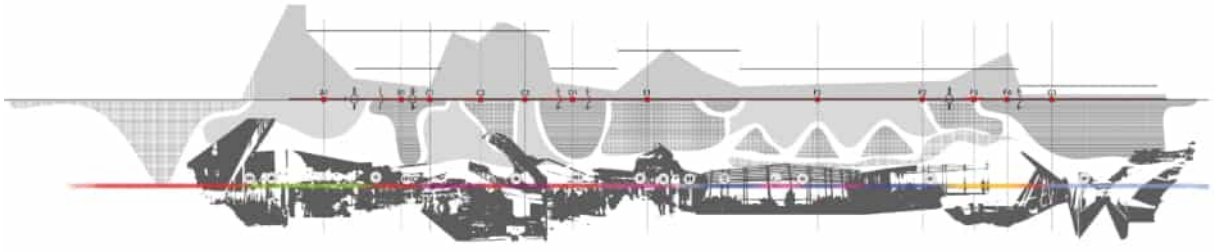

Figure 6. Sabiha Gökçen Airport departure experience map

5 FURTHER NOTES

From these source studies, the layers of the airports to be researched and transferred were determined. While space, the place where the experiment is performed, creates the possibility of event and action, it emerges as the founding element of the layers of experience. The movement that provides the establishment of the subject-space relation is both a layer of spatial experience and a trail for the expression of these relations. That is, when a movement, which is located on a two-dimensional plane, is opened up, it is turned into a pursuit of the other layers of experience and giving the visual expression a dimension allows the coding of the mind to be processed.

Event-space items are intertwined and consecutive situations in the experience of the passengers at the airport. During the movement, the mind of the individual moves from place to the situation and from situation to place. The source of this might be the dominance of the program items of the strict programmed structure and the deterioration of the continuity of the space image. Because the event seizes the mind of the passenger that wants to overcome the obstacles created by the operational and procedural situations and changes place with the space items. Because of the stream of instantaneous images generated by the motion, the event-space elements take place as an integral whole.

The time-space crossing can be seen as a situation created by the mind in relation to movement and space. That is, solid space gains a new dimension by fluid motion. The individual creates new boundaries that overflow from the programmed spatial and operational boundaries of the given space, which he perceives through motion. The zones formed by motion, transitions and spatial relationships in the mind are fluid and intuitive. They don't have strict beginnings or ends.

Attributes assigned to the place are "blinking" situations that occur instantaneously but occur as a result of a process. These instant situation detections that become evident in the passenger, are very important for the whole experience. But even if these instant judgments shape the whole experience, they gain a "blinking" character due to the strict schedule of airports and the lack of alternatives.

An individual who perceives the place with a certain emotion and new emotions created by the place on the subject emerge with a dynamic relation. Emotional state is a result of both an impulse and a space-subject relationship. This important layer, in the map of an experience created by the subject itself, adds a much deeper meaning, i.e. atmosphere/aura, to the relation of space and subject and to all mental coding.

In the process of transferring the subjective experience, a metaphor is created for the expression of these six layers and the possibility arises to read the experience as if the timeline had been shifted in a voice recording and to express the relationship between the space and the subject and the fluidity of the coding in the mind. The opening of the movement as a path provided a bridge between the physical and solid world of the space and its form in the mind.

Layers such as the subjective transfer of spatial experience, changes in the emotional state that cannot be fully achieved in objective observations, the focus event-space objects that are encoded in a fluid way and the time-space layers are also processed on the path. Since time-space is a crossing of the elements movement, space, event and time, it is the most important layer that shows the spatial relationships. The emotional states, however, reveal the change in the atmosphere and the sources for such together with the flow and other layers.

The passenger-oriented architectural values go, in this sense, beyond functional relations and it is necessary to put these in the middle of this experience stream, consisting of image, meaning and all other layers. In design, starting from the codes created in the mind about the layers of experience and the tested relational situations, it is possible that similar subject-space relations may lead to similar coding. In this case, the transferring of knowledge from the subjective experience during the design, for potential routes that may occur, may be an effective way to draw fictional spatial experience maps by using a library of tested situations.

Using the layers and presentation methods revealed in the method used to transfer the subjective spatial experience it is thought that subject-space relations will become more meaningful, especially with the creation of experience maps of different typologies with strict programming. The spatial experience maps that are processed in this study and include a journey, are an open beginning to convey the subjective experiences of different airports within the scope of different journeys. From here, the examination of different airports with similar methods can be used to reveal the situations of different subject-space relations and will provide the designer with a wide range of tested situations.

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DIRECTIONS OF TRANSFORMATION OF SOCIAL BUILDING IN POLAND ON THE BACKGROUND OF FOREIGN SOLUTIONS

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Abstract

One of the measures to improving the housing situation in Poland has to be integrated programme of social housing rent, under which it is anticipated the presence of three support instruments in the form of support building for the poorest and building for rent for people with lower income of a non-refundable, support found social housing in the form of the financing of the callback. The premises created under the program are intended for people whose financial situation justifies obtaining housing assistance. The most important element of the task will be the development of standards of new social housing construction. The developed and implemented standards will result in the optimal use of public funds through the introduction of methods and design solutions that will ensure optimal construction costs, low cost of living, respect for spatial order and high functional quality of flats. The papper will describe the following stages of the studies carried out:

1. Analysis of a representative group of undertakings in the field of communal and social housing construction

2. Analysis of solutions for cost optimization of investment and construction projects in the field of social construction implemented in other European countries

3. Analysis of individual elements of housing investment in terms of their impact on the total cost of the investment and the costs of subsequent exploitation of the housing stock

4. Developing conclusions and recommendations for solutions that will define standards for housing built in the social housing construction

Keywords

social housing, parameterization, quality of life, cost optimization, multi-family housing

Introduction

The aim of the study is to analyse the possibilities of optimizing the construction of residential units within the framework of the above-named program. The study aims at maximizing the efficiency of public funds utilization and developing standards for effective implementation of new social housing projects. The premises created under the program are intended for people whose financial situation justifies the obtainment of housing assistance. The most important element of the task will be the development of standards of new social housing construction. The developed and implemented standards will result in the optimal use of public funds through the introduction of methods and design solutions that will

ensure optimal construction costs, low cost of living, respect for spatial order and high functional quality of flats.

Analysis of a representative group of undertakings in the field of communal and social housing construction

The issue of cost optimization related to the construction of multi-family buildings, not only for people of low income, takes into consideration the necessity of obtaining favourable effects. They include not only the reduction of construction time and costs but also the decrease of running expenses. Moreover, the issue of cost optimization takes into account the effective use of living space, including its adaptation to changing social needs. An additional aspect involves the achievement of spatial balance, i.e. where a building investment does not disturb spatial order but fits into it or even sets new standards. Such an approach to cost optimization points out to the areas which are crucial in terms of analysis and within which possible optimization solutions (based on existing analyses) will be sought. The issue of cost optimization involves three major areas. The first of the above-named areas is **cost optimization** related to the reduction of construction costs as well as the follow-up operation. The intended result can be achieved by using building materials and services characterized by qualitative and price-related parameters simultaneously incurring minimum expenses. In view of the foregoing, the essence of the investment process includes not only the appropriate design of an investment (with the significant role of an architect) but also the efficient management of the building process-related deliveries of necessary building materials at the lowest possible costs. The appropriate combination of construction and management-related aspects enables the obtainment of optimum investment parameters and the best possible return on investment. The second area, i.e. **functional optimization** requires taking into consideration the future use of flats and communes' needs to provide flats to people with low income. The issue of functionality is viewed from two perspectives, i.e. that of residents and of investors or non-governmental organizations tasked with the implementation of a local social policy. The first aspect entails the design of spaces in buildings which will enable the satisfaction of dwellers' primary needs (providing kitchens and toilets) and additional needs (ensuring the storage of various objects in tenants' storerooms). The functionality viewed through the prism of a social policy should allow for the future usability of buildings, e.g. by providing additional residential spaces in the event of higher demand for social or communal flats. Finally, **spatial optimization** requires that investments into housing development should take into consideration the existing spatial order. It is therefore necessary to address a local cultural context, not only in relation to its historical background but, as much as possible, allowing for present spatial conditions. The principal requirement involves taking into account the layouts of local development plans. However, the satisfaction of the above-named demand should not compromise the manner of spatial design. Buildings should be characterized by an attractive form so that their residents do not feel socially excluded. It is necessary to prevent the degradation of space, which is allocated to people with low income. Therefore the buildings should not vary from their neighbourhood in terms of aesthetics and spatial composition. The spatial aspect is also related to functional issues, for instance in the scope of providing residents of buildings with access to recreational facilities in the vicinity. The aforesaid recreational facilities make the investment more attractive as regards its potential users but also because of the fact that they enter and enrich public space[1].

Analysis of solutions for the cost optimization of investment and construction projects in the field of social construction implemented in other European countries

The analysis of the architectural context related to the issue discussed in this article involved the analyses of similar investments in the world, Europe and Poland. The presentation of examples from the world aims to extend the context by including various investments and locations and showing both possibilities and architectural diversity of social housing. European implementations are treated as the closest context in relation to Polish investments, showing what type of investments can come into existence and what aspects should be considered at the designing stage to obtain the best achievable quality of architectural solutions on the basis of similar resources, materials and climatic conditions. Examples from Poland are used to present current Polish trends.

World examples

Investment: 10 Houses (Japan) comprises austere, minimalistic, simple and apparently chaotically arranged houses composing a housing estate for "the less well-to-do" in the Japanese town of Oita. The houses are located on a small slope, complementing the existing suburban housing. Ten residential units, each having an area of approximately 85 m², constitute an extraordinary composition perceived as one building. Individual houses perform the function of rooms designed so that the space between them forms virtual corridors and lounges integrating everything into one whole. Irregular perpendicular forms having glass perforations open up to outside space, encouraging meetings and integration of residents.

Figure 1. 10 Houses in Japan, source: http://www.shio-atl.com

Investment: Quinta Monroy (Chile) is the effect of collaboration of the local community of the town of Iquique with architects and the organisation of Chile Barrio, dedicated to the improvement of the poorest citizens' living conditions. A complex of 93 residential units is visually similar to previously existing undefined structures, yet is characterised by stability and functionality. The housing comprises three groups of one and two-storey terraced houses built around inner "piazzas". The fact that the residents participated both at the design stage and during the construction of the housing estate has made this investment fully acceptable by its residents. The primary objective of the project named **San Ignacio Houses (Mexico)** was a market analysis, which resulted in sticking to the regional building ideology, i.e. the construction of houses using solid slabs and reinforced structure.

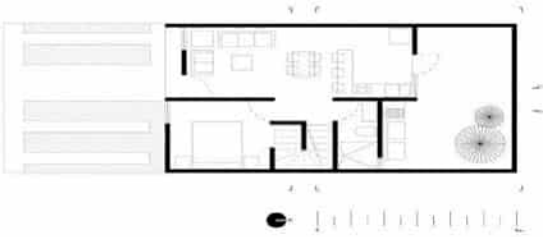
Figure 2. Quinta-Monroy in Chile, source:http://www.archdaily.com/10775/quinta-monroy-elemental

The project aimed at increasing residents' confidence in the commune authorities. The design includes a string of single-family terraced houses. The unfenced entrance yard is

arranged in a characteristic and functional manner – each building is provided with one parking lot and a front area with low greenery. All of the buildings have the same, one-storey cuboidal form, yet they vary in terms of functional solutions.

Figure 3. San Ignacio Houses in Mexico, Source: http://www.archdaily.com/796047

Europe examples



Investment: Qubic (Holland) is entirely located in the vicinity of docks, in Amsterdam's previous industrial district, currently undergoing regeneration and functional transformations. Qubic is a complex of 715 flats for students, designed as a continuous composition of containers located around two yards performing different functions.

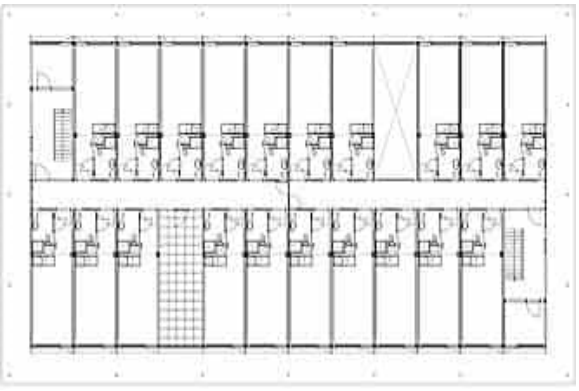


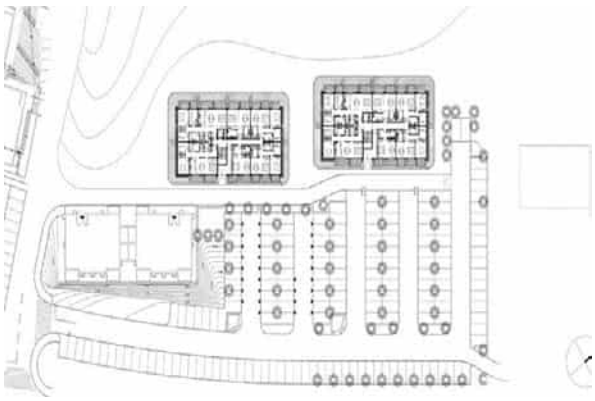
Figure 4. **Qubic in Holland,** Source: http://www.hvdn.nl/2111/projecten/0342t.htm

The first yard, small and covered with grass, should encourage meetings, whereas the second yard is intended for sport and active recreation. Undoubtedly, the advantage of the project is its location, close to a developing urban district. The plan is orthogonal and very simple. The same applies to residential units.

Investment: Izola (Slovenia) is a proposal of two residential blocks located at the Slovenian coast and addressed to young married couples who cannot afford to buy their own flats. The buildings are situated on a hill facing a mountain massif on the western side. The complex contains 30 variously sized and arranged flats, ranging from studios to 3-roomed flats. All of the flats have been designed as the necessary minimum, yet follow related Slovenian standards and regulations. Both buildings are five-storey tower blocks with 6 variously sized flats on each storey. To lower implementation costs, service areas such as kitchens or bathrooms are located in the central part of the buildings.

Figure 5. Izola in Slovenia, Source: http://www.archdaily.com/3245/izola-social-housing-ofis-arhitekti

Investment: Es Mercadal (Spain) is a project being the continuation of the existing housing development characterized by narrow streets and small courtyards. A complex of houses has



been designed as a perforated structure with small patios containing various functions filled with light and air. The design refers back to the tradition of courtyards and the rationality of traditional structure affecting the interior climate. In view of intense traffic around the land plot, the proposed system of patios improves the acoustics of the houses and provides maximum privacy. Projections of flats are identical. Each residential unit is lit by two atria, yet it only has access to one as its private mini-garden.

Figure 6. Es Mercadal in Spain, Source: http://www.archdaily.com/387245/courtyard

Polish examples

Investment in Świdnica (Dolnośląskie voivodeship) is a building on a rectangular plan located within the already existing residential housing. The scale of the building refers to the surrounding buildings. The three-storey building contains 24 flats, out of which 12 are one-roomed and 12 are two-roomed. Each flat is heated individually by a gas boiler located in the bathroom. Two flats located on the ground storey are intended for physically disabled residents. Storey projections are similar and repeatable. The concept of the form and the elevation of the building do not exemplify modern architecture.

Figure 7. Świdnica, Source: http://swidnica24.pl

Figure 8. Czerwionka, Source: http://www.dzachodni.pl

Investment in Czerwionka-Leszczyny (Śląskie voivodeship) is located at the border between a district of single-family houses and vast neighbouring fields. The urban layout contains one residential bungalow-type building and one utility building, in which one storeroom is allocated to one flat. The block at Polna street contains a total of eight small flats, each having an approximate area of 10 square metres. The flats designed for one or two residents are composed of a room, a kitchenette and a bathroom. Four flats intended for families are slightly bigger, with an approximate area of 20 square metres. Flat layouts are arranged in an orthogonal manner, yet room proportions could correspond to more typical interior furnishings. The building was created for responsible residents who will care for it and is inhabited by poor persons, yet without any legal problems and not troublesome for their neighbourhood.

The analysed social housing investments situated at various locations in the world, Europe and Poland, implemented by various organisational and ownership forms are characterized by significant qualitative diversification in architectural solutions. Examples from Europe and the world as well as those implemented by building cooperatives in Poland reveal significant disproportion in terms of architectural, functional and aesthetic aspects of the presented implementations.

Analysis of individual elements of housing investments and their impact on the total cost of the investment and the costs of subsequent operation of the housing stock

The research was based on data provided by Bank Gospodarstwa Krajowego. The obtained information revealed that the above-presented support was used by a total of 564 communes, 15 non-governmental organisations and 9 self-governmental real estate administration entities (which in this case can be recognised as a local self-government representation). As can be seen, the primary beneficiary of the support was the local self-government. The highest interest in obtaining the co-funding of residential housing investments addressed to people with low income was observed in communes located in the regions of: Mazowieckie, Zachodniopomorskie, Wielkopolskie, Dolnośląskie and Śląskie voivodeships.

Table 1. Number of investments completed by individual types of beneficiaries

	Number of investments
Communes	1261
Non-governmental organisations	15
Self-governmental real estate administration entities	9
In total	**1285**

Source: Individual study based on the database of beneficiaries provided by BGK

The analysis of the research results concerned with types of buildings being the subject of the investments co-financed by the BGK revealed that most of them were single or double-family detached buildings purchased for renovation (66.7%). The form of a single-staircase building was used in 45% of newly constructed buildings or buildings in which individual flats were purchased. Approximately 35.4% of renovated or rebuilt objects had the form of a single-staircase building. Approximately 33.3% of buildings bought for renovation were single-staircase buildings. Single-staircase buildings constituted approximately 30.4% of buildings the operation and utility manner of which was changed. As can be seen, the form of a single-staircase building has been the most popular form as regards investments co-financed by the resources obtained from the BGK.

Table 2. Types of buildings in the investments completed using BGK's funds

	Changed manner of operation	Con-structio n	Renovation or rebuilding	Purchase of flat	Purchase of building for renovation
Single-staircase block of flats	30.4%	45.0%	35.4%	45.5%	33.3%
Gallery-access block of flats	1.0%	12.8%	2.0%	0.0%	0.0%
Corridor-type block of flats	33.3%	12.2%	17.2%	9.1%	0.0%
Tower block of flats	3.9%	6.1%	9.1%	0.0%	0.0%
Mixed type building	11.8%	10.6%	28.3%	36.4%	0.0%
Detached single or double-family house	2.0%	4.4%	1.0%	9.1%	66.7%
Former public building	5.9%	0.6%	2.0%	0.0%	0.0%
Terraced house	2.0%	6.7%	1.0%	0.0%	0.0%
Unclear answer	1.0%	1.7%	2.0%	0.0%	0.0%
Former office building	3.9%	0.0%	1.0%	0.0%	0.0%
Former utility building	4.9%	0.0%	0.0%	0.0%	0.0%

Source: Individual study in conjunction with ASM – Market Research and Analysis Centre

The conducted research enabled the identification of the structure of buildings created within the investments co-financed using BGK's funds. Mostly, the investments were non-functional, i.e. residential investments with or without affiliated rooms defined as tenants' storerooms. The highest implementation range of 56 to 67% was concerned with residential investments with affiliated rooms, excluding buildings purchased for renovation and residential buildings purchased for renovation without tenants' storerooms. The next range of 32 to 40% included non-functional residential buildings with or without tenants' storerooms (as specified above). The remaining functional buildings including residential-service, residential-administrative and residential buildings with a garage constituted a small content of less than 8%.

Table 3. Comparison of the functional structure of buildings completed within the investments financed with and without BGK's funds

	Co-funded investments	Investments without co-financing
Residential buildings with affiliated rooms defined as tenants' storerooms	61.5%	52.8%
Residential buildings without affiliated rooms defined as tenants' storerooms	37.2%	32.3%

Residential–service buildings	6.1%	14.4%
Residential-administrative buildings	1.5%	5.6%
Residential buildings with a garage	0.3%	0.0%

Source: Individual study in conjunction with ASM – Market Research and Analysis Centre

The analysis of the finishing state of flats and residential buildings commissioned within the confines of the investments completed using BGK's funds revealed that most of the investments were finished on a turn-key basis, with sanitary whiteware or finished, furnished and provided with household appliances. The significant majority was composed of turn-key finished investments representing all groups excluding the purchase of a building for renovation (above 81%); the construction of new buildings constituted 95.6%. The highest percentage of finished and furnished flats was located in buildings purchased for renovation (66.7%). The remaining groups at this level of value constituted less than 20%. The research did not reveal investments in the form of building shells (the so-called finished raw state). The finishing state of buildings and flats strictly depended on the implementation of investments co-financed using BGK's resources.

Table 4. Comparison of the finishing state of buildings/flats commissioned within the investments implemented with and without BWK's funds

	Co-funded investments	Investments without co-financing
Building shell (without "finish")	0.0%	5.1%
Shell and core (without sanitary whiteware)	1.3%	8.6%
Turn-key finish (with sanitary whiteware)	91.9%	68.3%
Finished and furnished flats equipped with household appliances	11.7%	4.8%
Unclear answer	0.0%	11.8%

Source: Individual study in conjunction with ASM – Market Research and Analysis Centre

The technology of the implementation of the investments co-financed using BGK's funds was primarily traditional, i.e. 100% as regards the purchase of a building for renovation, between 45% and 60% in the remaining groups of buildings as well as mixed technology, i.e. between 33% and 46% in all of the groups, excluding the purchase of a building for renovation. The remaining technologies are used rarely. They are presented in the order of popularity , i.e. from the most popular monolithic, through large-panel and modular building to timber-based technologies. In general, the use of traditional and mixed technologies in investment implementations is primarily related to the availability of contractors specialised in a given technology, which inevitably translates into the time and cost necessary to complete an investment. The low interest in other building technologies can be ascribed to investors' unawareness of the advantages of such technologies or difficulty finding a contractor who could complete an investment on time. In addition, most of the new technologies including wooden panels, framing, prefabricated or modular building have not been accepted by the society in spite of successful implementations in many European, particularly Scandinavian countries, but also in Germany and Holland, i.e. the largest importers of prefabricated houses made in Poland.

Table 5. Technologies used in implementations of investments co-financed using BGK's funds

Technology	Changed manner of operation	Construction	Renovation or rebuilding	Purchase of a flat	Purchase of a building for renovation
Ceramic (traditional)	56.9%	51.7%	59.6%	45.5%	100.0%

Timber	0.0%	1.1%	0.0%	0.0%	0.0%
Reinforced concrete (monolithic)	6.9%	5.6%	4.0%	0.0%	0.0%
Large panel (prefabricated)	0.0%	0.6%	0.0%	9.1%	0.0%
Modular building	0.0%	3.3%	1.0%	0.0%	0.0%
Mixed	35.3%	35.6%	33.3%	45.5%	0.0%

Source: Individual study in conjunction with ASM – Market Research and Analysis Centre

Conclusions and recommendations for solutions defining standards for housing built within the social housing construction

The research presented in this article involved a number of analyses based both on the query of existing solutions in social housing construction and the results of surveys performed in local self-governments dealing with the implementation of social housing investments. The entire analysis was based on three interpenetrating levels of optimization, i.e. cost-related, functional and spatial optimization. The above-named types of optimization should be taken into consideration during the design and implementation of residential buildings for people with low or moderate income. Investing in the development of social or communal housing is not only of economic nature but also fulfils a number of widely defined social objectives. The conclusions based on the results make it possible to work out specific standards which should be implemented in social housing investments. The consideration of investors' needs as well as the analyzed subject matter led to the development of the hierarchical structure of recommendations presented below in the tabulated form:

- **obligatory** – required by the law or investor's internal regulations,
- **recommended –** preferable and based on related tests, analyses and expertise,
- **acceptable** – conditional and resulting from specific local conditions.

LOCATION		
Obligatory standards	**Recommended/preferable standards**	**Acceptable standards**
Locating of new investments in non-built-up areas possessed by communes	Compacting of housing estates – post-demolition supplementation, infill housing, rehabilitation and the modification of the functional system of tenement townhouses	Adaptation of non-residential premises for residential purposes
OBTAINMENT OF DESIGN DOCUMENTATION		
Appointment of a design quality commission in each region (regulatory and assessment body)	Architectural competition in collaboration with local branches of professional self-governing bodies	"Design and build" system
EXTERNAL SYSTEMS (UTILITY SERVICES CONNECTIONS)		
Water supply systems, sanitary systems and electric wiring	Heating system (municipal heat distribution network), gas piping, rainwater sewer system	Telecommunications wiring (Internet, cable TV, low-voltage wiring)
STRUCTURE OF FLATS		
2-roomed – M2, 1-roomed – M1	3-roomed – M3, 4-roomed – M4	5-roomed and bigger – M5, two-level on the top storey
TECHNOLOGY OF INVESTMENT IMPLEMENTATION		
None	Ceramic (traditional), reinforced concrete, timber	Modular, prefabricated (large panels), mixed
BUILDING TYPE – MULTI-FAMILY HOUSING		

None	Single-staircase building	Corridor-type block of flats, mixed, gallery-access block of flats
BUILDING TYPE – SINGLE-FAMILY HOUSING		
None	Terraced house, nest housing (triplex, quadruplex)	Detached single or double-family building
STRUCTURAL SYSTEM		
None	Transverse, timber frame	Longitudinal, mixed (cross-based), columnar (frame)
LAND DEVELOPMENT		
Exits from public roads, garbage bin shelters / area for litter bins, car park spaces, playground	Footpaths and cycling infrastructure, cultivated	Compound perimeter, home gardens
FINISHING STATE OF BUILDINGS / FLATS		
None	Turn-key finished (with sanitary whiteware), finished and furnished flats equipped with household appliances	Shell and core (without sanitary whiteware, building shell (without "finish")

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DAYLIGHT AND CULTURAL MEMORY IN PAINTING

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Abstract

This paper proposes that the idiosyncratic and eccentric nature of a region should be a major influence on how we light space. The cultural desires for natural light are linked to history, regional conditions and genetics through evolutionary adaptation, but often daylighting and efficiency are approached as a purely climatic condition, as if the human race could be subdivided into something akin to plant species. More effective is an approach that culminates in a built environment that honours our deepest desires and feelings about space, making it not only energy efficient, but emotionally sustainable. The challenge is not in its application but coming to an understanding of what that desire is. One of the most effective ways to understand a culture is through its art. When artist Agnes Martin said, "Art is the concrete representation of our most subtle feelings" she was speaking of this elusive quality we seek in our environment. This proposes that the subconscious visual long-term memory of our environment and events can be found in our culture's paintings, and these elements can be applied to the built environment. Comparing examples of seminal built work with iconic paintings illustrates that place and light simultaneously reside in our memory as well as the present, and both abstract and figural paintings might offer evidence of our attachments to light and shadow. Once we understand our subconscious motives we become better designers. In this paper light is subdivided into different aspects: shadow, colour of light and matter, intensity, spatial relationship of light and most importantly the human relationship to light.

An example of a particular relationship to light is shown in Richard Diebenkorn's Interior with Doorway. This Northern California scene of seclusion and the beckoning blue sky has endured as an image over time. The solitary freedom one feels through the stark clear light is indicative of the cultural legacy that began in the nineteenth century when Italian immigrant painters sought to portray a secluded paradise with hills of gold. This is only one small example of how we might better understand whom we are designing for. It is this knowledge that can be gained in painting analysis that will further enhance a deeper understanding of a culture and it is these abstract ideas that make art and architecture resonate as if the creator knows and understands us.

Keywords: culture, daylighting, art, painting, film

Light and Culture

This proposal is based on the interaction between culture, light and architecture, and makes several assumptions: art is the tangible representation of a culture's true essence; architecture, like art, can have a meaningful relationship with its inhabitants; light is an integral part of architecture. If all of these assumptions are accepted then the challenge is to design a meaningful relationship with space and light that takes into account how the space is to be used, energy efficiency, thermal comfort, and most importantly, how it connects with cultural memory so that space and light belong to its inhabitants. This last very important goal is often disregarded because it is so difficult, but to only apply knowledge of climate, program and energy efficiency is to lose the rich heritage that is manifested in the quality of light. Architecture that is tied to place and has explored the idea of what Kenneth Frampton later called "critical regionalism" became particularly debated as Modernism and the International Style emerged. It was eventually accepted that regionalism is not a rejection of Modernism but a site-specific reinterpretation of what is current.[i] For example, Lisbon and San Francisco may have many common climatic traits, but the history of place has been the major influence on the interior lighting and this is evident in paintings that are closely influenced by the region's culture. It should be clarified that there are many factors beyond light level, such as the glow of light, shadow patterns and colour of light that hold meaning and significance. By understanding the cultural identity as it relates to lighting through the study of that culture's art the designer ensures that the physical environment supports the well-being of the culture it is serving and provides meaningful shelter.[ii] Artist Agnes Martin said, "Art is the concrete representation of our most subtle feelings," referring to the complex nature of our connection to the world. People are born into an environment with a cultural history that predicts preferences for colour, light and texture. And a culture is not static nor is it unconnected from other cultures. In some cases, many layers accumulate and influence each other. The more a designer understands the cultural memory the more in tune the architecture will be.[iii]

The difficult aspect of this theory is applying seemingly subjective observations to the lighting concept of a project. In addition, the designer must also be knowledgeable about the enduring vernacular building traditions, since these are always influenced by cultural preferences. It is the complexity of conditions, and the fact that it is not quantitative, that often prevents this idea from becoming part of the lighting analysis process. And lighting analysis, because it is so incorporated with form, must really be part of the initial study. If lighting is applied after form has been designed then a primary opportunity has been lost. Form influences light and light influences form.

This paper will identify one region, the San Francisco Bay Area, primarily during the mid-twentieth century, to illustrate a culture and its relationship with climate, art, and light. The study will be limited to several well-known artists, films and iconic buildings. It is not the intention to prove a thesis, but rather to introduce another layer of the design process that may be deemed thoroughly subjective but nevertheless a worthwhile intervention. So, while this strategy is more theoretical than scientific, it avoids the danger of disregarding the unique qualities of one of the most important factors in the design of daylighting. And because one is determining something that may be highly technical like the quantity and quality of light, we should not disregard the poetic, emotional drama that makes space more meaningful. Whatever is chosen is biased and there is no reason why it shouldn't be. Really, it must be.

Case Study: The San Francisco Bay Area

In 1901 Italian immigrant Gottardo Piazzoni painted the landscape of California as a paradise with hills of gold, suggesting a sense of seclusion and peace with nature (figure 1).[iv] The Northern California landscape was captured by many artists during this time but it was Piazzoni who was particularly independent and helped to start what became known as Bay Area Regionalism. Simultaneously architect Bernard Maybeck was best known for creating the San Francisco Craftsman style where materials, space and light were directly tied to the landscape and culture (figure 2). While this style was strongly influenced by other cultures, Maybeck responded to Northern California's uniqueness and the promise it held. The light was not necessarily dramatic, but usually composed of a soft glow through side windows or stained glass. To walk into a Maybeck interior is to feel the fog follow you in and envelope you in solitude.

Figure 1. Gottardo Piazzoni. *Monterey Bay*. 1902, oil on board (private collection)

Figure 2. Swedenborgian Church, San Francisco. Built 1895. Designed by Bernard Maybeck. Source: atlasobscura.com

Cultural Transformation in the Bay Area

By the mid twentieth century many artists were leaving behind figural art and leaning toward abstraction. Ironically one of the most iconic and influential painters during this era was Richard Diebenkorn who was from the Bay Area. He had relocated several times and returned several times, and moved between figurative and abstract art. Just when abstract expressionism became the style of the 1950s Diebenkorn moved from abstraction to what is now termed Bay Area Figurative Art. A biographer wrote, "He shook off the words and examples of teachers and peers from San Francisco and found himself exploring a landscape impulse, reflecting the coloristic influences of regional light and incorporating a new and more autographic drawing technique, owing something to de Kooning's example." [v] It is only in the artist's Bay Area work that a figure is often included and became an important device to relate the mood of the scene. Author Marcia Tanner described Diebenkorn's Berkeley work as "quasi-abstract aerial views of East Bay terrain, suffused with nuanced Bay Area light and rich complex color."[vi]

It is unusual that Diebenkorn's work is almost always described in terms of his location, such as the New Mexico period, the Ocean Park period in Los Angeles, and the Bay Area or Berkeley period. Each time he relocated his work changed in several ways: colour, light and narrative.[vii] The Berkeley paintings show a cool aloofness of mainly female figures occupying an interior with the exterior beyond. This remoteness recalls Piazzoni's Monterey Bay painting, but also evokes isolation and loneliness. This is not apparent in Diebenkorn's paintings in other regions. It is the Berkeley paintings that explore the emotion, often with long cast shadows indicative of a northern climate, a region up until the past previous decades that was somewhat isolated. The isolation is vivid in *Interior with Doorway* (fig. 3): The dark interior with the lone empty chair and an open door give a sense of the contemplative nature of the space. One can squint and the service station in the background becomes a ship on the sea with a sandy beach in the foreground. From this the designer can better understand the pervasive feeling of expansive space beyond, the important connection to the environment, the conflict between interior and exterior, and the more subtle effects of reflected light in a dark interior. In contrast Diebenkorn's earlier New Mexico paintings are abstract, vast and warm. In Untitled (Albuquerque) the pink, red and ochre take over a majority of the canvas, while the charcoal grey at the top seems to indicate infinite space, as if one can see the curvature of the earth beyond (figure 4). This was a painter who tied his work directly to his place, and in particular was able to catch the mood of the region, making his paintings a valuable resource to better understand the temper of the region.

Figure 3. Richard Diebenkorn. *Interior with Doorway.* 1962. Oil on canvas. Richard Diebenkorn Foundation.

Figure 4. Richard Diebenkorn. *Untitled* (Albuquerque). 1952. Oil on canvas. Vincent Price Collection.

Diebenkorn's major influence was Henri Matisse and it is interesting to compare the two painters so that one might compare the evocative feelings found in two cultures. For example, the expansive space in Diebenkorn's *Man and Woman in a Large Room* (fig. 5) seems to overtake the anonymous couple. The interior space is dark and heavy with a black ceiling weighing down the couple. Simultaneously the rug reminds one of the sea or of a swimming pool, with California blue skies outside. It is typical of Diebenkorn to show this shifting interior-exterior relationship. This painting is considered an homage to Matisse's *The Conversation* but Matisse paints his interior in vivid blue with a nearby garden (fig. 6). The figures do not give a sense of isolation but rather confrontation. Here are two painters, one very influenced by the other, but both are about their heritage and their environment, and these paintings show the character of each culture.

Figure 5. Richard Diebenkorn. *Man and Woman in a Large Room.* 1957. Oil on canvas. Hirshhorn Museum.

Figure 6. Henri Matisse. *The Conversation.* 1912. Oil on canvas. Hermitage Museum, St. Petersburg.

During Diebenkorn's Berkeley years he often painted scenes in which the interior played against the exterior and the figure seems torn between the built environment and the natural environment beyond, as in *Woman on a Porch* (fig. 6). The melancholy of the human condition can also be found in Edward Hopper's paintings who focused on New York almost exclusively. The difference between Hopper and Diebenkorn are found most vividly in the quality of light as it relates to the figure. Both artists often show a shadowed figure, but Hopper's figures seem to be temporarily deluded as in *Morning Sun* (fig. 7). The sunlight hits the walls and floors and it seems as if it will lift the figures and take them out of their gloom. There is almost always a feeling of possible redemption. Not so with Diebenkorn's figures. Whether they are in light or shadow they are often faceless and seem to have come to terms with the fading light and shadows. And yet there is a sense of satisfaction with this isolation that may have to do with the relationship the figures have with the landscape. The landscape is something awesome, to be admired from a distance, giving a sense of quiet yearning and tranquillity.

Looking at these paintings for design inspiration one must pay homage to these subtle clues, that the San Francisco region is not where one resides for sun and warmth, but rather for the serenity and even escapism. And the spaces may be dark and heavy, or at times washed with dull light, but that light may be limited and fleeting. Architecture in the Bay Area took several avenues during this period. Parallels with Diebenkorn's paintings can especially be seen at the Sea Ranch residence in Sonoma County: cool aloofness and awesome landscape are its characteristics (fig. 8).

Figure 6. Richard Diebenkorn. *Woman on a Porch.* 1958. Oil on canvas. New Orleans Museum. The Richard Diebenkorn Foundation.

Figure 7. Edward Hopper. *Morning Sun*. 1952. Oil. Columbus Museum of Art.

Figure 8. Sea Ranch Residence in Sonoma County, California. Designed by Moore, Ruble, Yudell, 1965. Photo: http://www.moorerubleyudell.com/projects/sea-ranch-residence.

The relationship of film to regional lighting is even more obscure and abstract, but worthy of study. Director Alfred Hitchcock, an Englishman who had a longstanding relationship with the Bay Area, produced the film *Vertigo*. Though the movie is based on a French novel, Hitchcock and screenwriter Samuel A. Taylor made it a quintessentially San Francisco film. And just like the paintings around this period the film uses the cool, dark shadows, the glistening landscape in the background, the sense of isolation and betrayal. It does not have the quiet melancholy of the Diebenkorn paintings but an exuberance that can be seen in San Francisco architecture such as the floating green glass box and the interior of the *Crown Zellerbach Building* by Skidmore Owings and Merrill in 1959. This region and this decade are multi-layered and varied, but it is obviously a web of connections.

Figure 9 and Figure 10. Crown Zellerbach Building, San Francisco. Designed by Edward Basset of Skidmore Owings and Merrill. 1959. Photos: San Francisco Public Library.

Several decades later Francis Ford Coppola's film *The Conversation* uses similar methods to set the mood, but by now the culture has changed significantly. There is not even the hint of

illusion of a perfect world. The film immediately dives into dark desperation that is best described as postmodernist in its irony and scepticism. While Vertigo held hope, *The Conversation* ends all illusions as if to say that nothing is as it seems, and the downward spiral of the main character seems imminent. It is during the 1970s that San Francisco became embroiled between this sense of delusion and the extreme idealism that flourished during the Vietnam War. The films *Vertigo* and *The Conversation* both fixate on alienation and misinterpretation but Vertigo, from the 1950's, lures us into a seemingly ideal world and it is only the lead character's acquired case of vertigo that leads us to suspect that something will go wrong. The 1970s film *The Conversation* pits morality against menacing technology. By this point the ideal beauty seen in the 1959 Crown Zellerbach Building is full of nostalgia but does not exemplify current attitudes. Designers may continue to design in this way but it is not connected to the culture as, for example, the Berkeley Museum of Art is. This is an example of architecture that exemplifies the power struggles and alienation with deep shadows and large cantilevers; a brutalist icon built in 1970. Here, optimism and dark powers lie in the eye of the beholder, and the divergent opinions of this building illustrate the cultural struggle taking place. As is typical of brutalist architecture, this building is both hated and admired. Perhaps its ability to characterise a cultural era is overly effective.

Figure 11. Scene from The Conversation. 1974. Photo: magiclanternpodcast.com/episodes/episode-053-conversation/.

Figure 12. The Berkeley Art Museum, designed by Mario Ciampi, Berkeley, California, 1971. Photo: Andea Baldassarri via Flickr.

Art as the Initiator of Light and Space

The study of paintings and film do not tell us exactly how to treat light and shadow in architecture but returning to Agnes Martin's quote "Art is the concrete representation of our most subtle feelings" – these subtle feelings rule, and in essence connect the occupier with place. The parallels between these few examples embrace the idea that making a connection between culture and architecture provides us with enduring shelter.[viii] It can be beautiful, but more importantly, architecture which speaks to its culture is meaningful: when space reverberates who we are culturally, we make a connection and we feel understood.

[1] Alofsin, Anthony, *Constructive Regionalism* (*Architectural Regionalism: Collected Writing on Place, Identity, Modernity, and Tradition*. Ed. by Canizaro, Vincent), Princeton Architectural Press, New York. 2007.

[2] Trieb, Marc, *Spatial Recall: Memory in Architecture and Landscape*, Routledge, New York, 2009.

[3] Steane, Mary Ann. *The Architecture of Light*. Routledge, New York, 2011.

[4] Shields, Scott A. Eternal light: Visions of Gottardo Piazzoni. *California History, (Summer-Fall 2001),* University of California Press, Volume 80. Shields introduces Piazzoni as an immigrant from Switzerland who dedicated his artistic career to his new home in Northern California: "By his own admission, whether he was painting a landscape, a symbolic work, or figurative piece, he was always endeavoring to express the spirit of California."

[5] Nordland, Gerald, *Richard Diebenkorn*, Rizzoli, New York, USA, 1987, pp. 8.

[6] Tanner, Marcia, *A Fine Bromance: Matisse/Diebenkorn at SFMOMA*, in Berkeleyside, April 2017 (web: http://www.berkeleyside.com/2017/04/12/fine-bromance-matisse-diebenkorn-sfmoma).

[7] Jones, Caroline. Bay Area Figurative Art 1950-1965. Berkeley, CA: University of California Press. 1990.

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PATTERNED FLOW, AUGMENTING AIR MOVEMENT IN URBAN ENVIRONMENTS

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Abstract

This research explores the design of novel building forms that pattern airflow to enhance passive cooling effects in warm environments. A series of physiological experiments that correlate certain air flow patterns with an increased cooling effect form the premise of this study. The physiological experiments found that undulating patterns of air velocity create significantly more cooling effect than the same mean velocity at a constant speed. This discovery implies that warm urban environments could be made to feel cooler without using significant energy to increase the overall flow. To test the applicability of this premise a series of experiments were performed to establish how effectively surface features and building form could pattern ambient air.

Keywords

Airflow patterns, Outdoor comfort, CFD, PIV experiments, Airflow control.

1 Introduction

The design of a prototypical exterior canopy is used as a case to study the effects of various surface textures on airflow. Canopy designs were vetted using digital simulation and then selected designs were physically tested to confirm their performance. In these experiments, Comsol computational fluid dynamic (CFD) simulation and particle image velocimetry (PIV) testing were used to examine the flow structures (ie airflow patterns). 3D printed physical models are used in PIV testing which involves a combination of a water tank, camera, motorized gantry and a laser to document fluid motion. The initial results show that surface features can change the patterns of air velocity within and outside of the structures tested.

Design of the canopy began with a smooth, double funnel form meant to increase air velocity through the Venturi Effect. This baseline form was enhanced with surface textures using symmetry, asymmetry, ridges and bumps to create vorticity (ie spinning patterns) which create local accelerations. In the more complex later iterations the vorticity created by the textures sheds (ie moves downwind) and creates patterns of varying air velocity. In these initial experiments there was some correlation between the patterns found to increase cooling in physiological tests and the patterns created in CFD models.

2 State of the art:

Thermal comfort studies have been a prevalent area of research in the past decades, and a rich body of research has been conducted to examine the effects of air movement on human comfort. Although mean velocity was considered as the main parameter that contribute to comfort, more recent studies indicated that Turbulent Intensity, air flow direction and fluctuation frequency as an important parameter for perception of thermal comfort. Most experimental research in this area of study included documenting subjective responses in a controlled climate chamber and compared these responses against PMV (predicted mean vote). PMV is the average response of a large number of people calculated using P O Fanger's equation involving 6 environmental and physiological parameters (1). Comparative study of past experimental data indicated a different acceptance of air flow frequency in cold and warm climates. Experiment results of flow fluctuation frequency by Fanger and Pederson (2) show that the maximum discomfort was experienced when air velocity fluctuated at 0.3 - 0.5 Hz in temperature range of 20-26◦C. However, in warm and humid climate conditions at 30◦C, higher air frequency of 1.0-2.5 Hz are accepted and often expected as a cooling measure (3). Experiments by Tanabe and Kimura (4) conducted similar experiment in warm and humid conditions at a temperature range of 27-31◦C. They looked at the different patterns of air flow over time and concluded that sine waves with cycles of 10, 30 and 60 seconds produced significantly cooler thermal sensations.

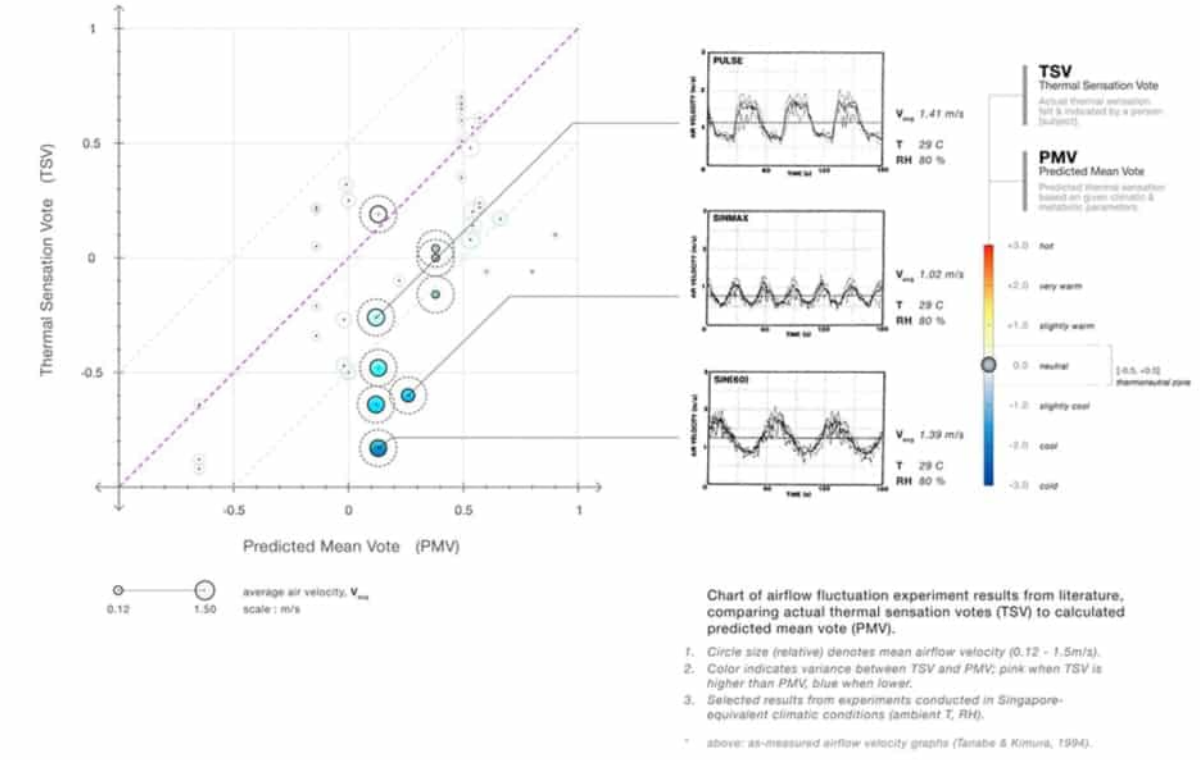

Figure 1: Combined chart of airflow fluctuation results for warm and humid climate. Note: with the same mean velocity of air, the air flow pattern of "Sin 60" yield significantly cooler thermal sensation compared to "Pulse" air flow pattern.

This was also confirmed by Zhou et al (5), from experiments carried out with simulated natural flow and sinusoidal waves at cycles of 10 seconds. Figure 1 illustrates a combined graph of airflow fluctuation experiment results in warm and humid climatic conditions. This shows that although similar environmental input parameters like air velocity, operative

temperature, relative humidity etc produces the almost similar PMV results but varying just the airflow pattern can strongly affect the subjective cooling sensation (TSV) of test subjects.

These studies as a collective indicate that specific airflow patterns with dominant frequency distribution can provide more cooling sensations specially in conditions where airflow velocity is limited and cannot be elevated. Currently, airflow fluctuation frequency is a criterion that remains unaccounted for in empirical models of thermal comfort. The comparative study from past experiments suggest air flow patterns can be considered as another control factor to offset increased temperature in warm indoor as well as dense, stuffy outdoor environments.

Outdoor airflow research on an urban scale has been currently limited to understanding airflow behaviour around existing urban environments or by manipulating different generic urban configurations for optimised natural ventilation potential in buildings, urban and pedestrian comfort. This is illustrated by Toparlar (7) in an exhaustive review on the use of CFD for urban microclimate analysis. This review calls for changes in urban geometry and inclusion of open spaces like courtyards, parks etc (7). These solutions aren't always applicable to already built cityscapes like CBD districts or old downtown areas. Hence, alternative novel methods are required to address urban ventilation. As per current state of the art preliminary research by Dash et al (7) in fluid dynamics has been carried out on both static and moving surface features of an isolated bluff body to control air flow separation. The recorded experimental results in Figure 2, showcased that active movement on the surface of the bluff body were able to create a turbulent boundary layer region which allowed it to reduce drag on the body by more than 40% and air flow separation was delayed similar to the popular phenomenon of a golf ball (8).

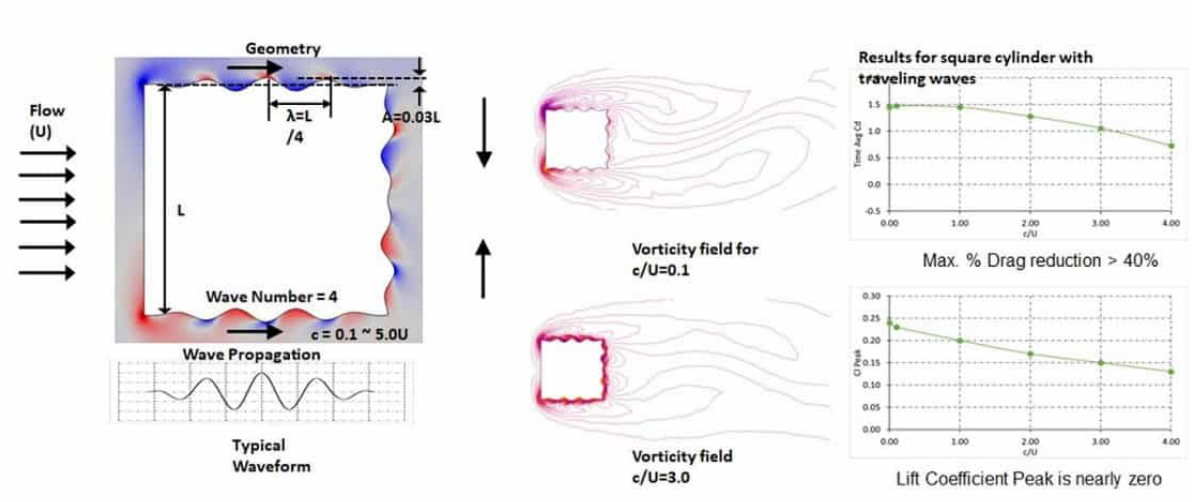

Figure 2: Dash et al (2017) Active wave propagation on bluff body to reduce flow separation control.

Controlling airflow field on an urban scale by means of actuated movement of façade features has not been yet explored. If this technique of controlling air flow movement around bluff bodies (like a building) can be extrapolated in urban conditions, it would mean better airflow in congested urban spaces, facilitating the possibility of airflow patterning and pedestrian thermal comfort. Considering this as an initial hypothesis, the authors created various textures replicating waveforms on an urban canopy to investigate their performance

on producing air flow patterns. As a first step these experiments consider only static textures.

3 Methodology

3.1 Design and selection of base model:

The baseline for the urban canopy was considered as a funnel shape as it allows for acceleration of existing low wind speeds because of the phenomenon of Venturi effect. Simulation test of the baseline funnel shape urban canopy validate that wind speeds do increase by 25% at the leeward side of the canopy. Adhering to flow separation control guidelines of mimicking rolling wave form (7) which would allow for delayed onset of flow separation as seen in the experiments carried out by Dash et al (2017), a series of waveform is arranged symmetrically and asymmetrically onto the baseline figure of the funnel shaped urban canopy. (Figure 3)

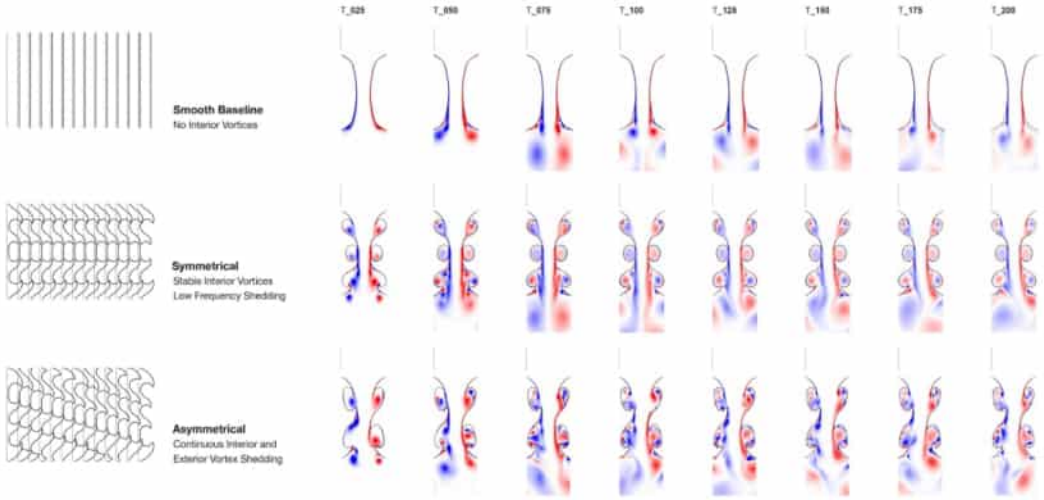

Figure 3: Series of captured instances over 200 seconds of 2D simulation performed on Baseline, Symmetrical and Asymmetrical waveform arranged in a funnel shaped urban canopy.

Then a 2D RANS transient models were simulated in order to understand the flow structure around these canopies. This was done using a commercial Computational Fluid Dynamics software – COMSOL multiphysics version 5.2a. The simulations were run over a period of 200 seconds and the velocity variation over time was mapped to analyse the possibility of airflow patterns over the simulated time. The simulation was carried out at a Reynolds no. of 100 and with an inlet speed of 0.1m/s in order to match up with the PIV experiments that is planned to be carried out with these iterations.

The two dimensional simulation results produce distinctive flow structures between symmetrical and asymmetrical waveform propagation. Figure 3 illustrate a series of captured instances at an interval of 25 seconds. The symmetrically replicated waveform figure created stable interior vortices with low frequency shedding. This is in contrast with the asymmetrically replicated waveform figure that create continuous interior and exterior vortex shedding. To gain an understanding of what these varying flow structures relate to the fluctuating air flow velocity and pattern, the research group plot the velocity magnitude

at a specified point (marked red in figure 4) in both canopies. Comparing both experiments, the asymmetrical canopy exhibits some characters of air flow patterning and hence it was selected for further detailed study (figure 4).

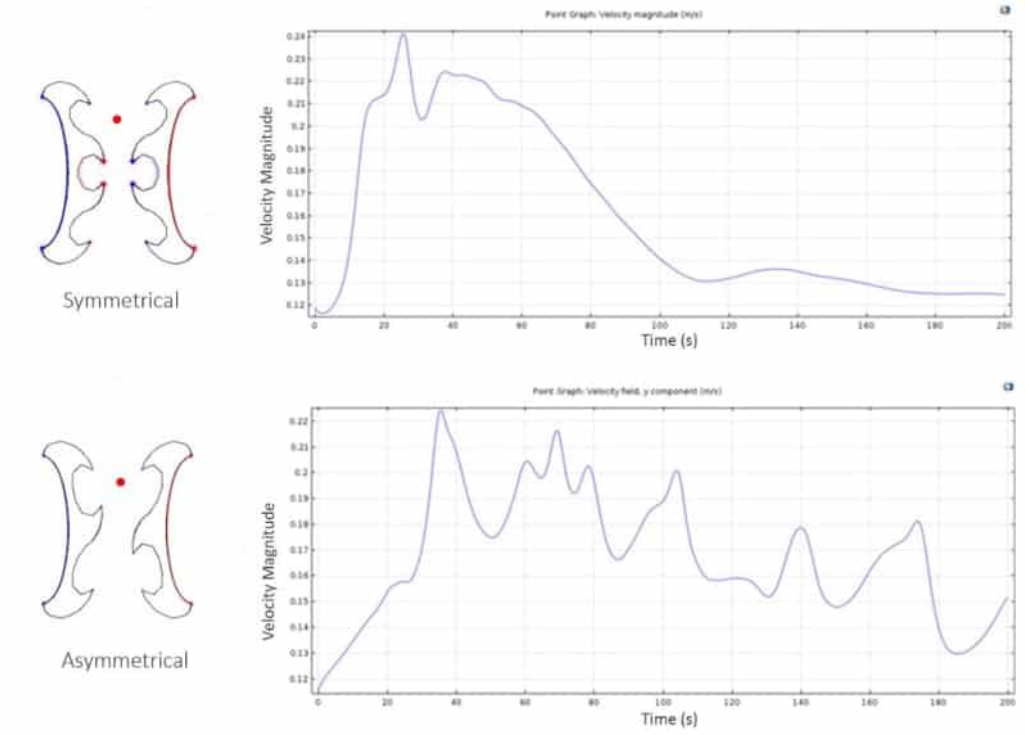

Figure 4: Point graph for the Symmetrical and Asymmetrical Canopy 2D simulation. The red point on the drawings indicates the position where the velocity magnitude was measured over time.

3.2 PIV Setup and Results surface texture iterations

The 2D simulation results in COMSOL are validated through physical Particle Image Velocimetry (PIV) experiments. Three dimensional models of these canopies were digitally modelled, and the asymmetrical waveform was modeled into two distinct iterations- continuous ridge and alternating bumps (figure 5).

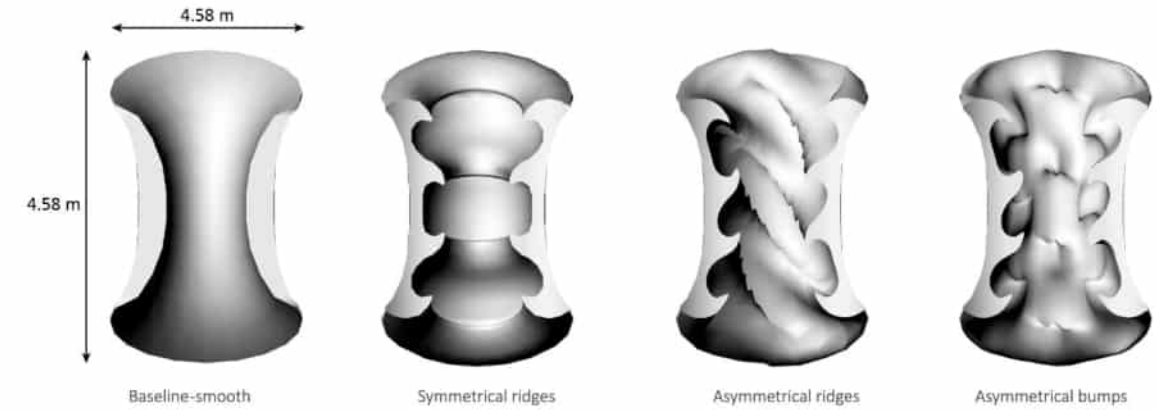

Figure 5: The final four models used for Physical experiments (PIV).

A PIV experiment is a way to physically simulate fluid behavior with respect to an object. The fluid flow is visualized by mixing micron-scale particles in the water tank (light enough not to affect the fluid movement) and illuminating it by a laser / laser plane in a dark space. The

particles in the path of the laser are illuminated, and their collective movement reflects the fluid's movement. By tracking the movement of these particles, then, the fluid flow behavior around the test object can be analysed (figure 6). An Reynolds number was maintained at 100 for both the PIV experiment and the CFD simulations because keeping the Reynolds no. constant facilitates the simulation of airflow with the help of any other fluid, be it water, oil or gas etc. For any two different situations, if the Reynolds numbers are the same, it can be said that the fluid behavior will be same. For this experiment, the test canopies were scaled to a size of 1:100 and towed through the water table (figure 6 a) at a constant speed of 1 m/s and to match the CFD simulations which were full scale models run with an inlet velocity of 0.1m/s. This reduction in velocity is to compensate for the scaling of the canopies under the same Reynolds number of 100. When PIV experiments were being carried out there was also a known limit of 1m/s for the towing speed of the test objects. It was not possible to run the speeds greater than 1m/s, as it caused fluttering of the acrylic base resulting in faulty results.

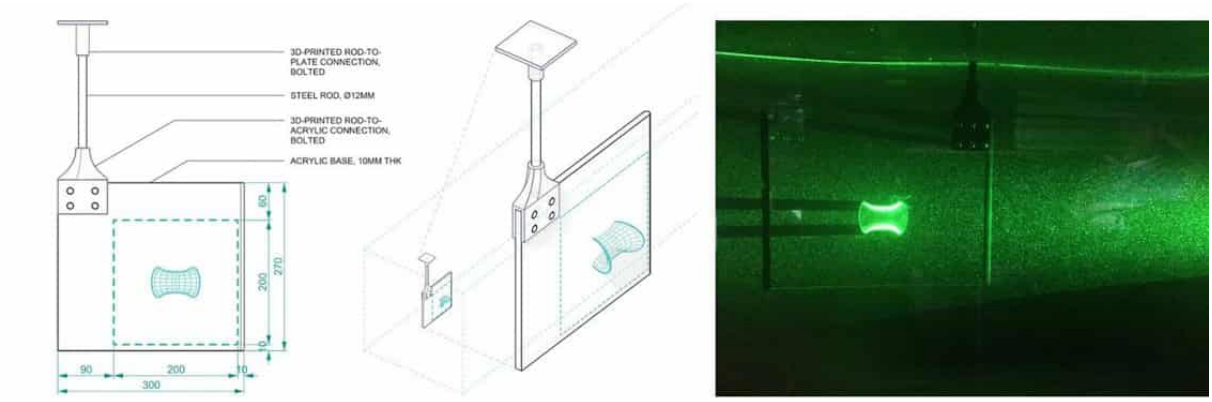

Figure 6: LEFT a) Setup dimensions for the test canopies and image of how the model is towed on a base board through the long water table marked in blue dashed lines. RIGHT b) Laser plane through the model illuminating the seeded micro particles (looking like white noise in the image) for flow field analysis.

The video for the PIV experiment was captured only after the towed canopy reached a steady state condition. For this reason, the time frame for the capture was only 2 seconds. Although the data was enough to analyse flow field structures and validate the CFD simulations, it was insufficient for extrapolation to a longer time frame (60 - 180seconds) for airflow pattern analysis. In order to overcome this limitation, detailed CFD simulations were then carried out to analyse flow patterning in the asymmetrical canopy.

3.3 CFD simulation of selected Asymmetrical model

Once the CFD setup for the base model and the four iterations were validated with the help of PIV experiments, the previously selected ‘Asymmetrical ridges’ and the baseline canopy model was then simulated again with a higher wind speed of 1 m/s, that adhere to a wind speed that is in the range of perceptible to human sensation. This change also allows the research group to compare the airflow patterning in the canopy simulations with the state of the art (4, 5) where average wind speed was 1m/s.

For the 2D CFD setup, again the commercial software COMSOL Multiphysics version 5.2a was used. A horizontal cross-section through the canopy was considered and a bounding box sized (20L X 20L, where L is the width of the canopy- 5m) was drawn around it. This would act as the wind tunnel for the test canopy sections. For boundary conditions, a velocity of

1m/s was chosen for the inlet and a Pressure value of 0 Pa was considered for the outlet. The side bounding walls were also given a symmetry condition. The initial conditions were kept the same as the boundary conditions. A laminar physics-based fine meshing was created around the test geometry approximating to x number of cells. The solver was then set to transient simulation with a time step size of 0.1s and run for 200 seconds. The resolution factor was kept at 0.01. This model setup was same for both baseline and the asymmetrical models (figure 6). Certain points as shown in figure 6 were considered on the leeward side of the canopies. These points represent the places where a person standing would experience the impact of the static ridges of the canopy on the incoming airflow.

4 Results

4.1 PIV flow field

Results of the flow fields attained from PIV experiments of 4 different test cases are illustrated in Figure 7. The leeward side of the canopy iterations see increasing degree of wake interferences. The baseline being least affected and the asymmetrical ridges with highest amount of wake structures. Because of this, the vorticity magnitude represented in green and blue has higher intensity than the baseline. The asymmetrical bumps also seem to continually shed vortexes (inward spiral flow formation) and the phenomenon is more pronounced than the other iterations of the test canopy. Since the PIV experiment is 3-dimensional it can be noticed that at the windward side of the canopy, the incoming laminar-type fluid flow creates a small singular or dual vortex right before it hits the canopy opening.

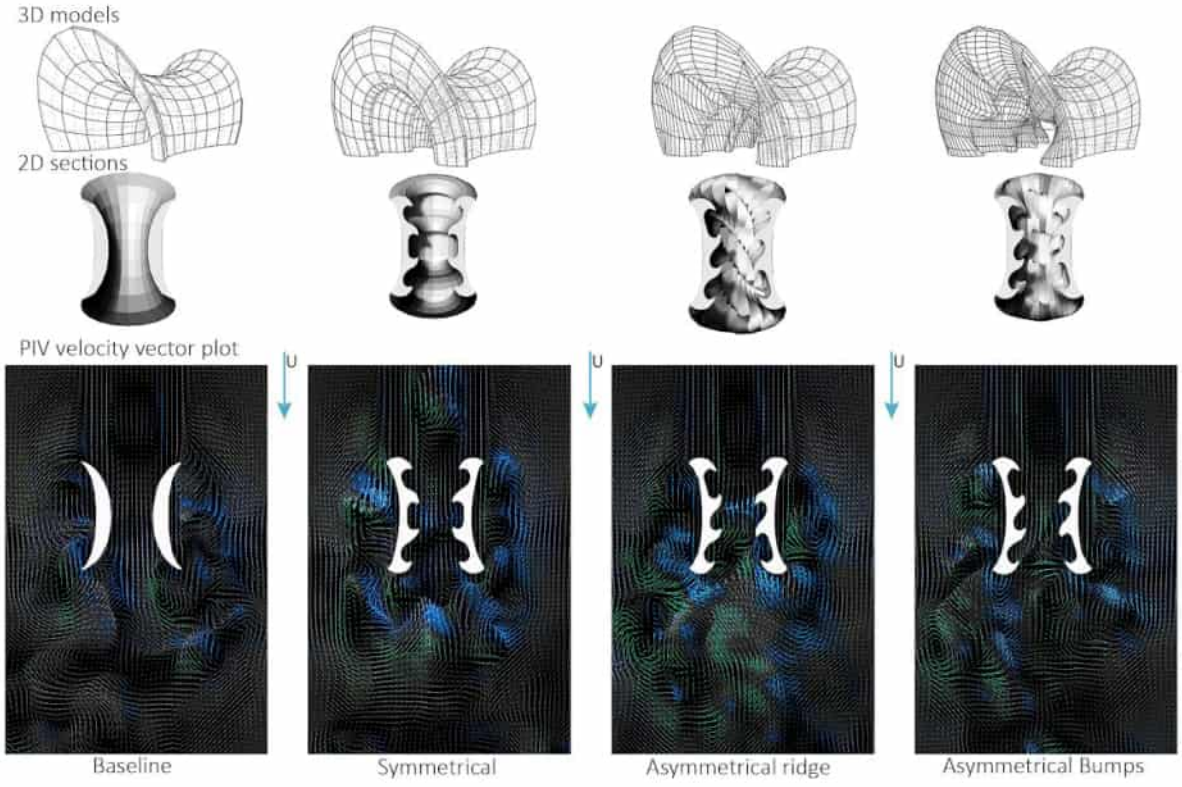

Figure 7: Particle image velocimetry (PIV) test results used to examine the flow structures created by a series of physical models

4.2 Flow patterning in Asymmetrical ridge model

Figure 8 illustrates the flow behaviour over a period of 200 seconds. The leeward side experiences Von Karman vortex shedding. The points A and B are the probable positions where a person would be standing while walking through such a canopy was also plotted. This allowed the analysis of velocity fluctuation frequency and airflow pattern a subject experiences as mentioned in the state of the art. Point A (midpoint) is located at the centre of the canopy. For both baseline and asymmetrical canopy we see an increase in the average velocity by 18% and 25% in baseline and asymmetrical respectively. At midpoint, the amplitude of velocity variation is much smaller in baseline (0.03 m/s) in comparison to asymmetrical canopy (0.1 m/s). When the test subject moves from midpoint to trailing edge, the mean speed decreases to 0.95m/s and 0.8m/s for the baseline and asymmetrical respectively but the fluctuation/amplitude increase.

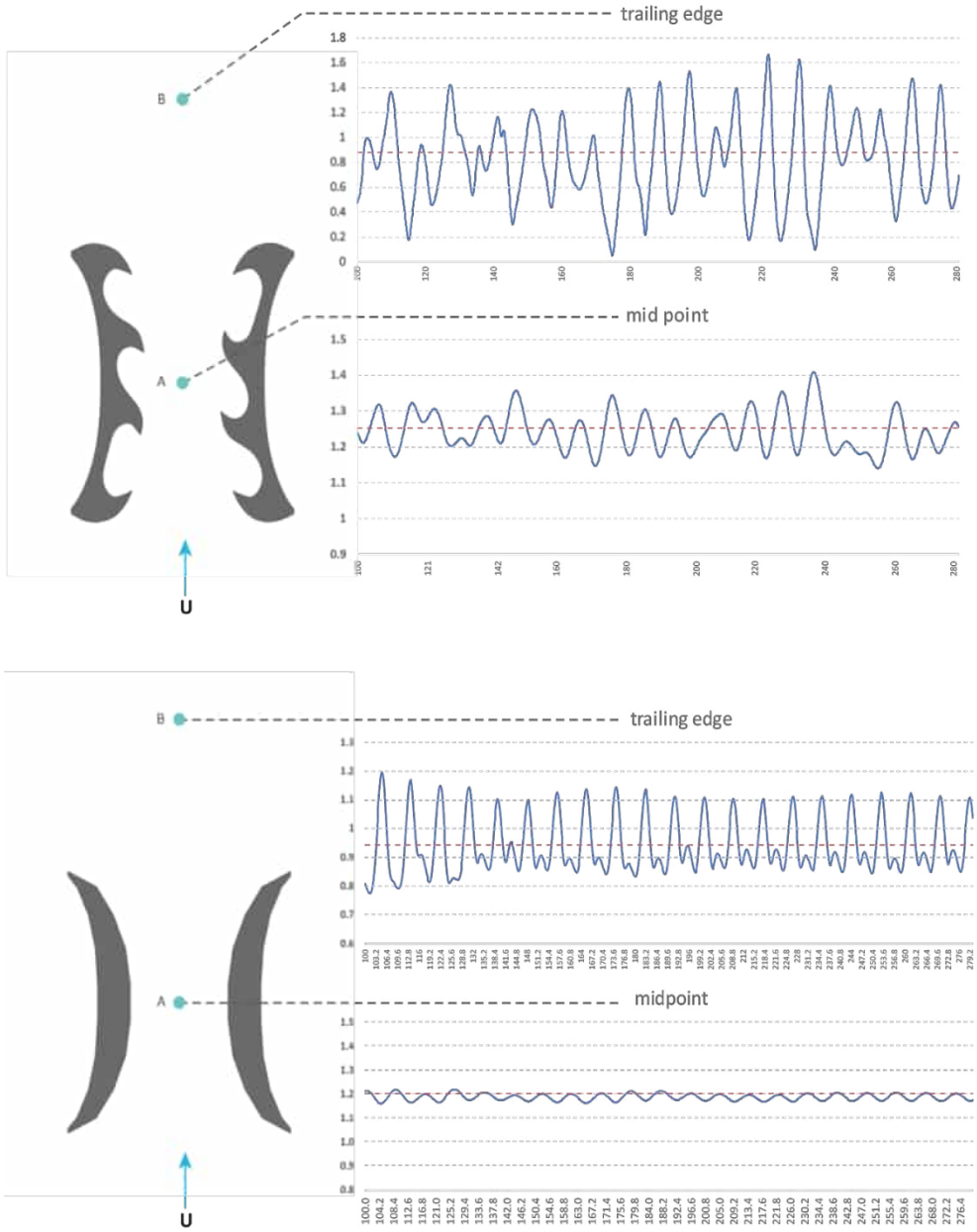

Figure 8: Baseline and Asymmetrical canopy simulation results.

4.3 Flow patterning comparison with state of the art

The frequency of the wave in asymmetrical model is in cycles of 10 seconds and the pattern is similar to natural wind. This means that standing around the trailing edge position in such asymmetrically textured canopy would provide for cooler thermal sensations in warm and humid conditions, as indicated by Tanabe and Kimura (4) as well as Zhou et al (5) in their subjective experiments. Figure 9 illustrates the frequency match with SIN(10) which had cycles of 10 seconds and also the mean speed match with SINMAX which has a wind speed average of around 0.8m/s with a cycle of 30s. SIN(10) and SINMAX also provides a TSV vote of -0.48 and -0.6 which means it has more cooling effect than constant or random airflow patterns for identical temperature and humidity conditions. This confirms the idea that with certain specific texturing and morphing of the overall building can facilitate the modification an incoming low constant wind in a sine wave like pattern which is studied to provide cooler thermal sensations.

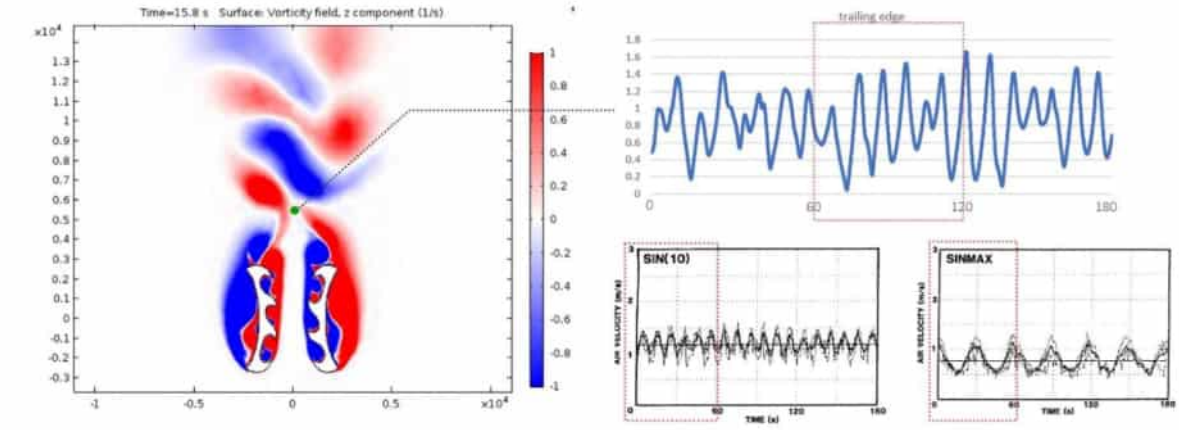

Figure 9: Comparison of asymmetrical flow pattern results with Tanabe and Kimura (3) results.

5 Conclusion

The experimental results showcase that airflow behavior and pattern can be actively altered through applying textures on surfaces. These airflow patterns can be controlled to some extent to create patterns that correspond to those found to create cooling sensation to building occupants. These fluctuations are achieved without significant increase in air speed and in complete absence of any mechanical means. This research establishes a direct relationship between surface texture and periodic air flow velocity fluctuations.

The CFD and PIV results from this study consider near laminar incoming airflow which is not representative of urban environments. This decision to look first at near laminar flow versus turbulent flow established a baseline for the design of textures and observation of patterns. Also given that periodic variation is typical in urban air flowmore research would have to be done to consider the efficacy of changing exterior, turbulent airflow into patterns optimized for comfort.

Though preliminary, this study hints establishes a workflow and potential direction for modifying airflow in cities with relatively small interventions/variation in overall form low

input energy. Further studies examining turbulent models and moving/actuated textures are ongoing. These studies hope to establish an architecture, engineering and building science methods for designing more comfortable cities using more qualitative metrics for comfort.

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EXHIBITION SPACES IN THE CONTEXT OF REPRESENTATION OF ARCHITECTURE: TRANSFORMATION OF WAREHOUSE 5 OF ISTANBUL

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Abstract

In the modern world, in which we know that architecture is as old as the first human who felt the need for shelter, architecture's creation is thought to be attributed to an instinct of human nature. Although architecture was born due to a basic human need, architectural understanding shaped by aesthetic thinking in humankind has been created in a long process throughout history. Although architectural productions are shaped in different physical environments and in different societies, they have been one of the most important productions representing society in the physical environment in various contexts throughout history. Representative powers of architecture and spatiality have been known by societies since time immemorial and have also been used for specific purposes. Since ancient history, architecture has sometimes represented social classes and economic structure, sometimes power, and sometimes current cultural structure and beliefs of society. While architectural products represented situations expressed through an architectural need in the pre-modern era, with the arrival of the modern era they began to represent themselves or their architects, beyond place. Among these architectural products are museums, which are exhibition areas. In the 20th century, the transformation of exhibition areas into objects of exhibitions themselves, beyond the mere functional aspect of exhibiting, was very common around the world. An example of this is the Istanbul Contemporary Arts Museum, which is still under construction. The structure is among the seven warehouses (Warehouse 5) [1] designed by one of the most important Turkish architects, Sedad Hakkı Eldem[1].The aim of this study is to investigate and evaluate the transformation of architectural representation through exhibition areas via the transformation of Warehouse 5 into the Istanbul Art and Sculpture Museum. In the study, similar examples of existing structures transformed into exhibition areas while having different functions in an historical context have been researched and compared with Warehouse 5. Additionally, a literature review has been

[1] Sedad Hakkı Eldem (1908-Istanbul, 1988-Istanbul): Turkish architect and educator. One of the most important representatives of 20th century Turkish Architecture, Eldem contributed through his works to the formation of a genuine Turkish Architecture, introduced a new point of view to the concept of national architecture especially with his research, documentation and archiving efforts relating to Turkish Civil Architecture [2].

carried out on the relationship established by issues of exhibition and representation with the city.

Keywords

Representation of Architecture, Exhibition Spaces, Transformation, Istanbul Painting and Sculpture Museum.

1 Introduction

"The buildings are considered strong evidence
and witnesses in terms of culture and civilization."
Sedad Hakkı Eldem

In the modern world, in which we know that architecture is as old as the first human who felt the need for shelter, architecture's creation is thought to be attributed to an instinct of human nature. Although architecture was born due to a basic human need, architectural understanding shaped by aesthetic thinking in humankind has been created in a long process throughout history. Although architectural productions are shaped in different physical environments and in different societies, they have been one of the most important productions representing society in the physical environment in various contexts throughout history. Representative powers of architecture and spatiality have been known by societies since time immemorial and have also been used for specific purposes. Since ancient history, architecture has sometimes represented social classes and economic structure, sometimes power, and sometimes current cultural structure and beliefs of society. While architectural products represented situations expressed through an architectural need in the pre-modern era, with the arrival of the modern era they began to represent themselves or their architects, beyond place. Among these architectural products are museums, which are exhibition areas. Museums in the modern sense are known to have first been built in the 18th century. Continuing in to the 19th century, museums began to change shape based on the idea of "places for objects" and were differentiated according to content. In the 20th century, the transformation of exhibition areas into objects of exhibitions themselves, beyond the mere functional aspect of exhibiting, was very common around the world. An example of this is the Istanbul Contemporary Arts Museum, which is still under construction. The structure is among the seven warehouses (Warehouse 5) [1] designed by one of the most important Turkish architects, Sedad Hakkı Eldem,[2] along the coast of the Bosphorus in 1958 for temporary storage of goods that had passed through the customs. Construction of the structure continued through 1960.

The aim of this study is to investigate and evaluate the conversion (transformation) of architectural representation through exhibition areas via the transformation of Warehouse 5

[2] Sedad Hakkı Eldem (1908-Istanbul, 1988-Istanbul): Turkish architect and educator. One of the most important representatives of 20th century Turkish Architecture, Eldem contributed through his works to the formation of a genuine Turkish Architecture, introduced a new point of view to the concept of national architecture especially with his research, documentation and archiving efforts relating to Turkish Civil Architecture [2].

into the Istanbul Art and Sculpture Museum, designed by Emre Arolat[3] Architects in 2011 and expected to be completed in 2018. In the study, similar examples of existing structures transformed into exhibition areas while having different functions in an historical context (New York-MOMA PS1, London-Tate Modern and Paris-Musee d'Orsay) have been researched and compared with Warehouse 5. Additionally, a literature review has been carried out on the relationship established by issues of exhibition and representation with the city. Furthermore, detection studies with observations and photographs have been carried out on the present structure.

2 Architecture, Space and Representation Relationship

The term "representation" is by and large derived from old French, or the Latin word "*repraasentare"* [4]. In the dictionaries, it has the following meanings: "model, picture, and sign of something" [5], "image or artistic resemblance" [6]; "definition or impersonation of someone or something in a specific way" [4]. According to Grush [7], representations are formations that suggest something or are used for something. Representation is part of a trilateral relationship, also including a user and a purpose. It is used as a counterfactual presentation. Roughly, it is a target model employed to attempt possible actions [8].

In the extant literature, different definitions such as "representation of drawings of the building," "representation of space," "representational space," and "representation of space via exhibition" are encountered. In architecture, representation means representation of an architectural product existing in the traditional sense through visual and copying techniques [9]. In other words, an architectural product is not just a building that is already built. Drawings of the building are also architecture, "representing built architecture" [10]. Savaş [11] approaches the issue of representation through a situation's "direct relationship with that not eventuated yet." A product created by the architect is "the object that is fantasized to be a space; the object expressed with such tools as orthographic sets, models, perspectives, and drawings." Uraz [12] divides the issue of representation in architecture into three stages. The first stage is contemplation of reality, deliberation thereof in the mind, or externalization. The second stage is development of style. The third stage is the "presentation" stage. Additionally, throughout the history of architecture, whereas structure was represented with drawings in ancient Egypt and with three-dimensional models in ancient Greece, wooden three-dimensional models began to be employed during the Italian Renaissance. Toward the end of the 18th century, Gaspard Monde developed the basis for descriptive geometry in "Ecole Polytechnique" in Paris. Descriptive geometry is the representation of three-dimensional objects in two dimensions through the X, Y, Z coordinate system. Following the proliferation of the Beaux arts design methods, planning of the design was performed with plans and perspectives drawn by hand [13]. Development of the diagram toward the end of the 1920s rendered design more scientific [14]. Bauhaus attached importance to drawing techniques in representation, in addition to geometry and modelling [12]. Additionally, architectural "representation problematique" emerged with modern architecture. Previously, "representation" was considered drawings on the front end

[3] Emre Arolat (1963-Ankara, -): Worked with Şaziment and Neşet Arolat between 1987-2004 as a designer. Won four National Architecture Awards in total for the "Project" branch in 2004, "Structure" and "Project" branches in 2002, and the "Structure" branch project in 1992; in 2000, he won the "New Pursuits in Architecture Award" from the Tepe Culture of Architecture Foundation. He continues his studies at EAA-Emre Arolat Architects [3].

of the architectural design process was not extended to the design phase. Later on, “drawn architecture” developed an intellectual identity.[4] Architectural drawing techniques resulted in revolutionary changes in the field of architecture. Architecture was created through drawings [10]. According to Lefebvre [15], area representations are “designed areas.” They represent the areas of scientists, planners, city planners, and artists that are close to scientific fields. They are the sovereign areas, where indicators are created intellectually. Representation areas, on the other hand, are areas experienced with “images and symbols accompanying the area.” There are symbols and indicators in representation areas. In the celestial sphere, divine spheres are ancient representations of an area. In the modern era, on the other hand, area representations have been transformed into representation areas, in which palm trees and leaves reflect divinity. Jameson claims that there is a relationship between area and political representation. This process began in the early periods of the modern era, when modern political cross references were intensely used[5] [16]. In the “representation of architecture” via exhibition, the exhibition of architecture previously meant the exhibition of representations of the architectural product. Representative objects such as models, drawings, and perspectives were found in architectural museums. Over time, representative objects broke away from architectural products, and these objects became directly architectural products [9]. Furthermore, architecture was transformed into a “representative object” in England in the 1930s through “interbuild/exhibition stands in the English building trade fair.” Here, it was represented as disconnected from the modern structural context, and the transformation thereof into a structure was deliberately avoided [11].

3 Exhibition Spaces in the Historical Context and Representation Relationships

The concept of exhibiting, which has a long history, is explained as the showing or presentation objects and works by individuals. According to Velarde [17], the primary purpose of exhibiting items is to have a story be told. The need for exhibition space first emerged in Italy when the exhibition of religious paintings was desired in Europe during the Renaissance period in the 15th century [18]. When merchants, who grew rich following the improvement of trade in the 16th century, started collecting artists’ works, collections developed. The idea of opening these private collections to the public was an important milestone for museum studies. An area organized on the second floor of the Uffizi Palace in order to exhibit the special collection of the Medici family in Italy was the first exhibition area in the present sense of the word [19]. of the ongoing opening of comprehensive national museums worldwide during the 18th century played a great role in the development of museum studies. In the 19th century, the concept of exhibitions in a museum meant collecting artefacts and putting them in chronological order. Paintings were generally presented to visitors side by side on the walls within the gallery area, without pursuing any aesthetic concerns. According to Jenkins [20], exhibition areas then formed the image of a crowded warehouse that was not properly designed. Following the ideas of

[4] Ideal city, fantastic architecture, utopic projects.

[5] Avant-Garde: Designers’ referring to mythological and ideological information, futurists’ imitation of the Roman Empire while planning Italian nationalism, Saint’Elia’s attempt at designing an identity in architecture through the power of factories and machinery.

modernism suggested in the 20th century, modes of seeing and understanding modern art changed to a great extent. Modern art exhibition areas of the period offered a rich exhibition archive, prioritizing such artworks including photography, cinema, industrial products, design, and architecture as a whole, as was the case in Bauhaus in its first years [19]. During this period, purification from all kinds of attention-grabbing elements other than the artefacts themselves was in evidence. Following the 1970s, on the other hand, when daily life gained greater influence over objects of art, eclectic elements came into prominence in art, marking the start of the postmodern era in architecture, when differentiation was observed in exhibition areas. During this period, art began to be exhibited in many areas of the city. Following the refunctionalization of idle areas of the city, such spaces housed exhibition venues, biennials or areas in which various art activities were organized. In Section 4 of this study, below, the representation of Warehouse 5 in Istanbul/Turkey through architectural exhibition spaces, as specified in the purpose of the study, is investigated under three headings through the definitions of representation (see Section 2): 1) representation through historical meaning, 2) representation through images used, and 3) political representation. Comparisons of the aforementioned concepts, with examples that remained idle in historical contexts and were transformed from different functions into exhibition spaces from New York to London and Paris, (MoMa PS1-New York, Tate Modern-London, Musee d'Orsay-Paris), which are world metropolitans, are provided in the conclusion.

4 Transformation of Istanbul Warehouse 5 into State Art and Sculpture Museum

4.1 Representation Through Historical Meaning

The Tophane District, including Warehouse 5 (Figure 1,2), was in general an open country and forestland area in which mostly religious buildings were found until the Ottoman Period. Military industrial structuring in the nucleus of the city, which is the reason why the name "Tophane" was given to the district upon the conquest of Istanbul by the Ottoman Empire, transformed the Tophane district into an important focus for Istanbul. In the 19th century, the existing military industry in Tophane began to diversify, with arts and crafts embracing different modes of production. Painting studios, sewing workshops, carpentry workshops, blacksmith workshops, and armoury workshops were opened.

Figure 1. Location of Istanbul in Turkey (on the left), Location of Tophane in Istanbul (on the right) [21]

Figure 2. Location of warehouses in Tophane (on the left) and numbers thereof (on the right) [21]

Ongoing demolition and construction works in Tophane throughout history continued to create different stratums within the district. In parallel with the modernization of ports, structures harbouring such functions as customs, warehousing, storage, and management were constructed on the coastline to meet the needs of new ports from the late 19th century to the early 20th century. At the end of the 19th century, construction of the modern port, storage facilities, and management buildings began to overtake the military character of Tophane in the Ottoman Empire, and military facilities in Tophane lost their significance in general [22]. The inadequacy of existing ports became a critical issue again in the early years of the Republic, and preparation of a reorganization and modernization plan in the harbour region and surrounding structures that fell behind was considered. Following the initial works carried out in the 1930s, the first concrete step was taken in the 1950s. Customs and storehouse facilities and the Tophane Square Arrangement Project were introduced by Sedad Hakkı Eldem between 1953 and 1960 [23]. The project consisted of two-story sheds with a total area of 16.00m2, a small motor vehicle harbour, and the arrangement of roads in the rear area. Seven buildings in total, consisting of three warehouses on the shoreline and three offices to be used by the Turkey Maritime Organization, were designed by Eldem. However, according to the specifics of the situation, the project was changed to seven structures consisting of four warehouses on the shoreline and three offices on the street were built (Figure 3) [1].

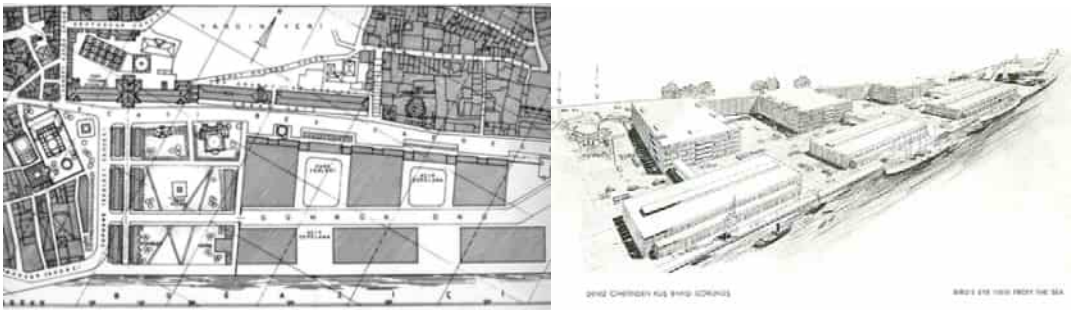

Figure 3. Drawings of Sedad Hakkı Eldem [24].

Among these seven warehouses, Warehouses 1 and 2 were used as passenger lounges for many years. Warehouses 3 and 4 constitute the exhibition areas of the Istanbul Modern Arts Museum, which was Turkey's first modern art museum, opened in 2004. Warehouse 5 is at the disposal of the Mimar Sinan Faculty of Fine Arts. Warehouses 6 and 7 were used by Coastal Safety. Demolition of Warehouses 1, 2, 3, 6, and 7, which carried historical value, was planned for the construction of hotels, restaurants, commercial units, and recreational

areas included within the scope of the Galaport[6] project, which stipulated the restoration and arrangement of the Tophane coastline in 2013. The Istanbul Modern Arts Museum in Warehouse 4 and the Mimar Sinan Faculty of Fine Arts in Warehouse 5 were excluded from the project due to their 28-year rental agreement. Demolition work on the warehouses in question was completed in 2016, and construction work relating to the Galataport Project is still underway in the area. As a result of the idea of the transformation of Warehouse 5, which remained idle for many years, into the Modern Arts Museum to exhibit the collection of Istanbul State Art and Sculpture Museum, the project was completed by the Emre Arolat Architectural Office in 2011. The project, construction of which is underway, is expected to be completed and opened to visitors in year 2018 (Figure 4).

The Istanbul State Art and Sculpture Museum was located in the Palace for Heir to the Throne in Dolmabahçe Palace for 75 years, beginning in 1937. In 2012, the Istanbul State Art and Sculpture Museum collection was placed in Warehouse 5 in Tophane. The National Palaces Painting Museum was founded in the Palace for Heir to the Throne, and the collection of the new museum was opened to visitors in the same year [27].

Figure 4. Project for Transformation of Istanbul Warehouse 5 into State Art and Sculpture Museum [26]

4.2 Representation Through Images Used

He primary design approach expressed by Emre Arolat while transforming Warehouse 5 into the Modern Arts Museum was maintenance, with a reinforced concrete structure of the grid imprinted on the urban memory for about 50 years. The significance of this grid for Sedad Hakkı Eldem was the reference it makes to a “framework,” which he considers the founding element of Turkish architecture. Walls and floors covering the structure were removed, and in their place, a three-dimensional structural grid system was obtained by installing 40 containers, the heights of which varied between 4 and 8 metres. These containers are connected to one another via platforms, ramps, and bridges in intermediate locations in a manner that avoids contact with the outdoors. The reason why the front facade of the structure is transparent is attributable to the desire to present customers with a view of Istanbul, as the structure is located at the seaside in a historical context [26]. The building design was included in the Cityscape Awards for Emerging Markets 2012 and made it to the

[6] Designed on the Historical Galata coast, which has the characteristic of a door opening to the sea in an important spot in Istanbul for hundreds of years, Galataport is a multi-functional urban design project extending over a construction area that is 1 to 2 km in length, with an open area of 100.000 m2 and a closed area of 151, 66 m2, and consisting of an art museum, hotels, restaurants, pubs, fast-food outlets, offices, fair areas, and car parks [25].

finals in the "Cultural Structure of the Future" category (Table 1) (Figure 5, 6). Although the project is stated to have been designed by Emre Arolat with historical references, academic circles have criticized the structure for being designed in a manner that departs from the closed nature required of museum studies in a manner that is architecturally reminiscent of a shopping centre [28]. Moreover, the industrialization of art and culture, which has recently transformed into an iconic architectural representation spread around the world, and the fact that structure rather than the art collection comes to the forefront, has become a subject of criticism among both academics and artists [29].

Table 1. Warehouse 5 – Representation of Istanbul Modern Arts Museum Through Images

Features Carrying a Preserved Image Value	**Warehouse 5 – Istanbul New Modern Arts Museum**
Structural Structure	*Wall and floor tiling of the historical warehouse building has been removed, reinforced concrete grid structure system has been preserved
Architectural Language of the Structure, which Carries A Lot of Weight for the City	*Warehouse buildings and Tophane District describe an industrial area and international harbour for Istanbul *Reference made to industry has been delivered with a surface geometry based on order *Reference was made to its once being a harbour by means of the containers used in gallery areas
Facade Lining	*Grey exposed concrete effect can be read transparently on the front facade thanks to the preservation of the grid system *Red containers used in gallery areas, at the same time, provide movement in the front facade *Bridges and ramps establishing connections between gallery areas have been made from glass so that they can establish a permeable relationship with the city
Furnishing Elements Indoors	*A sterile gallery area is created
Elements Evoking the Former Program	*The most powerful of elements evoking the former program of the building is the reinforced concrete grid system and red container gallery areas
Existing Landscape Area	*Ground floor of the new museum design is permeable in a manner that will allow for public events * The building has created a cultural landscape by establishing relationships with surrounding structures and an open area
Silhouette Effect in the City	Differentiation from the warehouse thanks to the red containers installed

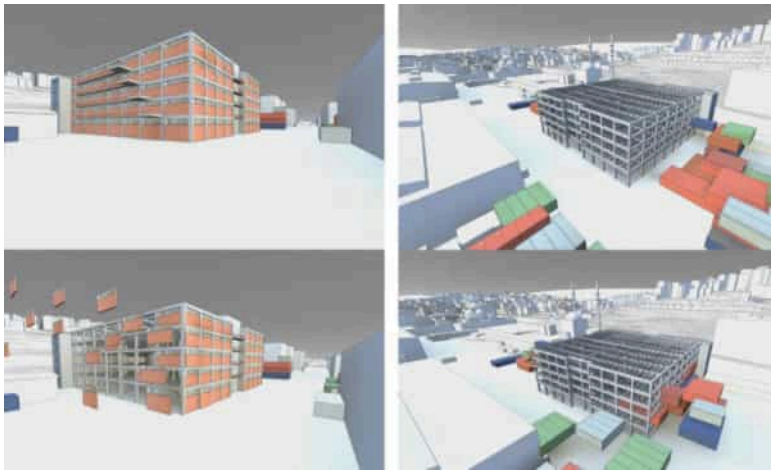

Figure 5. Transformation of Istanbul Warehouse 5 Preserving the Reinforced Concrete Grid Structure [26]

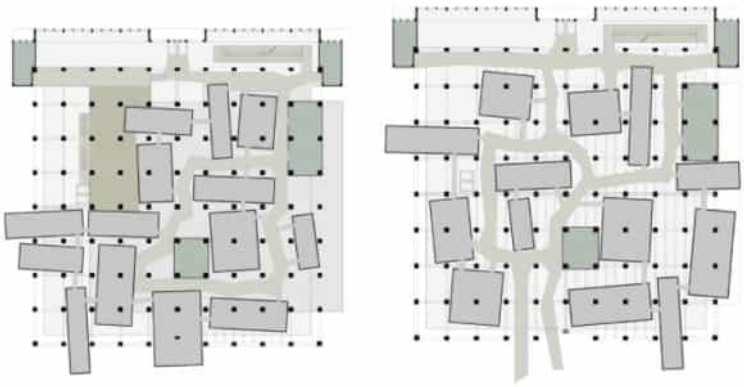

Figure 6. Floor Plans of Container Gallery Areas Placed in Istanbul Warehouse 5 [26].

4.3 Political Representation

Opened in the Palace of the Heir to the Throne in Dolmabahçe Palace in 1937, the former Istanbul State Art and Sculpture Museum, as the first and only "Modern Art Museum" in the country, was a reflection of the ideology of becoming a nation state and of the modernization movements encountered in other countries during the period [30]. This museum was closed in 1939, reopened in 1951, and closed again in 2007 to undergo restoration by the Office of Deputy Secretary-General of National Palaces [31]. It was announced in October 2011 that an engagement letter was signed between MSGSÜ (Mimar Sinan Faculty of Fine Arts) and the Republic of Turkey Prime Ministry Privatization Administration for the transformation of Warehouse 5 in Tophane into the New Modern Arts Museum, and that the project would be designed by Emre Arolat [32]. The National Palaces Art Museum was founded in the Palace of the Heir to the Throne, the restoration of which was completed in 2012. The political environment, in which Warehouse 5 was built – the historical building under construction in the Istanbul Modern Arts Centre, to which the collection of the Istanbul State Art and Sculpture Museum was transferred – corresponds to the second National Architectural Period, in which searches for local architecture took place for the second time in Turkey, following the end of World War II. A western-origin, modern formal approach – far from the Ottoman- and Seljukian-based formal elements of the second national architectural movement, which prevailed during that period – was adopted

in the warehouses, construction of which was designed by Sedad Hakkı Eldem and completed in 1960. In Warehouse 5, which was redesigned by Emre Arolat, on the other hand, while using various historical references, the creation of a new modern arts museum was the goal. Additionally, features represented in this context represent Turkey in the 21st century. A design that could reflect Istanbul's cultural missions, enhanced by the designation of Istanbul as the Capital of Cultures and the relationship established by Turkey with modern art, was expected.

5 Conclusion and Evaluation

Within the scope of this study, the change representation of architecture initiated through exhibition areas is investigated by way of comparison with examples from all over the world via Warehouse 5, the Istanbul Modern Arts Museum, which has recently found itself in a highly controversial situation, under the following headings: historical meaning, images used, and political representation. The investigation of the representation of three exemplary structures selected and Warehouse 5 through historical meaning revealed that while built for different functions in the historical background, all of these buildings were transformed into the same function (Exhibition Area – Museum). Considering their representation through images, each of the buildings was designed with special architectural images such, as facade layout and elements, material use, and indoor furnishings, in a manner that clearly makes reference to their past and/or context. As to the political representation of the buildings, the fact that the architectural language of the structures was governed by the political and social events rising to the forefront on the date they were first built is certainly noteworthy. For example, Queens Public School #1 (MoMa PS1), built in New York toward the end of the 19th century, was built under the influence of the Neo-Romanesque structures commonly seen in England as a result of close encounters and interactions between the U.S. and England. Similarly, the Bankside Power Station (Tate Modern) was built with brick under the influence of modernism in the midst of the 20th century, and this was the facade material of traditional English architecture, so as not to draw reaction to the white facades of modernism. The Orsay Train Station, on the other hand, represented political power and modern technology of the period using the Beaux Arts architectural style in a manner that renders the political power and modern technology compatible with Paris toward the end of the 19th century, during the reign of Governor of Paris Baron Eugène Haussmann and Leader of France Napoléon III, to the entrance to Paris, which was the heart of France. As for Warehouse 5, it was designed with a simple and rationalistic approach to the modernism of the 1950s, which was the common architectural style of the period within the framework of modern architectural movements developing based on the west after the single party period in Turkey. In this context, all of the buildings that were transformed into exhibition buildings are, at the same time, pioneer buildings of their era. They represent architectural development within their home countries both when they were first built, and also after they were transformed [Table 2]. According to the evaluations carried out on these buildings, which were investigated within the scope of all of the identified contexts, museums – which are exhibition areas – cannot be thought of as architectural productions fulfilling the function of exhibiting objects of art only. Beyond exhibiting objects of art, these areas are architectural products, representing the circumstances of their political and social environment with their architectural language and

elements through the images they employ in their unique historical context, exhibiting their fundamental heritage and forming their own historical narrative.

Table 2. Comparison of Representation of Architecture over Exhibition Areas with Examples Transformed into Exhibition Areas (Moma PS1 –New York, Tate Modern- London, Musee D' Orsay-Paris, Warehouse 5)

Representation Elements	**MoMa PS1 New York 1893**	**Tate Modern London 1947**	**Musee d'Orsay Paris 1898**	**Warehouse 5 Modern Arts Museum Istanbul 1953**
Representation Through Historical Meaning	Constructed as a Public School	Constructed as a Power Station	Constructed as a Train Station	Constructed as a warehouse building
Representation Through Images Used	*****The school building has been preserved, together with its conveyor system, its facade and the indoor sections. ***** Architectural details, such as a blackboard and wooden desks that are reminiscent of the former program, were used in the cafe indoors. *The same details can be seen in the outdoor landscape of the structure as well.	***** Steel structures and floor coverings give a feeling of incompleteness; metal staircases and exposed concrete walls were used inside the structure. ***** Original brick lining on the front facade was preserved.	***** Large openings passing through steel structures and facade linings were preserved. * Indoor train platforms were transformed into gallery areas. ***** The clock tower was transformed into a cafe and is used for this purpose.	*****The reinforced concrete grid was preserved and formed the structure of the new museum. *****Gallery areas of the warehouse building positioned across the harbour were placed in the reinforced concrete framing in the form of containers.
Political Representation	Queen's Public School Building was influenced by the neo-Romanesque approaches of the architecture in England, with whom America had an intimate	The technological power of the period was represented with large openings passed through steel structures at the Bankside Power Station. *It has the simple	*It was built with the modern technology of the period and in the gorgeous eclectic style. * As an access building, it has the characteristics of	*The idea of transforming the Warehouse 5 building, which remained idle for many years, into a Modern Art Museum was considered a positive

	relationship in the 19th century.	lines of modern architecture influential all over the world. * Reactions of the conservative structure in the city were avoided thanks to construction of the building with brick facade lining existing in traditional English architecture.	an entrance gate to Paris. *It represents the outward frontispiece, power and technology of Paris, and in fact all of France.	approach. *Removal of the state art and sculpture collection from the strong historical context it belonged to in Dolmabahçe Palace without seeking public opinion was criticized.

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THE URBAN INFRASTRUCTURAL BECOMING OF AN IMPROBABLE INFRASTRUCTURE, A POETICAL CATASTROPHE IN VIENNA

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Abstract

The transfer and dissemination of the philosophical discourse to the architectonic and urban theory and practice have been important since the last decades of the 20th century.

When we mention dissemination, the dissemination as trace-trail of the other, a spectral presence, we mention Derrida, inasmuch as they are operational concepts of the Derridean philosophy, in addition to the Supplement and the *Parergon* (as something that is allegedly beyond the limit of the fundamental, the *Ergon*).

They are concepts that lead us to the extra, the "*extranjero*". Foreigner has always meant all of these concepts in the Derridean thought, that is to say, "the thing that arrives", the outsider that becomes the insider and still remains in the outside, a spectral presence, not completely present or absent. It is neither inside nor outside, an in-out, an out-in that disrupts the stability of the current, central meaning. Thus, the foreigner, the outsider is an important issue, considering that the philosophical concepts work, oftentimes, as the foreigner in the architectonic theoretical discourses.

The dissemination is catastrophic. According to Catherine Malabou [1], in a reading of the disrupting and supplementary thinking of Jacques Derrida in the work La Contre-alleé (DERRIDA, MALABOU, 2009), the verb *strepho*, which is the origin of *strophé* [catastrophe], has contradictory meanings: to go and come back, to turn towards something, but also to spin around, to wander; in short, remain in disturbance, not to maintain fixed in an [alleged] original direction. The *strophé* of a poem, its verses, may assume the repetition of something. But, said return does not come back as the same, spectral presence of it-self; it is a spectral iterability. Even if it comes back, it is a palintropic, maze-like return, a spacing that bears its own *différance* (concept created by Derrida to explain the permanent deferral in time and space of something that is never done, always in process of self- divergence, self-opposition because there is no a final destination. *Différance* is the "millieu" between the divergences in time). Time and space are other entities even in the thing that returns as allegedly the same. When it repeats itself, because it repeats itself, the initial situation is not the same, the repetition is the spectrum of the previous situation.

Thus, the issue approached by this essay is the catastrophic movement of an urban structure driven by a "foreign", outside, *paregonal* action, a super-structural architectonic addition [which is beyond the structure], authored by Zaha Hadid, which couples with a historic infrastructure [which is beneath the structure] existing in the City of Vienna (the Spittelau Viaduct, projected by Otto Wagner), which, based on said amalgam, creates a transmutation of them both, a structural becoming that disrupts their meaning and representation.

Another historic archive seems to come from said *parergonal* action, which is not only super-structure, not only infrastructure, but maybe a spectral, indiscernible urban *ergon*.

Keywords

Amalgam / Dissemination / *Parergon* / Transmutation/Become

1.On Palintropic Returns

In 1995, Jacques Derrida publishes "Archive Fever" [2], a work that allows him to deepen the issue of the archive when it articulates technique and politics, ethics and law, psychoanalysis and Judaism. In the work, Derrida approaches the technological revolutions that may always transform the archives and, particularly, the relation we establish and create with them, good and bad archives. In the end, to whom does the authority over said archives, over the institution of the archives belong? – asks Derrida. Archives that are historically related to the means of communication, but mainly, the archives made available, accessed, generated and handled by said new means of communication, such as the Internet, major spectral source these days.

Nowadays, we have faced different modalities of image filling, whether objectual-figurative or written. The archive, a trans-historic modality connected to the preservation and conservation of the object, superseded the object itself when it rendered the object an inexhaustible source of fillings, de-fillings and re-fillings. Thus, what would be the archive today? What would be the act of archiving?

To archive means both preserve and abandon, as suggested by Derrida. However, what is preserved when the archive is, from the beginning, threatened by incontrollable de-fillings and re-fillings (the principle of Wikipedia, for instance)?

> "La pulsion d'archive, c'est un mouvement irrésistible pour non seulement garder les traces, mais pour maitriser les traces, pour les interpréter. Dès que j'ai une expérience de trace, je ne peux pas réprimer le mouvement pour interpréter les traces, les sélectionner, les garder ou non, donc pour constituer les traces en archives et pour choisir ce que je veux choisir [...]. L'archive, comme je le dis quelque part, ce n'est pas une question de passé, c'est une question d'avenir. L'archive ne traite pas du passé, elle traite de l'avenir. Je sélectionne violemment ce dont je considère qu'il faut que ce soit répété, que ce

> soit gardé, que ce soit répété dans l'avenir." (DERRIDA, J. Trace et archive, image et art, p. 62). [3]
>
> (Free translation of the excerpt in French: "The impulse of the archive is an irresistible movement not only to keep the traces, but to master the traces, to interpret them. As soon as I have an experience of trace, I cannot repress the movement to interpret the traces, to select them, to keep them or not, to constitute the traces into archives, and to choose what I want to choose […]. The archive, as I have said before, is not a matter of past; it is a matter of future. The archive does not deal with the past; it deals with the future. I violently select what I consider that should be repeated, kept, repeated in the future." (DERRIDA, J. Trace et archive, image et art, p. 62). [3]

We archive what has already been published, made public, something that became public domain, filed to be preserved and which may return when needed. However, what comes back if its request and time in which said returns take place are not coincident with the ones of the conception?

Following the rationale of Derrida, the thing that returns in the moment it returns is something that is beneath and beyond the thing, it is never the same thing because there is always a selection, an exclusion in the processes of filling and return from said past. And because they are not the same thing, considering said impossibility of being at the same time of its conception and appearance, the thing that returns is always a trace of the thing itself, a spectrum.

But, as previously said, the spectrum may be something beyond the thing when it returns because its being may be associated to other logics of world different from the ones in which it was conceived. Space and time are not the same; the thing that was filed returns as its own trace, traces of archived traces, because the thing that is archived is also traces of the thing.

Therefore, what traces do we find in Vienna? Or, in an expanded field, what archives are we dealing with when we see the return of traces of old railways or roadways in the world? What did it return together with the High Line or the Spittelau Viaduct in Vienna? What are these spectral presences, which are no longer the same, but still persist also as another thing? Which are these infrastructural spectra that return as something that exceeds their own infrastructural presence when they return as an architectonic super-structure? What was expropriated from the being of those infrastructures at the moment in which they were re-appropriated according to another urbanistic logic? And, which other expropriations may be produced in the same time we appropriate, in an interpretative gesture, the images that show us something? What do we have in front of us and what is still to be seen?

> "C'est ce que j'appele quelque part l' "exapropriation", c'est que l'appropriation est une expropriation. Eh bien, le film, j'en dirai pas seulement qu'il montre ça. Il le montre, c'est iconique, c'est une image qui donne à voir ou une image qui se donne à entendre, iconique. Le film ne donne pas simplement cela à voir et à entendre, mais il est cela et il fait cela, il coupe, c'est um art de la coupure. Et on sait très bien que tout revient à l'art du montage, à l'art de "édition", de l'editing, au sens anglais. Au début j'ai fait allusion au couper-coller, edit, comme on dit em anglais. Je crois que c'est la marque de l'art dans um film, c'est d'abord um art de la couture et de la coupure [...]" (DERRIDA, J. Trace et archive, image et art, p. 34). [3]
>
> (Free translation of the excerpt in French: "It is what I call "expropriation", the appropriation is an expropriation. Well, the movie, I would say that it is not only what it shows. What it shows is iconic, it is an image that allows us to see or hear, something iconic. The movie does not allow us simply to see and hear, but it is that and it does that, it cuts, it is the art of the cutting. And we know quite well that all amounts to the art of editing, the art of the "edition" in the sense of the English language. Initially, I made reference to the "copy-paste", the editing, as we say in English. I believe that this is the mark of the art in a movie; it is, above all, the art of the sewing and cutting […]" (DERRIDA, J. Trace et archive, image et art, p. 34). [3]

According to Derrida, said archives, expropriated from their temporal worlds at the time of their conceptions, return as another entity and, when they return, they find another time to which they become part. Said temporal assembly, an edition of overlapping times, builds an unprecedented and intangible becoming, spectra of a past and future time that are not achieved in full, traces of something that is beneath and beyond the thing that returned, a palintropic return. The thing that returns is edited by the surroundings. But, what does surround it? Would it be only what we see or also what we don't see? Said entity that returns is edited by what is visible as spectral, invisible forces.

Said palintropic return of the structure, or the infrastructure, establishes relations with the surroundings, with the mundanity of the surrounding public space, editing and being edited by it. The act of making public said entity that returns together with its spectra is interesting to us - traces of the past and of what is to come.

2. Catastrophic poetics: traces, spectra, becomings

In the possibility of a becoming, the dissemination and radicalism of the potential experience at all times - and, in this sense, always catastrophic, radical - the architecture transmutes the infrastructural into super-structure. Its trace draws a presence that is also absence, because it leaves the trace for the new and the unpredictable. Thus, the spatial experience is always a becoming contained in the spectrality of an initial intention that does not end, but renews itself as supplement, and contains, at the same time, past and future.

Therefore, the infrastructure that restricts it extrapolates its limits at the same time that it corrupts when it interferes with what would be another monumental unique object that arrives, rendering it an infra-structural support for other urbanities of the city: the beneath becomes the beyond, but the beyond-the-place is merged with the place when it provides conditions for the manifestation of another place. What would be a super-structure extrinsic of the place mergers into it on the level of the infrastructure.

As the *ergon* is the work, the *Parergon* is its beyond, which includes it. As limit, margin, frame, *passe-partout*, the *Parergon*[1] establishes the basis to determine text and context, the inside and outside of the work; it exceeds the limit, becomes supplement and shows the ruin of the stable representations that are interesting to the deconstruction. Which ergonal and *parergonal* situations can we consider?

Palimpsestic, palintropic, catastrophic, the architectonic object turns in the poetry of its verses transforming illegible logics into interpretations previously unknown, made stronger by the spectra that multiply its structure. Therefore, the *paregonal* spectrum, which is beneath because it is invisible, becomes beyond in said invisibility that destabilize the entity and its purpose, because it reveals the insufficiency of the being in the original limit, transforming the entity in another entity. The precipitations of a becoming in the onto-teleological weakening open a perspective of alterity, provoking a disrupting displacement and broadening in an intense and catastrophic manner the possibilities of multiple, different, unknown experiences.

2.1.Urban superstructures, infrastructural becomings and marketing spectra

Located in the north region of the City of Vienna, built over the Spittelau Subway Station and a viaduct (project conceived by the Viennese architect Otto Wagner of a deactivated railway branch, nowadays transformed into a bicycle lane which, in fact, extends itself through the canal of River Danube, which passes through the city), the set of three apartment buildings (Figures 1 and 2), concluded in 2008, initially planned to be a low-income apartment building complex, is now intended, in its majority, for students, probably because it is close to the campus of the Economy and Business Administration University (Figure 3).

[1] *Derrida (2010, p. 72) says about the Parergon,*

"always a form over a background, the Parergon, however, is a form which traditional determination is not to stand out, but to merge, become blurred, melt down with the moment it releases it major energy. The milestone is not, under any circumstances, a background, as the means and the work can be, but its thickness of margin is neither a picture. It is not even a picture that removes itself". [4]


Photo by Igor Guatelli, 2009


Photo by Igor Guatelli, 2018

Figures 1 and 2: View of the apartment building complex planned by Hadid over the Spittelau Viaduct, conceived by Otto Wagner.


Source: Google Earth, 2018

Figure 3: Aerial view of the apartment building complexes projected by Hadid in the center, besides the Donau canal, the Spittelau rain and subway Station above, in the north and the university in the west. It is possible to observe the old railway, nowadays a bicycle lane, that starts at the subway station, going through the project of Hadid and extending itself to the south towards the city center.

The super-structural architectonic addition of Zaha Hadid in the Spittelau Viaduct generated, based on said amalgam, a transmutation of both, a structural becoming that disrupts their meaning and representation. It may relate to a spectral urban *ergon*, indiscernible, an *ergon* yet to come based on the interaction with a *parergon*, not completely work in its foundation, not something that is beyond the work, but an urban supplement that begins to perform other roles and meets demands yet to come, whether urban, marketing, social and advertising demands.

The Spittelau Viaduct, an infrastructural spectrum in the landscape of Vienna, becomes a vector of new urbanities when it becomes an architectonic super-structure with the project conceived by Zaha Hadid. Fundamentally, this infra-structural support, launched to

beyond itself when it is associated to an architectonic superstructure, emulates some traces of the future that underlie the project itself.

If the Spittelau Viaduct had a precise destination, its abandonment opens up a possibility of errancy that will send it to other destinations at the moment it couples with an architectonic superstructure projected by Hadid. Said association launches the complex to unpredictable destinations (*destinerrances,* or unpredictable or provisory destinations, in a derridean sense. For Jacques Derrida, there is never a real destination), to beyond the destination that each one bears when considered separately. Which would be those possible destinations allowed by a support that is, at the same time, beneath and beyond the ontological logic of an infrastructure and a superstructure?

3. From infrastructure to an infrastructural superstructure: "hantologies" of an supplementary support

In which sense could we think about architecture, the architectonic object, based on an existence for something else, and not an existence-to-itself, a support of an infra-structural addition, absent and present at the same time? A being up to certain point fragile as a condition for a becoming based not on a state of existing-to-itself when it becomes public, but a being together with something else (notion based on the *Mitdasein* concept, by Heidegger).[5]

A being that builds itself, comprises and strengthens itself based on seams, bastings and articulations with something that is beyond itself, a process of placing itself in public as a being present, but not self-sufficient, reduced in its sense, and fragile enough to place itself with something else; form itself not as an ideal or idealized entity, timeless and above the public, but something to be strengthen in its reason to be, by the public, that is to say, the city and its inhabitants.

Therefore, could the architecture of the building be considered as a trace, without absolute absence or presence, but a wish-to-be or, in the expression of Heidegger, an being-there (*dasein*) capable of joining, comprising and connecting itself to something, in a productive process of spatial connections, a becoming-space, a spacing? As the alterity, the other that always rises to beyond-the-being and the being itself, could we think the architecture of the building based on the trace, the wish-to-be-something beyond itself?

An architecture considered as a way to strengthen and enrich a past-being, neither absolutely absent nor absolutely present and, when accepting the conflicting nature of its own process of composition, to place itself and position itself with the other, would allow the appearance of new meanings and the alterity when connected, more than that, hybridized, deformed, amalgamated, almost merged into something beyond itself, beyond-it-self.

An architecture that would let itself to be contaminated, in its expressive totality, when it merges into other traces, with marks and inscriptions beyond itself. The practice of the amalgam as proximity of the thing that is close, approximation, the dissolution of

borders between the self and the other, between architecture and city, the blur of the formal limits of the building in its process of placing-itself-together-with – forming itself – something beyond itself became a reflexive engine of the project conceived by Zaha Hadid.

3.1 Traces and De-formations

A former line of urban mobility in the city, the Spittelau Viaduct becomes a place of interior urbanities. Under the arches of the old viaduct, artists' workshops, restaurants, shops, bicycle maintenance shops. Under an urban trace, an "almost" absence, a territorial inscription "almost" erased, Hadid inserts inscriptions that reinforce and re-signify the "trace". The project inaugurates the possibility of a mutual addition by means of an exchange to be established between the "trace" and the "inscription"; fundamentally, the idea of a being-together-with, a being that strengthens itself when it sets itself up together with presences beyond itself.

Despite the visual presence, the project conceived by Hadid is not a being-in-itself, or a simple overlapping in relation to the thing that is "almost" not there any longer. Associations between the thing that arrives and the thing that is already there are common in the history of architecture. However, what draws the attention in this project is the way the architect establishes an articulation between the element that arrives, the addition, and the existing "trace".

With its potency of territorial connecting line restored, the former railway branch, re-signified when it was transformed into a bicycle lane, is articulated with something that did not seem to be necessary for its reactivation and re-functioning. However, a radical shock may only be provided by the outside, by something that comes from the outside, not to complete, confirm, consolidate or disrupt, but to disarrange, wear the given meaning (Figures 4 and 5).

The project conceived by Hadid is inserted as a supplementary addition (the *Parergon*), an un-necessary inscription, because it is not only complementary. It does not seem to be created to fulfill a need, but to change the dynamics of a territory. The viaduct, performing once again a role of territorial basting, evidently would not be "complemented" by an low-income housing program.

Figures 4 and 5: The architecture as a supplementary scripture, a *parergon* which, when combined with the infrastructure, builds another *ergon*, an ergonal *parergon*. The supplement generated is neither the superstructure nor the sum of both, but a collapse of the borders between them both. The result is the element that remains as the spectral trace of the urban becoming.

The viaduct, the paradigmatic and enhanced object in its "being", an urban line, gains the possibility of becoming at this moment of the territory in which a supplementary, non-necessary inscription arrives and interferes with it and deforms this existing "being".

The Spittelau Viaduct bears, in its name, its title, its own historical condition, attached to a convention, a structure that represents a territorial line based on displacement and connection; a mark over a territory, branded by an "identity" when it is identified as infra-structural line.

However, to which extent would the element that arrives, the "outside the work", unrelated to the work itself, be capable of altering the condition of which seems to be part of the work itself? In other words, could the "supplementary" game be a strategy of destabilization of the "being" of the work when it provokes unforeseen deviations (contingencies), in addition to the ones foreseen in the work?

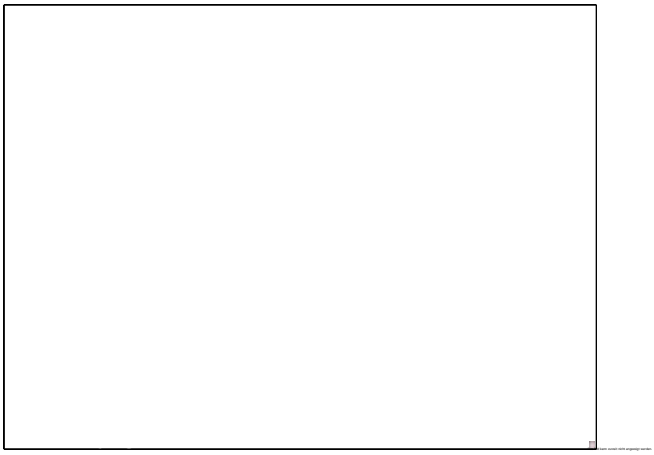
In this project, Hadid creates three major blocks of apartment buildings over pillars, which present irregular geometry, built over their own structure (maybe a para-site, but not a parasite), independent from the structure of the viaduct. Located alongside a canal of the River Danube, the set of buildings articulates with the river by means of a two-level deck system; one of them, larger, as a terrace alongside the arches of the viaduct, and the other, lower, almost on the level of the river, an other bicycle lane.

A major tectonic set, with irregular, fractured, tortuous and apparently unstable forms involves the old viaduct. As previously mentioned, under the viaduct we find stores, graphite galleries articulated with the subway station, which establish other urbanities without denying the place. It is interesting to observe that students started to inhabit and qualify the place markedly by means of a process of qualification that makes it an urban patchwork of images and inscriptions resulting from spray-painting, graphites, spectra of a wish to be underground in a territory marked by the inscription of a architectonic superstructure that would lead it to the opposite direction.

Which urban territorial potency is there in this combination between the physical urban space, the dwellers-students and the urban passers-by? A territory that ceases to be an inert physical set comprised of a stationary structure of buildings, streets, uses, infra-structures to become a support undergoing permanent interaction with people, a "microsystem" in which flows of energy and materials interact; territorial disturbances and interferences that potentiate the appearance of ephemeral special settings (spacing), movable landscapes and temporal rhythms – the time established by the bicycle lane and the subway, the time of the dwelling, the time of the daily and night leisure, the time of the "artistic" inscriptions.

An urban becoming initiates with the arrival of the superstructure when it brings other possibilities of existence for the three urban infra-structural lines: the viaduct, through which the bicycle lane passes, the subway and the river. Residences, shops, bike racks and infra-structural "force lines" become part of a new space-time condition of this place, an urban set that can no longer be seen as a sum or juxtaposition of situations, or as a difference between what was already there, the work, the existence (the viaduct) and the thing that arrives, the outside-the-work, the thing beyond the existence (the set of residential apartment buildings).

Infrastructures and supra-structure start to function as an inseparable system; points and lines melt together in the possibility of structuring another space-time relation of that territory. Over a territory of displacement, passage and connection, a territory of texture, sewing, articulation, and permanence (Figures 6 and 7).



Figures 6 and 7: View of the canal: the three apartment buildings with inferior and superior decks. Open spaces and openings sew views of the viaduct, which becomes a trace of itself when it crosses over and is crossed over by the set of residential buildings.

Neither the three infra-structural lines are maintained as urban "traces", erased marks in their paradigmatic existence, based solely on displacement and fluidity, nor the supra-structure, the three blocks of apartment buildings, which is sentenced to an in-itself or complementary existence. Viaduct, subway and river, normally, and as a result of different reasons, urban spectra (presences little considered), together with the habitation, shops and bike racks comprise a fundamental urban system for the formation and advent of other contingent situations in that territory.

The project conceived by Hadid, a superstructure, a landmark, with limits that could only overlap itself as an exciting and expressive picture over an almost inexistent background, losses vividness when it is contaminated and merges itself with a trace, the Spittelau Viaduct, in addition to contributing to its supplementary formation – overcoming – whether in relation to its condition of infrastructural line, whether in relation to the previous attributed representation it has.

Attempts of compositions and framings between the supra and infrastructures are substituted by an associative game among points (three blocks, three points, suspension points, etcetera – which may be continued?) and lines, which limits and scope seem to go far beyond the one suggested by the undeniable landmark in the landscape and the symbolic urban "place" thus originated. Three solid blocks are sewed (implementation in zigzag) to the "traces" by means of three points of contact. They become mutually supportive in a process of overcoming of its representations towards a future presentation in relation to possible appropriations and new attributions.

The project suggests the impossibility of comprehension based on it-self. Its associative condition places itself in a position of the being-together-with, a can-be that goes beyond the being proposed by Hadid. When it associates itself with the viaduct, the subway and the river, it creates an urban system, which is supplementary in relation to previous systems and its own being, namely, the sheltering / inhabiting.

Said new condition thus generated - a combination between infra-structural "traces" (subway + viaduct / bicycle lane + fluvial route) and a supra-structure (the complex of residential buildings) creates a complementary and supplementary (*parergonal*) situation at the same time. The project conceived by Hadid, apparently un-necessary in that scenery, seems to become indispensable to the articulation and strengthening of the juxtaposed and autonomous infrastructures in that place. Three urban "traces" alter the urbanistic quality of Hadid's project, and have their urban quality altered by it. Inversely, neither presences nor absences, said urban "traces" – the three infrastructural lines – sew the complex of residential buildings to the territory, ensuring new urbanity to it.

The overlapping and perhaps "de-formation" - condition for other formations - of the viaduct designed by Otto Wagner become a pre-condition for other formations when they allow the overcoming of their meanings. In that instant, in that point, the viaduct ceases to be an infrastructure almost absent, associated solely with passage and connection, to become a fundamental support (vigorous existence of the trace) to the three blocks of residential buildings, which, on their turn, cease to be only points in the territory to become a delimitation in the distance-passage through the viaduct.

At the same time, concentration and dispersion (point and line), the architectonic duet (or would it be a healthy duel?), the being-together-with formed by the projects conceived by Hadid and Wagner promotes relations of proximity/exchange (between students/dwellers and urban passers-by) and urban irradiation; proximity and distance coexist in an architectonic and urban momentum which is quite uncommon in a time of useful formal exploitation and triumphant exercise of autonomous objects, which are paradigmatic in their condition of closure in-them-selves.

Maybe the potency yet to come of this project resides in its capacity to promote urban mobilization and mobility because it is configured at the same time as a catalyzing pole (reinforced by a strategic program capable of generating daily routine) and a territorial dissipating structure. A situation that could be a hyper-place, constituted by an excessive landmark, another example of the triumph of the merchandising of the iconic design per-se, is, actually, the other-place, perhaps - if we consider the city of Vienna a kind of touristic over-

place - an under-place constituted by an [over] urban support of alternative mobility filled by ordinary activities, a super-structure absorbed by a metropolitan and local routines.

The political space, the *polis*, becomes dynamic in this promising process of strengthening of one trace - or would there be three traces (the Spittelau Viaduct, the subway and the canal of the River Danube)? - almost absent and desirable "weakening" of which could be only another image supra-structure. Based on the strengthening of traces, the possibility of future traces. Based on the being-together-with, a being-that-surpasses-itself, the possibility of being-in-itself another being; not only infra-structure, not only super-structure, but one and another at the same time.

The perspective, here, is the perspective of a territory that ceases to exist as an inert physical set comprised of a stationary structure of buildings, streets, uses and infrastructures to become a support in permanent interaction with people, a "microsystem" in which flows of energy and materials interact; territorial disruptions and interferences that intensify the appearance of ephemeral spatial configurations (spacing), movable landscapes and temporal rhythms - the time established by the bicycle lane and the subway, the time of the dwelling, the time of the daily and night leisure.

Infrastructures and supra-structures begin to function as an inseparable system; points and lines amalgamate in the possibility of structuring another space-time relation of that territory. Over a territory of displacement, passage and connection, a territory of texture, sewing, articulation, temporary permanencies announces itself (Figure 6).

4.Collapses and spectral others

Super-structural infrastructure or infrastructural superstructure, maybe neither one nor the other, but one and the other at the same time. A force can never be really opposite to another force, because it is comprised of the same counterforce of which it feeds to become a force. Maybe, the major merit of the Spittelau set in Vienna is its insufficiency and lack of completeness as infrastructure or super-structure. Considering it is neither one nor the other, it precariously presents itself as both, and maybe, this is its merit.

Neither one nor the other, but non-plenitudes (spectra) of both that build another force, by means of composition of traces of them both. As indicated by Derrida in his unnumbered compound term-concepts, the composition is the supplement that bears the trace of the other, at the same time it preserves traces of which it is, without fully being, precisely because it is a supplement.

The logic of the supplement is the impossibility of an ontology, because there is no essence of the supplement. The supplement is the spectrum that haunts the essence of the being because it is both beneath and beyond the thing, because it is not "exactly" what is imagined as the being that originates the thing; when it exceeds the thing, it lacks something to be precisely the thing.

The spectral logic of the supplement – it is not the being because it exceeds the being – is, therefore, the logic of becoming; it becomes another thing, but it never becomes completely another thing, because the supplement does not complete. According to Derrida, if the supplement is the thing that threatens the precision of the *logos*, the being and the purpose of both structures - viaduct and complex of residential buildings – is threatened precisely by the composition of them both.

The new archive is not something registered in the landscape solely to be seen, it does not present itself to be seen; it is a temporal and territorial sewing, another catastrophic poetics of the sewing resulting from the collapse and disturbance of precise edges and limits [*la bordure*] of each one of the structures, where the leading role of each one dissolves into the sewing between them; and said dissolution creates a possibility of disseminations and deviations of approach in relation to their identities, a possibility of another being, maybe "infrastructural" traces of another being, which diffuse limits fade the outlines, and expand their urban "possibilities".

Said other being would not be the monumentalized object in the singularity of its own image by the informational technologies or a memory produced based on its being-in-itself – which considers the urban "writing" only as a supplement - but a *tropos*, another tropology build with traces yet to come, as memory of the future, as an absent presence, a *restance* in a derridean sense, the thing that is still despite already being another thing, the thing that belongs to itself but, at the same time, it structurally belongs to another thing, one of the many *nomos* of the spectrum approached by Derrida.

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TRANSFORMING ARCHITECTURE MADE WITH SCISSOR-HINGED DEPLOYABLE STRUCTURES: ALHAMBRA PAVILIONS IN CAMBRIDGE MARKET SQUARE

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Abstract

Deployable structures can transform, expand and contract due to their geometric, material and mechanical properties. This technology enables an architecture that can be transportable, mobile, adaptable, rapidly built, reusable and that makes efficient use of space and materials. Scissor-hinged deployable structures, made by units of bars joined by a pivot, can generate large complex lattice structures that can expand and contract. In this field an advancement is made when a new structure is created that can achieve optimal deployment. The 'form generation method of relative ratios for two-bar scissors' formulated by the author of this research can be applied to infinite combinations of lines, and therefore allows for infinite scissor structures to be made with optimum deployment. The aim of this research is to test the allowances of this method, and therefore extend the theory and our knowledge on what can be achieved by this technology.

Keywords

Deployable, transformable, scissor-hinged, Alhambra, Cambridge

1 Introduction

Transforming architecture can be generated by the manipulation and design of deployable structures, which allow a maximum motion, expansion and contraction with the minimum energy input. These structures are light, adaptable and reusable. All these qualities therefore enable deployable structures to fully embrace the concept of sustainability. In an age where society evolves in unpredictable ways, were programmatic possibilities for architecture change rapidly, the emerging field of deployable structures is receiving increased interest as it offers a novel and versatile field for research and innovation for both its theory and practice.

There are many different types of deployable structures [1]. This research will focus on the scissor-hinged type, which is made by units of bars joined by a pivot. These scissor units are then replicated and joined by hinges generating large complex lattice structures that can expand and contract. These structures have a fluid motion and are stable and durable.

Scissor surfaces were pioneered by Pérez Piñero in the 1960s for prototypes as well as applications such as transportable pavilions [2, 3]. Other scissor structures include the swimming pool cover in Seville by Escrig, Valcárcel and Sanchez [4], and the Iris Dome by Hoberman [5]. The author of this manuscript developed the 'form generation method of relative ratios' (FGMORR) [6] which can generate infinite scissor-hinged deployable structures, and it is enunciated in the following chapter. In order to test the allowances of this method, the FGMORR will be here applied here to a combination of lines inspired from the Alhambra in order to make a scissor-hinged pavillion. A pattern from the Alhambra has been chosen because it is part of the culture of the country of origin of the author of this manuscript, and for its great tradition of geometry.

2 Form generation method of relative ratios (FGMORR)

Scissor-hinged surfaces have been made by grids that make triangles or squares [2, 3, 4, 5]. In this field an advancement is made when a new structure is created that can achieve optimal deployment. The 'form generation method of relative ratios' (FGMORR) [6] can be applied to infinite combinations of lines, and therefore allows for infinite scissor structures to be made with optimum deployment.

The FGMORR states: in any given combination of lines, a ratio for a scissor unit (or various ratios for different sizes of scissor units with equal angles of motion) can be found as the relation between segments and sub-segments, with respect to the number of times the ratios are contained in the segments and sub-segments. This method enables for the scissor structure to be made with the minimum number possible of different sizes of bars, as well as achieving an optimal expansion and contraction. In order to apply this method to any given combination of lines, the first step is to identify the smaller sub-segment and to divide it in a series of equal ratios for scissor units; the first ratio is denominated C1. In some situations the smaller sub-segment can be made of one single ratio for one scissor unit, however when the combination of lines has a certain level of complexity, dividing the smaller sub-segment into three ratios (3 x C1) for instance allows a greater manoeuvrability when transferring this initial ratio to the rest of the segments and sub-segments. The smaller sub segments will dictate the mobility of the structure, therefore this first operation is critical. The next step is to transfer this initial ratio C1 throughout the segments and sub-segments of the structure, and by doing this, other ratios for other scissor units can be generated in order to develop a scissor hinged deployable structure with optimal deployment. The FGMORR always seeks to find ratios in which the smaller bars are at least half (and ideally bigger than half) the size of the original bars in the first ratio C1; this will allow an optimal deployment of the structure made with a reasonable ratio of thickness and length of bars. For translational scissor units, the bars of all scissor units from the central node to the end nodes must mirror another scissor unit with equal lengths to guarantee an optimum deployability, by doing this the geometric deployability constrain is guaranteed [Escrig 96]. Another property of the FGMORR is that it is not restricted to any given combination of lines, but one could add (or remove) segments or sub-segments; this is particularly relevant when seeking to reinforce and optimize a structure. The FGMORR has so far been tested with 2-bar translational scissor units, further research will test this method with different types of units such as polar units, and with different number of bars.

3 Diamond origami-scissor hinged structure

This chapter illustrates a new technology created using the FGMORR [6], and it is also an example of a built prototype derived from this geometry theory method. Throughout the history of deployable structures origami and scissor-hinged have been two different types out of many others that exist [1]. Rivas-Adrover made a diamond origami-scissor hinged structure, which signifies the birth of a hybrid new type of deployable structure: origami-scissor hinged [7]. This was achieved by combining two methods: 'origami of thick panels' by Chen, Peng and You [8], and the 'form generation method of relative ratios' (FGMORR) [6] applied to 2-bar scissor-hinged structures. If the FGMORR could indeed be made with infinite combinations of lines, then the segments that determine the geometry of the thick origami could be made into a scissor structure. This is done with two-bar scissor hinged translational units. Where in the diamond thick origami, one triangulated face is made of two panels, in the diamond origami-scissor structure one triangulated face is made of 77 bars and 124 nodes (2). Figure 1 displays the deployment of the diamond origami-scissor prototype made of six triangulated faces. This prototype is made of 744 nodes and 462 bars (with six different types of bars). The prototype is structurally stable and has a fluid motion. While the diamond origami of thick panels has one degree of freedom, the origami-scissor structure has two degrees of freedom.

4 The language of geometry and the art of the Alhambra

This chapter introduces geometry and some of its branches, including architecture and art. The aim here is to choose a combination of lines inspired from the art of the Alhambra, and in the following chapter it will be tested to establish whether this Alhambra pattern can be made into scissor-hinged pavilion with the FGMORR.

Geometry, a field of knowledge dealing with spatial relationships, can be defined as the mother of the sciences and the arts. In its origin and through the works of Euclid's 'The Thirteen Books of the Elements' [9] 300 B.C., it was regarded as a theoretical entity. Despite this, geometry continuously branched in numerous fields of knowledge, including practical applications. Geometry was used by Eratosthenes to prove that the Earth was a globe and to calculate its circumference 235 B.C. in Alexandria [10]; and before him geometry had been used by Aristarchus of Samos and to propose the first heliocentric model of the Solar System [11] 1800 years before Copernicus. Geometry could also radically transform architecture and art: to calculate earth movements to build cities [10], to set up the building foundations and to determine its space, geometry could be in the walls in tiles, in the floors as mosaics, in drawings, sculpture, furniture and artefacts. Art could express the infinite possibilities that can be generated with geometrical relationships. Such meaning, truth and beauty could be derived from geometry that culturally in some instances it became an expression of divinity. Pythagoras 500 years B.C. was not only a polymath, but a spiritual leader [12]. Geometry as an expression of divinity also resulted in the art of the Islam.

Figure 2A displays the chosen combination of lines inspired from the Alhambra [13]. A square with an inscribed circle and dodecahedron determined by star formation that radiates towards the centre marked by another star formation inscribed in a dodecahedron, from which lines part that make four set of squares inscribed inside the original grid; this operation is then repeated by rotational symmetry and the lines generated can generate

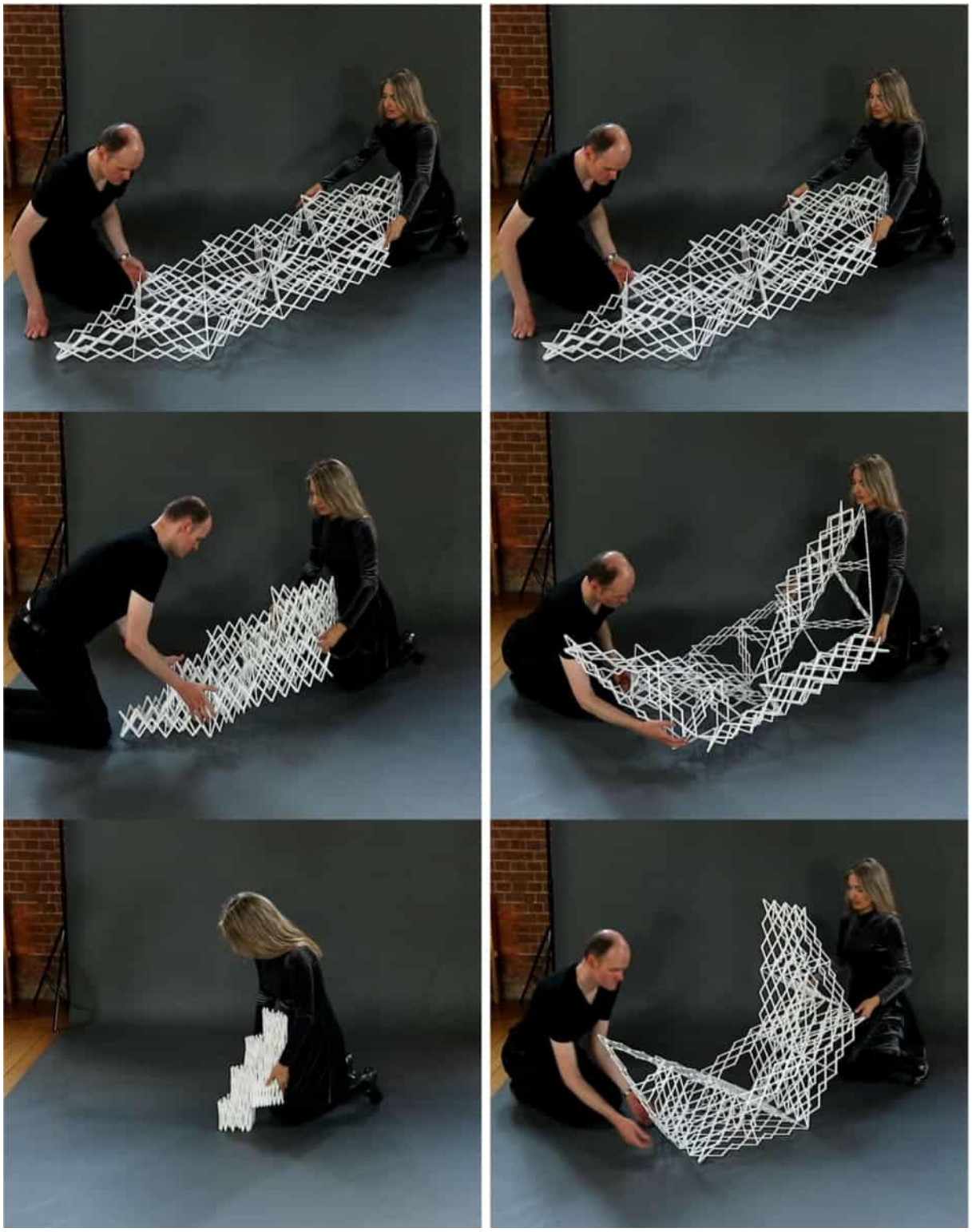

Figure 1. Diamond origami-scissor hinged deployable structure. Deployment sequence of six faces: scissor deployment and origami fold.

multiple further connections within the grid. In the centre, three sets of lines whose vertices would make an equilateral triangle (vertices 3) have been chosen to generate a triangulated central support for the pavilion.

5 FGMORR applied to Alhambra combination of lines

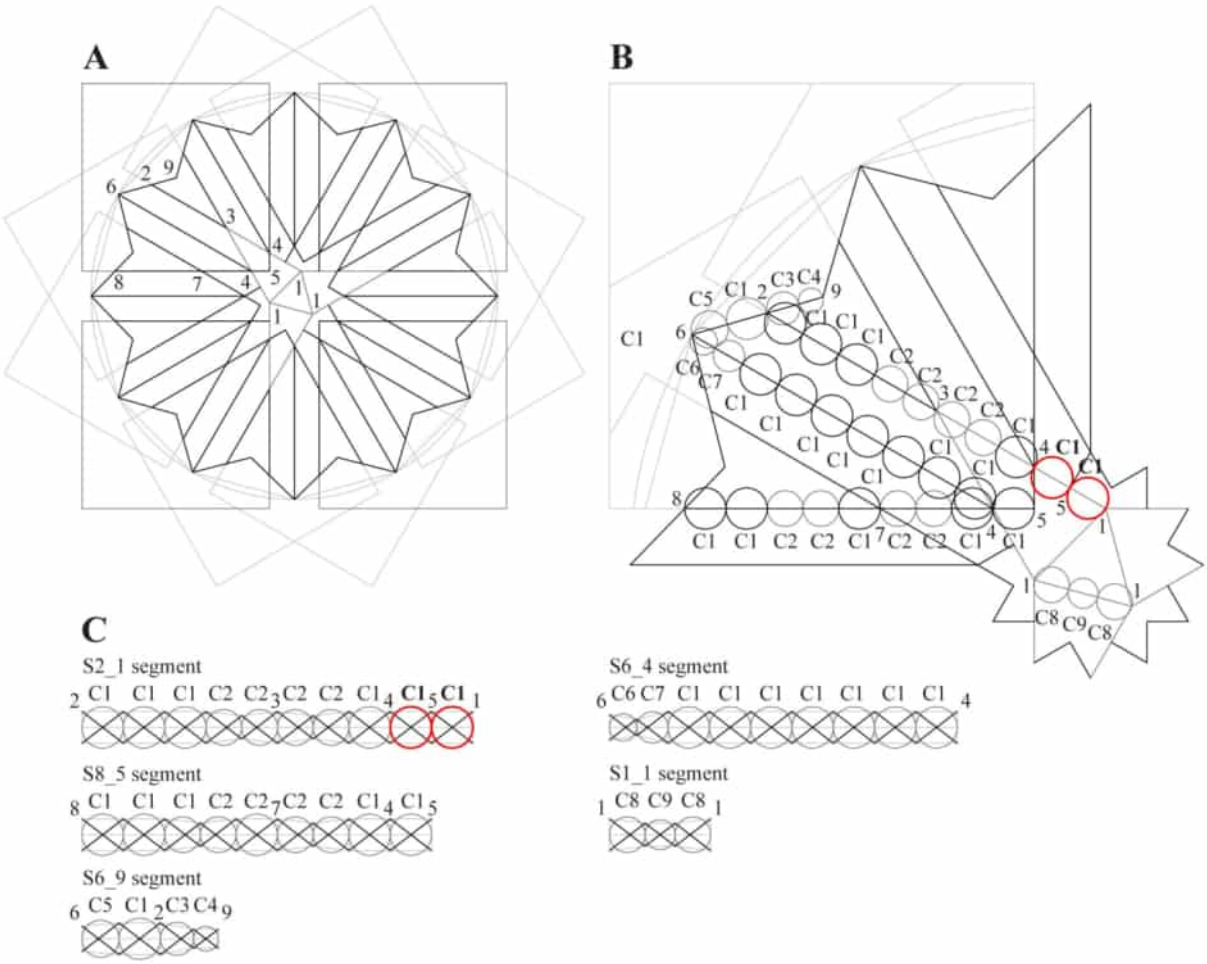

Figure 2. Alhambra combination of lines made into a scissor-hinged deployable structure. (A) Alhambra combination of lines, determination of its segments. (B-C) Applying the 'form generation method of relative ratios' for two-bar scissor units to the Alhambra segments.

If the FGMORR [6] could indeed generate infinite scissor-hinged structures from infinite combinations of lines, then the segments that determine this geometry derived from the Alhambra (Figure 2A) could be made into a scissor-hinged structure. The scissor unit types used here are translational, in which a vertical line connecting the end nodes is perpendicular to the horizontal plane. Figure 1B displays a quarter to the geometry and its determination from vertices 1 to 9; by joining these vertices five segments are generated: S2_1, S8_5, S6_9, S6_4 and S1_1 which have sub-segments determined by the vertices. These five segments are repeated through the pattern: there are 6 S2_1 segments, 18 S8_5 segments, 24 S6_9 segments, 12 S6_4 segments and 3 S1_1 segments. Figure 2C displays how nine ratios are established to make this combination of lines into a scissor hinged surface: C1, C2, C3, C4, C5, C6, C7, C8 and C9. The first ratio C1 is marked by the smaller sub-segments in S2_1, S1_5 and S5_4. The geometry of the segments and their sub-segments is defined by the relative ratios C1 to C9, which are described by the following geometrical relationships described by the following set of equations in (1) and (2):

$$S2\_1 = (C1 \times 6) + (C2 \times 4) \qquad S1\_5 = S5\_4 = C1$$

$$S8\_5 = (C1 \times 5) + (C2 \times 4) \qquad S6\_9 = (S2\_1 - S8\_5) + C3 + C4 + C5$$

$$S6\_9 = C1 + C3 + C4 + C5 \quad (1) \qquad S6\_4 = ((S2\_1 - S8\_5) \times 7) + C6 + C7 \quad (2)$$

$$S6\_4 = (C1 \times 7) + C6 + C7 \qquad S8\_5 = S2\_1 - C1$$

$$S1\_1 = (C8 \times 2) + C9$$

The resulting Alhambra inspired scissor-hinged surface can be seen in Figure 3. Figure 4 displays how the central triangle has been repeated in order to make a central support with further triangulation at the base and junction with the surface for stability and for structural efficiency. Figure 5A, 5B and 5C display three different stages of the deployment capability of the Alhambra scissor-hinged pavilion; Figure 5B the desired position for the pavilion.

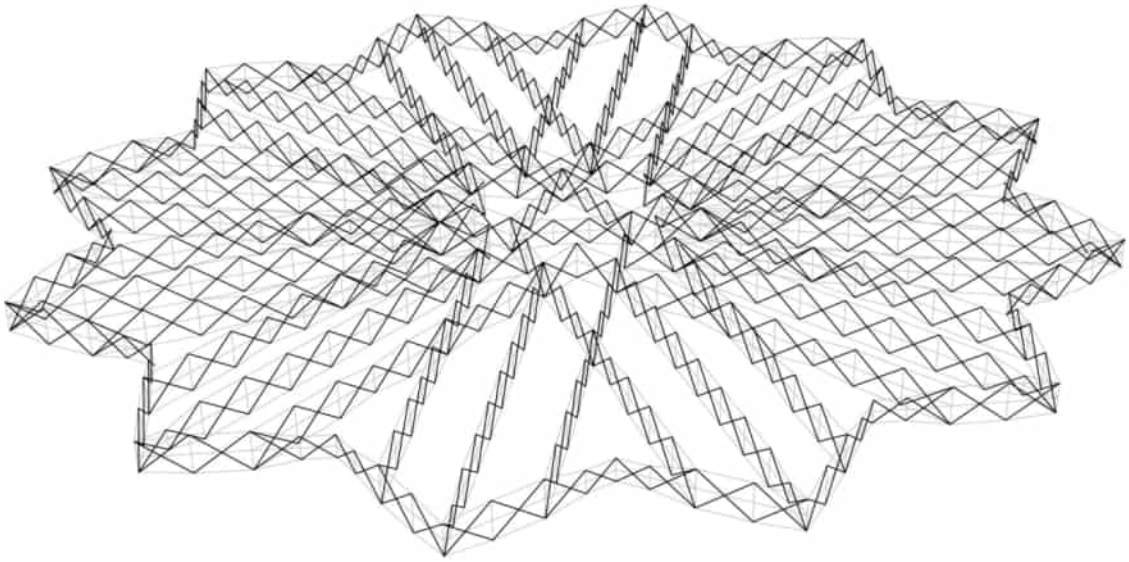

Figure 3. Resulting scissor-hinged deployable Alhambra surface.

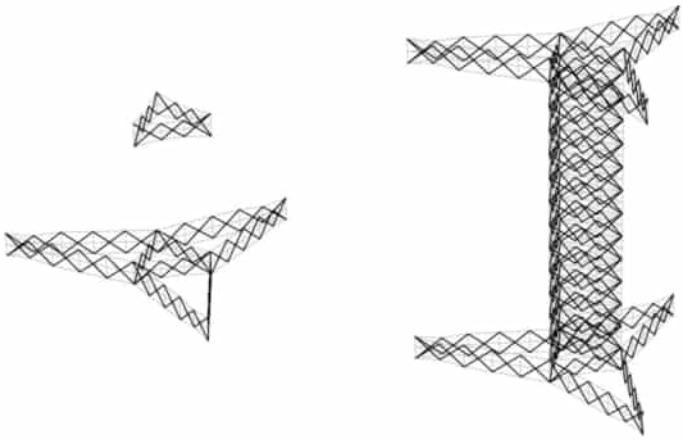

Figure 4. Central support.

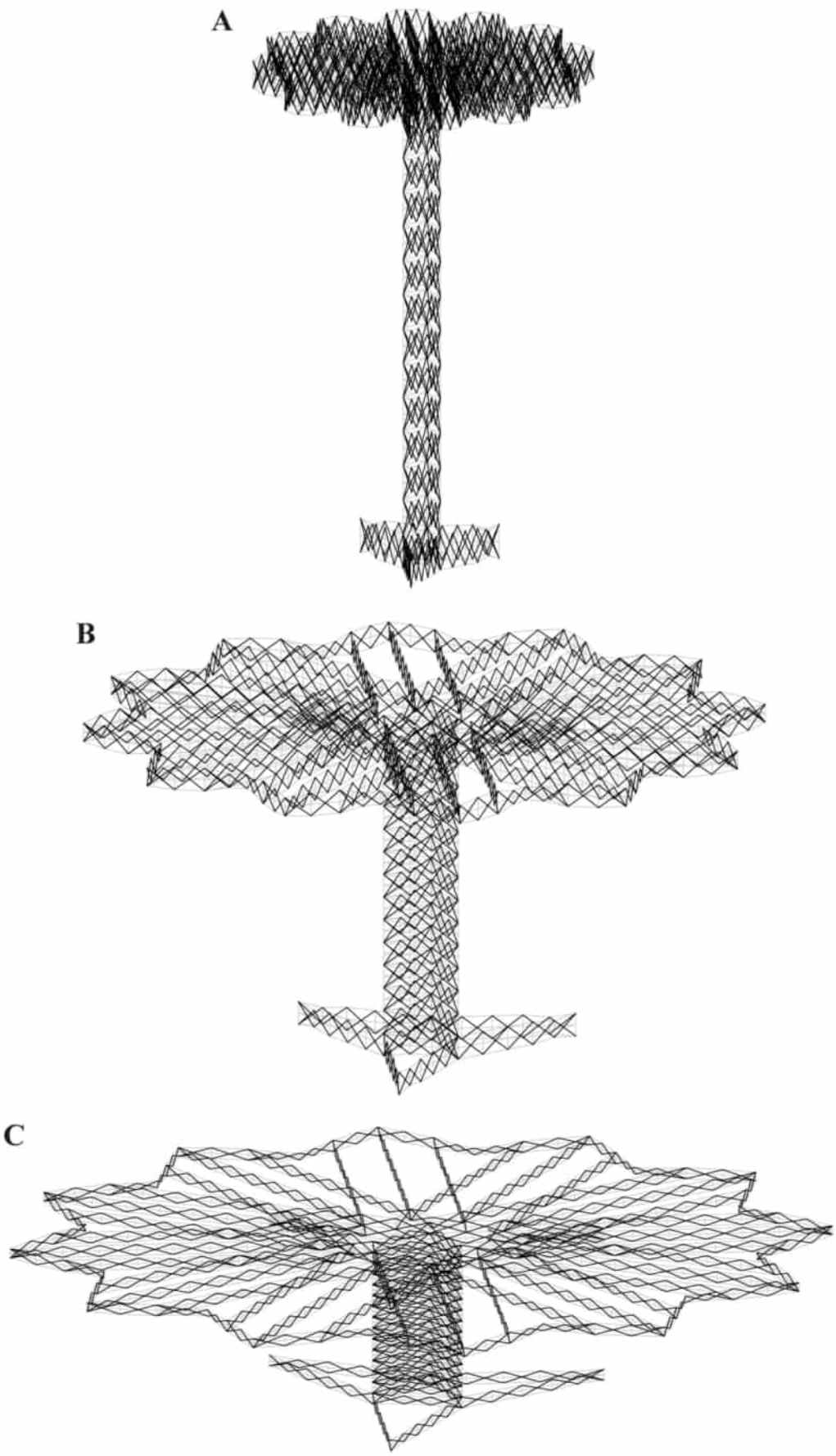

Figure 5. Deployable Alhambra pavilion. (A-C) Three stages of deployment.

6 Alhambra pavilions in Cambridge Market Square

The Alhambra pavilions can have multiple functions (for instance for travelling exhibitions, temporary events) and could be assembled in multiple sites. The following is an outline of a potential intervention in Cambridge Market Square as market stalls that sell from food to local arts and crafts. An intervention would be an opportunity to carry out a design development of this scissor-hinged technology theory investigation, with considerations such as choosing how to attach a weatherproof layer to the structure, or adding wheels to the base of the structure to facilitate deployment, or to consider different market layouts based on circulation: for instance east to west, or semi-random layout. A crucial aspect for an intervention is its assembly and deployment on site.

By understanding the deployment of the pavilion illustrated in Figure 5, the strategy can be outlined for its assembly and deployment on site. While the surface is packaged, the central support is extended (Figure 5A); and while the surface is extended, the central support is packaged (Figure 5C). While this may appear as a challenge, it could be turned into an advantage. Firstly all the different parts are carried on site in their packaged state to use the minimum space during transportation. Once on site, the central support is assembled vertically in its packaged state. The surface can then extended and placed on the central support. This has many advantages: the deployable structure is always perpendicular to the ground therefore it won't suffer stress is by being inclined during assembly; also, this is done at ground level therefore the parts can be assembled manually without the need of a crane. Once the surface is attached to the central support, it can be deployed by applying pressure inwards towards the centre of the pavilion which raises the upwards the pavilion, which can also be done from the ground. Once the pavilion reaches the desired position it can be locked. This assembly process is sketched in figure 6.

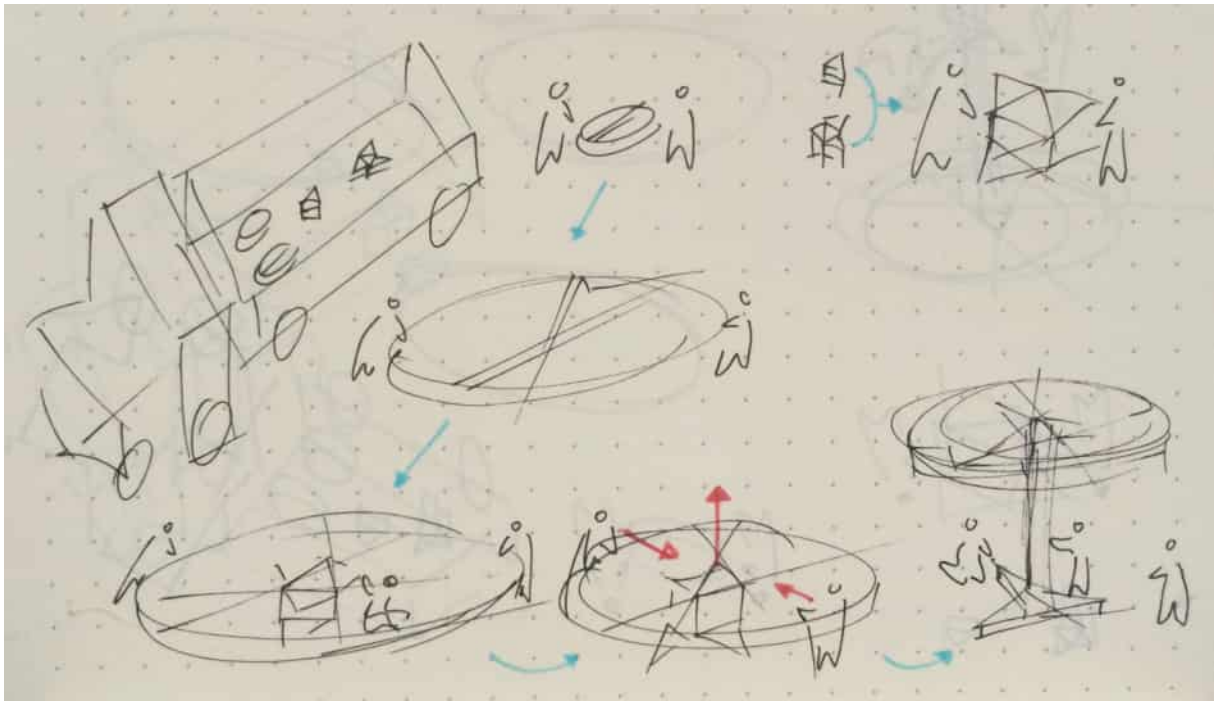

Figure 6. Assembly and deployment of the Alhambra Pavilion.

Figure 7. Alhambra pavilions in Cambridge Market Square.

Figure 7 illustrates the Alhambra pavilions in Cambridge Market Square, where the pavilions are repeated and located following the current layout of the market. Their architectural language is in dialog with the historic site, Great St Mary's Church and Kings College Chapel that can be seen at the background. This could also be an opportunity to reinstate the Gothic fountain most of which was demolished in 1953, and which replaced the Hobson's Conduit fountain following the fire in 1849.

7 Conclusions

This research extends the theory of the FGMORR [6] for scissor-hinged deployable structures. So far scissor-hinged structures had been designed one by one, and scissor-hinged surfaces have been made of grids made of triangles and squares. The 'form generation method of relative ratios' (FGMORR) by Rivas-Adrover can be applied to infinite combinations of lines and can therefore generate infinite scissor-hinged structures. This has been demonstrated by applying the FGMORR to a combination of lines from the Alhambra in order to make a new scissor-hinged surface. Also, while so far scissor-hinged technology has been used to generate surfaces, here it has been demonstrated that the FGMORR allows for creating not only the surface or roof, but also its supports, as demonstrated by the Alhambra pavilion.

The combination of lines chosen from the art of the Alhambra is a two-dimensional geometry of ancient origin. In this research and through the FGMORR it has taken a new meaning: the geometry of the Alhambra pavilion enters the four-dimensional geometry of

mechanics, as explained by Lagrange in 1788 [14], as it inhabits the three dimensions of space and the fourth dimension of time, due to its expansion and contraction. This technology enables a connection from theoretical geometry to a physical architectural proposition.

Scissor-hinged deployable structures can be prefabricated with a minimum number of different lengths of bars. They can be packaged and carried easily to the site where they can be assembled. Their lightness and deployability allows them to be mounted and deployed easily on the ground, reducing the need for cranes and on site operations. This significantly reduces the materials, time and cost of assembly and construction. Once on site they can further readapt, expand and contract, and therefore adapt to different weather conditions and changing programmatic possibilities. They can also be packaged in a much smaller spaces and be reused in different locations. Their versatility, reusability and easiness of construction exemplify a sustainable emerging technology.

While this research extends the theory of the FGMORR for scissor -hinged deployable structures, it has also given a clear outline of the assembly and deployment strategy, as well as a potential intervention. The Alhambra pavilions in Cambridge Market Square demonstrate that this sustainable technology can embody cultural symbols, and can embrace the concepts of identity, place and culture; this therefore allows a conversation equally relevant that interacts with contemporary life, future technologies, and historical heritage.

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EXPLORING STRUCTURAL BEHAVIOR WITH AUGMENTED REALITY

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Abstract

Current research shows that immersive environments such as Virtual Reality (VR) and Augmented Reality (AR) are among the most promising mediums to support learning. These technologies help students to interact with representations of concepts and visually experience intangible phenomenon.

The following paper describes a project designed to improve teaching of structures and building science to architecture students using immersive technologies. The project, harnesses the advances of AR to design an interactive structures book to help students to visualize and interact with 3D representations of concepts that would otherwise be impossible to observe. By embedding AR codes in the hardcopy pages of the book, students can engage with 3D visualization of structural behavior using their cell phone, tablets or headsets. The visualizations range from animations showing load travel paths through various elements of the structure, to deflection mechanisms of beams, columns, and etc. To access these visualizations, students will download an AR application to their cell phones or tablets and hold their device's camera on the image marker in the book.

The paper will first examine the research, theoretical context, and the pedagogical methodology used to develop the framework for the AR book. Then it will discuss the process of developing animations and simulations showing, and discuss their integration to a cohesive tool for architecture students.

Keywords: Augmented Reality, Interactive Structures, Structural Simulations, Dynamic Structures.

Topic: T04 Interactive Structures

1 Introduction

Developing effective educational materials requires an understanding of learning processes, cognition, and developmental processes. Such understanding is critical in identifying strategies and methods for educating competent architects who can respond to the future technological challenges in building design and construction.

Among many challenges in architectural education, teaching structures curriculum in an effective way has been a concern for many educators. Structures courses require some preparation in the STEM area however, not all architecture students are adequately prepared to fully engage the subject. Many structure courses rely on an engineering based model that teaches the subject using abstract mathematical concepts. As a result new approaches to teaching and experimenting with various pedagogies and technologies are always under consideration.

The project "Exploring Structures" described here is work in progress , as one of the of the outcomes of a larger effort supported by the U.S. National Science Foundation from 2015-2018. The project uses an alternative teaching tool designed to better meet the architecture students' needs, capabilities, and proclivities. The project's goal is to transform the engineering based content of structures courses to a suitable format by rethinking the "content" (theory and pedagogy) and "delivery systems" (tools and methods). The paper begins with a literature review of learning theories in relation to technology in order to establish the theoretical context. It will then describe the process of developing the framework and process for creating the project.

2 Review of Learning Theories in Relation to Technology

Cognitive theorists view "learning as involving the acquisition or reorganization of the cognitive structures through which human process and store information" [1]. They see knowledge a mental construct in the learners' mind and consider learning the process by which the mental constructs become memory [2]. According to Cooper, the internal workings of the mind, the identification of functional information filtering, short term and long-term memory, and memory retrieval are at focus of the cognitive model [3]. Cognitivists places learner's information processing as the central cause of learning [4].

Constructivism is a psychological perspective which grew out of the cognitive development research of Piaget (1896-1980) and Vygotsky (1896 -1934). The several perspectives which stem from the work of these psychologists share the common view that "individuals actively construct knowledge based on experience, thus knowledge cannot be simply passed on from teacher to learner, but must be constructed individually by each learner" [5]. Joanssen writes that constructivists are concerned with how learners construct knowledge, arguing that knowledge is a function of prior experiences, mental operations, and cultural constructs which help us to interpret events. He writes that "Constructivism views reality in the mind of the knower, that the knower constructs as reality, or at least it interprets it, based upon his or her appreciations" [6].

The relationship between technology and learning theories could be best understood in practical aspects of education. An interpretation of cognitivism in the field of education by Collins, led to the instructional design (ID) model over half a century ago. Collin and Brown developed an ID model called cognitive apprenticeship. This model embraces mentorship and the individual connection between the teacher and the learner and places importance on the learner's engagement. The has ID became model for teaching with technology, as it stressed the role of communication. Collin and Brown identified modeling, coaching, scaffolding, reflection, and exploration as features of the ideal learning environment [7].

In the recent decades, online and e-learning ID, has integrated cognitivism research to develop educational content. The influence of cognitive theories has been on how to enhance and transform mental processes by organizing instructional material into meaning full groups, use of metaphors, and organization of content from simple to complex [8]. Some cognitive theorists link the capacity of digital technology to cognitive material by grouping them into meaningful parts, and organizing them from simple to complex learning.

Mayer writes that multimedia learning builds on the assumption "that our information processing system includes dual channels for visual/pictorial and auditory/verbal processing…". People learn better when words are accompanied with visuals because they have an opportunity to make mental models by connecting the verbal and visual cues [9]. In 1990s creation of Computer Assisted Learning (CLA) which includes simulations and virtual worlds, have been associated with the Constructivist theories. Because these environments provide a realistic context for the learner to explore and create their own mental constructs, they reinforce the idea that knowledge generated from experience [10].

Researchers have written that game-based learning has its origins Constructivism. Wu, et al. write that in educational games, players construct a world based on their interaction and social engagement with each other for creating new experiences [11]. Another emerging technology in the field of education associated with constructivist theory is creation of immersive environments with Augmented Reality (AR) and Virtual Reality (VR).

The theoretical framework of "Exploring Structures" builds on the constructivist theory as it uses immersive multimedia with full visualization (pictorial) and audio narration (auditory) delivered with an AR application.

3 Immersive Technologies

Immersive technologies, simulations and data visualization are creating new opportunities for educational reform. Augmented Reality (AR) is a technology that augments real world with Computer Generated (CG) objects, simulations, and various types of information to enable user interactivity [12]. Although the use of AR in educational settings is at its infancy, emerging studies show its effectiveness, particularly as it relates to learning subjects in sciences.

Concurrent with research showing favorable results on learning in technology-rich environments, the capacity of cyber space to facilitate data storage and access to content through mobile devices has vastly increased. These advances are making AR and VR technologies user friendly and ubiquitous. The possibility of adapting cell phones to VR and AR headsets by using easy to build cases made of cardboards and magnets, is making virtual reality walk-thoughts, field trips and site visits accessible to many.

AR technology is enabling learners to interact with representations of natural phenomena that would otherwise be impossible to observe: a process that helps users to formulate scientifically correct explanations for these phenomenon [13]. This is confirmed by reports showing that computer simulations help students to visualize invisible phenomena and provide opportunities of interaction with embedded variables in the simulations [14].

Yuen writes that AR technology offer several other affordances for learning. These include the capacity to: 1) engage, stimulate, and motivate students in exploring lessons and concepts from different angles, 2) enhance learning where students could not feasibly gain real-world first-hand experience, 3) promote collaboration between students and teachers, 4) foster

student creativity and imagination, 5) aid students to control their learning at their own pace and on their own path, and 6) create an authentic learning environment suitable to various learning styles[15].

4 Project Description

The project builds and expands on the success of multimedia software called "Visualizing Structural Behavior", published by John Wiley and Sons in a DVD format in 2004. The software uses over 1500 animations and interactive diagrams to describe statics, strength of martials, and structural behavior. These range from showing load travel paths through various elements of a structure to deflection mechanisms of beams, columns, and etc. Although the tool uses advances of digital technology at the time of its development, the technology and the educational research have advanced significantly in the past decade, offering new perspectives and possibilities.

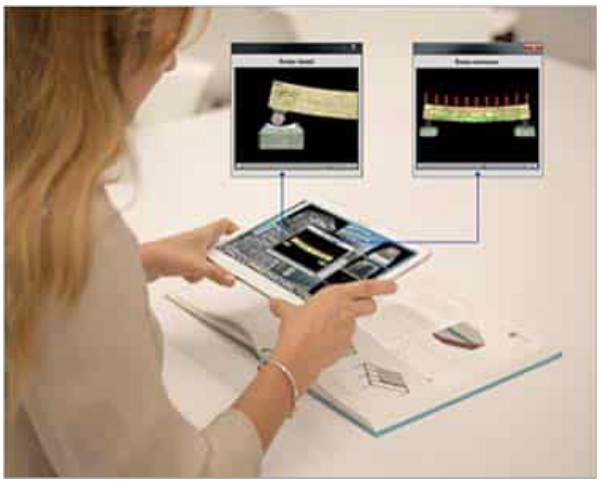

Figure1. Image showing beam deflection and connection mechanism

"Exploring Structures" uses the content from the exiting software, as the basis for developing an AR application. Building on constructivist theory, it modifies the content based on two pedagogical principles. First, it removes the limitations of two-dimensional abstract representations which are often used in the traditional structure textbooks. Many textbooks approach teaching structures with a diagrammatic approach that reduces structures to simple elements disassociated from the overall systems. While this diagrammatic approach is critical for teaching structures, it takes away all the contextual information that is particularly important for architecture students. Visualization technologies provide the possibility of grounding the diagrammatic approach in the border context. Figure 1 shows an example of beam diagram which is captured from the overall building. In this case students can interact with the entire structure and select a beam element to examine. The use of animation in the background allows the student to see the overall picture, understand the location of the beam, and gain a holistic understanding. The diagram is both visually and spatially grounded, so that it is understood as an integral part of the conceptual aspects of design.

Figure 2. Reinforced Concrete Beam

The second principle is to help students understand the structural behavior through visualization. Structural elements are subject to deformation, deflection, and bucking, all

phenomenon that are not often visible to the learners. Visualization technologies enable students to get visual access to a process that may be impossible to see other vise. Figure 2. shows the internal working of a reinforced concrete beam under loading. An animation with detailed diagrammatic annotations shows how the beam begins to bend, how cracks develop, and how the steel reinforcement stops cracks from propagating through the depth of the beam.

Another example is presented in Figure 3. The diagrams and the accompanying audio narration describe the process of pre-stressing concrete beams using the AR application. The students can play multiple animations to learn about the pre-tensioning process which is conducted in a controlled environment and compare it with the post-tensioning process which conducted onsite. Alternatively Figure 4 shows an animation helping students to understand wind pressure around a square building. Students can run two animations in parallel: one, a building with a large opening on the ground floor, and another with a small opening at the ground level. They can compare the intensity of wind forces on the ground level.

Figure 3. Process of Pre-stressing concrete

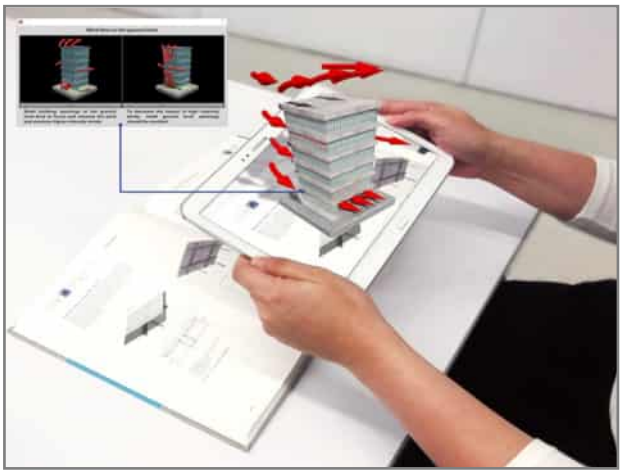

Figure 4. Animation showing wind patterns around a square building

Studying the work of master architects is compelling to many architecture students as it is a part of their overall learning process. Exploring Structures examines a number of building from renowned architects including Renzo Piano, Norman Foster, Frank Lloyd Wright, Santiago Calatrava, Richard Rogers, Nicholas Grimshaw, Eero Saarinen, and Luigi Nervi. The project uses 3 buildings from each of these architects to provide visual analysis of the structure and the construction process.

Figure 5 shows how the Kansi International Airport structure works. Three animations show the structural behavior of the roof under the wind load, the structural logic of the curved roof, and the process of shimming its columns which prevents the building from sinking. The animations in Figure 6 helps students to see column buckling in the Renualt building under exagerated load and Figure 7 descibes the load path and the construction process of Nervi's Palazzetto Dello Sport.

5 Production Process

The process of producing the project requires a workflow that combines and uses multiple 3D computer graphics software. The first step is to create new content for the book using Autodesk's 3ds Max, a professional 3D computer graphics program. During this process 3D models are produced, textured, animated and rendered. The next step requires creation of the augmented reality application. This makes use of Unity, a multipurpose game engine with drag-and-drop functionality and scripting in C#. Using Unity's mobile platform that is integrated with AR, the content is produced to be experienced in real time. The final step uses Vuforia's software development kit in conjunction with Unity to generate image markers for mobile cameras to identify and virtually display the 3D content. To access these the AR students will download the AR application to their cell phones or tablets and hold their device's camera on the image marker in the book.

Figure 5. Animation showing the roof structure under lateral loading for Kansi International Airport designed by Renzo Piano

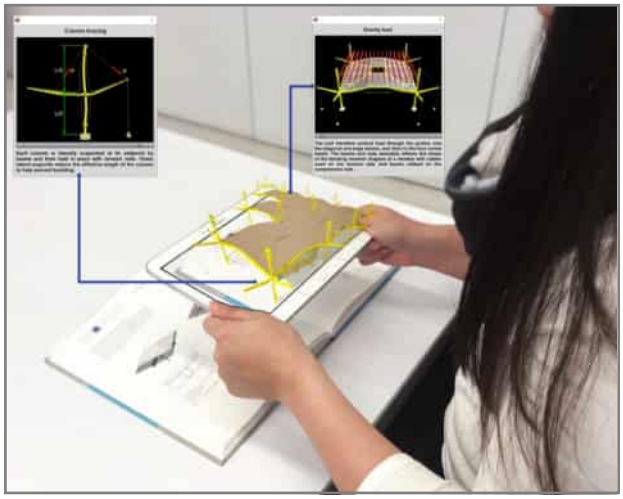

Figure 6. Animations showing column behavior in Renault building designed by Norman Foster

6 Conclusion

The project described here harnesses advances of digital technologies to create a holistic environment for learning structures. The overarching aim of the project is to transform the engineering based content of structure courses to a format appropriate to the needs and proclivities of architecture students. Therefore, it is expected that the project will enhance teaching of science and technology in the architecture curricula by helping students to better understand building physics, structures, and construction systems. Building on the pillars of constructivist theory, the project build on two principals: 1) limiting abstraction and reduction of complex systems to overly simplistic diagrams by providing contextual information, 2) helping students to understand concepts that are difficult to comprehend using visualization tools.

This project is a small step to create an immersive environment for learning. As technology advances further and we learn more on how people learn, technology and immersive environments will become ubiquitous in education.

Acknowledgement

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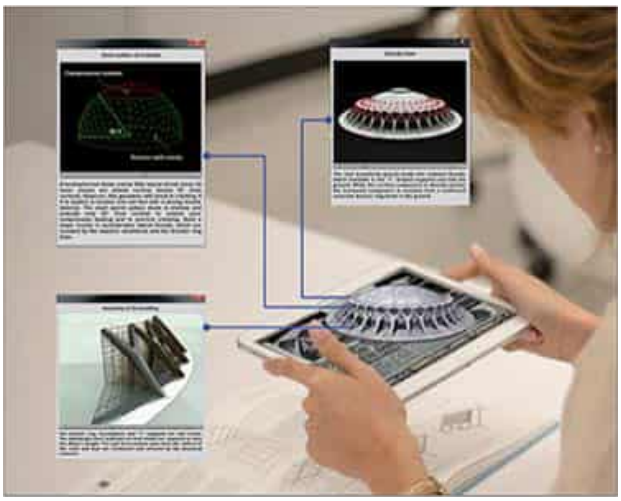

Fig. 7: Animations showing the load path and construction process of Nervi's Palazzetto Dello Sport

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BIOFEEDBACK RESPONSIVE EMPATHETIC SPACES

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Abstract

This paper focuses on the kinetic and adaptive architecture that is capable of conveying information about the feeling, thoughts, and activities of users within the space. Advances in computational design, information technology, material science, and fabrication technology have enabled architects to create adaptive spaces. Despite the high level of efficiency and sustainability introduced through adaptive thinking, users' physiological and neurological needs is an area yet to be further explored. The objective of this paper is to offer an approach to democratize design and rethink the conventional rigid architectural spaces in favor of structures that respond to users' deeper levels of engagement. It aims to create cognitive smart built environments, robotized self-adjusting buildings, that adapt and respond to users' psychological and emotional needs based on their behavioral patterns. This interdisciplinary research aims to create spaces which can "feel" and resonate with cognitive synapses and feeling of the user through embedded responsiveness and material intelligence. It has significant implications in the medical field assisting people with disabilities, neuromuscular diseases, motor system disorders, age-related incapacities, PTSD, and autism, ultimately empowering these individuals to have a greater role in shaping their built environments.

Keywords

Human-computer interaction; AI for design and built environments; Smart and compassionate Buildings; IoT for built environments; adaptive and responsive architecture.

1. Introduction

Advances in computational design, data sensing, Internet of Things (IoT), information technology, material science, and fabrication technology have enabled architects to create adaptive spaces. Merging information systems with wireless sensor networks, transceivers, and physical actuators, the Internet of Things (IoT) allows physical devices to respond to one another and to human participants, either directly or remotely. Our physical environment is on the verge of becoming an extension of the Internet (Atzori et al. 2010 [1]; Gubbi et al. 2013 [2]; Vermesan & Friess 2014 [3]).

Adaptive thinking has transformed conventional rigid architectural spaces to an unprecedented level of dynamism by addressing the need for flexibility and reconfiguration while enhancing building performance, optimizing resource use, and increasing human

interaction. The Internet of Things and related computation technology merge seamlessly with the goals of adaptive architectural systems, providing tools to enhance the environmental quality of buildings and promote more flexible, human-centered designs. Despite the high level of efficiency and sustainability introduced through adaptive thinking, users' physiological and neurological needs is an area yet to be further explored. Future architectural design requires solutions to integrate people, structures, and sensing technologies to arrive at a successful Human-Computer Interaction. (Beilharz 2005, [4]) To fill this gap, this research focuses on developing tangible reciprocities and an empathetic relationship between users' feelings and the built environment through a unification of materials, form, structure, and interactive systems of control. This research focuses on the concept of "Compassionate Spaces." This smart built environment lies at the center of inquiry, which examines the impact of robotized self-adjusting structures, relying on programmable materials and sensory network to allow architectural spaces to change and respond to real-time emotional and neurological data in a fluid manner. This interdisciplinary research aims to create spaces in which capacity to resonate with immaterial aspects of the human, such as cognitive synapses and feeling, make them particularly compassionate. The aim is to create spaces that can "feel" and empower users by understanding and accommodating their needs. It fosters a process in which synapses in the brain trigger responses in buildings that could ultimately modulate emotion and heighten the level of intimacy between mind, body, and the environment to dissolve their boundaries and make a single entity.

2. Hypothesis

Will the kinetic and adaptive architecture of the future be able to convey information about the feeling, thoughts, and activities of users within the space? How can we make synthetic spaces through constant exchanges of matter, feelings, and information? In our contemporary world with advances in sensory environments, how might our sense of space be augmented by artificial intelligence? How can we use human thoughts, feelings, and emotions as a means of interacting with the built environment? To answer these questions, I am proposing a research that focuses on "Compassionate Spaces".

Equipped with smart means of interactivity, architectural spaces are the perfect setting for nurturing humans' mental, bodily, social and psychological needs and concerns. Just as humans needs, thoughts, and feelings change at any given moment, the built environment can learn from those changes and transform itself to a new state that best serves those changes. Current advancements have made us capable of achieving an incredible level of adaptivity and dynamism. The key is to bring together various smart elements including data sensing, artificial intelligence, algorithmic thinking, programming and design generation, material innovation, and robotic fabrication.

3. Objective and Significance

This research rethinks conventional rigid architectural spaces in favor of transformable structures that respond to users' deeper levels of engagement such as thoughts and feelings and reconfigure themselves accordingly. It aims at creating built environments treated less as features independent of the human condition but as entities in constant communication with it. This project contributes to the design of future spaces that will be considered as living

organisms, as they learn users' behavior and respond to their deeper needs and desires in real-time, using embedded responsiveness and material intelligence. In doing so, they can learn the user behavior and can be controlled with user's thoughts and feelings. The objective of this research is to move toward democratizing design, creating a user-oriented built environment, and offering a greater role to users in shaping their built environment. This project seeks to find solutions to evolve human needs. It tries to accommodate an under-represented group of people who are not capable of shaping their spaces base on their needs and preferences, offering them more equality and independency.

Among many outcomes, the project has significant ethical implications in the medical field. It focuses on assisting people with disabilities, neuromuscular diseases, motor system disorders, elderlies, PTSD, and autism, ultimately empowering these individuals with physical and mental challenges to regain control over their environments. Specifically, by looking at the problems of PTSD and autism, where people experience a deficiency in social-interaction and their ability to express desire, needs, and feelings, this research can serve as an augmentation tool to compensate for those deficiencies by treating the spaces as a medium of interaction and communication. This research is shifting the role of architecture from a discipline strictly concerned with space and aesthetics to one whose operation is first and foremost communicative and interactive.

So we started with a wall as a case study for such structures using embedded responsiveness and material intelligence. Once all the elements come to full integration, the same method could be applied to larger, inhabitable structures. The objectives for the proposed structure to be built are:

- **Objective 1**: Computational and algorithmic design of the flexible structure based on user's emotional and neurological data
- **Objective 2**: Implementation of a sensory network, data collection, and actuation system comprised of sensors, actuators, and applications for smart devices.
- **Objective 3**: Robotic fabrication of self-adjusting wall that is performed through mechanical actuators, programmable materials, pneumatic systems, soft robotics, and SMA (Shape Memory Alloy)

4. Methodology

To achieve the goal of the project, this research requires a multi-faceted approach. Part of it is engaged in a sensory network of collecting data and understanding human condition (Emotional computing, Affective computing, Expression recognition) while other parts involve structures, actuation systems, and materials that can respond in kind. Here the built environment is treated as a learning machine that implements in real-time data collection and actuation systems to achieve user-oriented, body and mind-controlled spaces. To obtain the objectives of the project:

(i) A sensory network is implemented to collect data (physical and emotional) to understand the human condition within the realm of IoT and Human-computer Interaction (EEG Headset, eye tracker, facial emotion detectors, biological data collector, voice and gesture recognition, smart devices app, etc.). The project is to equip users and the environment with smart embedded devices that can collect users' real-time behavioral data, mental and physical, within the realm of IoT.

(ii) The structure implements kinetic components and surfaces and active shapes to perform certain reconfiguration such as seamlessly opening or closing upon receiving commands. (Figure 1)

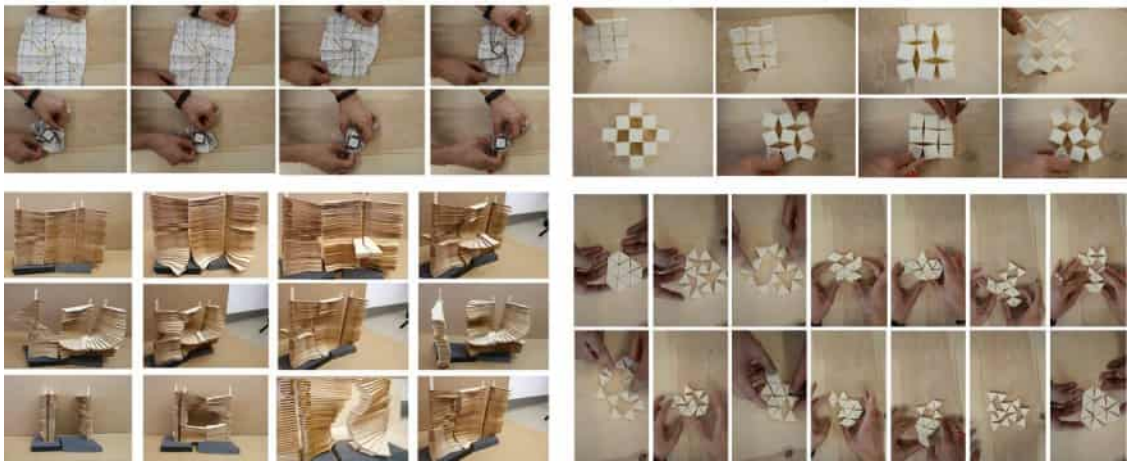

Figure 1. Mechanism study, Transformable structures, active shapes, origami, and folding

(iii) Data is registered by sensors and processed by algorithmic and generative design. In doing so, Rhino 3D modeling and its graphical algorithm editor (Grasshopper), Ghowl, and Python are used to incorporate data as input. The algorithmic logic is used to perform predefined operations, calculate the results, perform simulations, evaluate the design strategies, and subsequently to generate an optimized parametric design output.

(iv) As a result, real-time data is collected from users' cognitive and biological state, sent to embedded microcontrollers, decisions are made by programmed microcontrollers and forwarded to the actuators. (Figure 2)

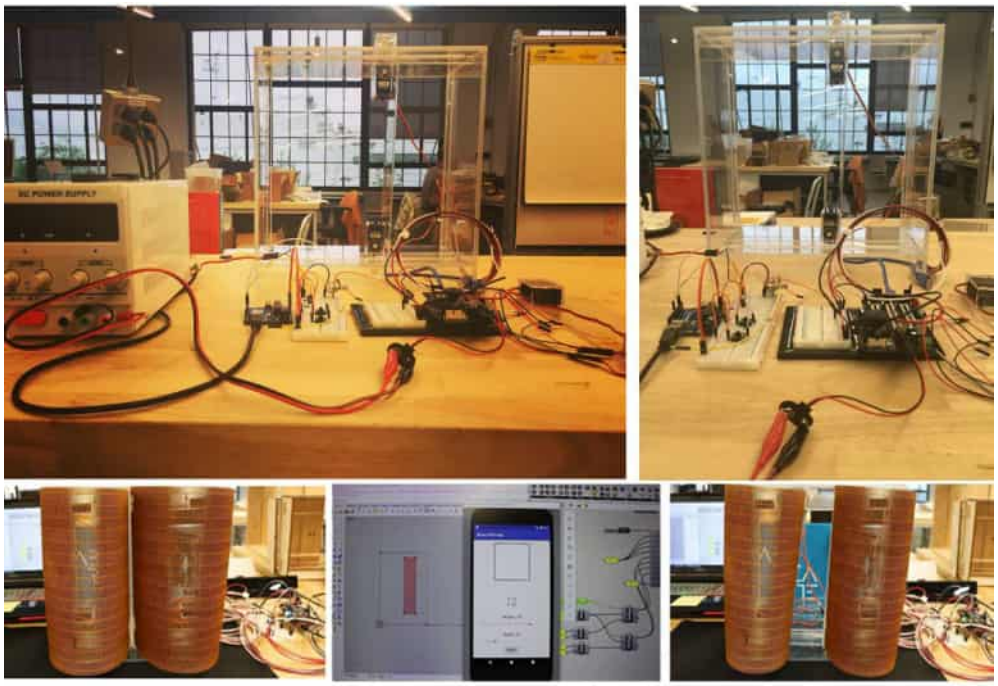

Figure 2. Operation of the wall prototype with collected data and microcontrollers

(v) Afterward, actions are performed through mechanical actuators, programmable materials, SMA (Shape Memory Alloy), pneumatic systems, and soft robotics. Materials are studied and exposed to elements such as heat, light, and air pressure to activate kinetic components and achieve maximal geometric transformation. (Figure 3)

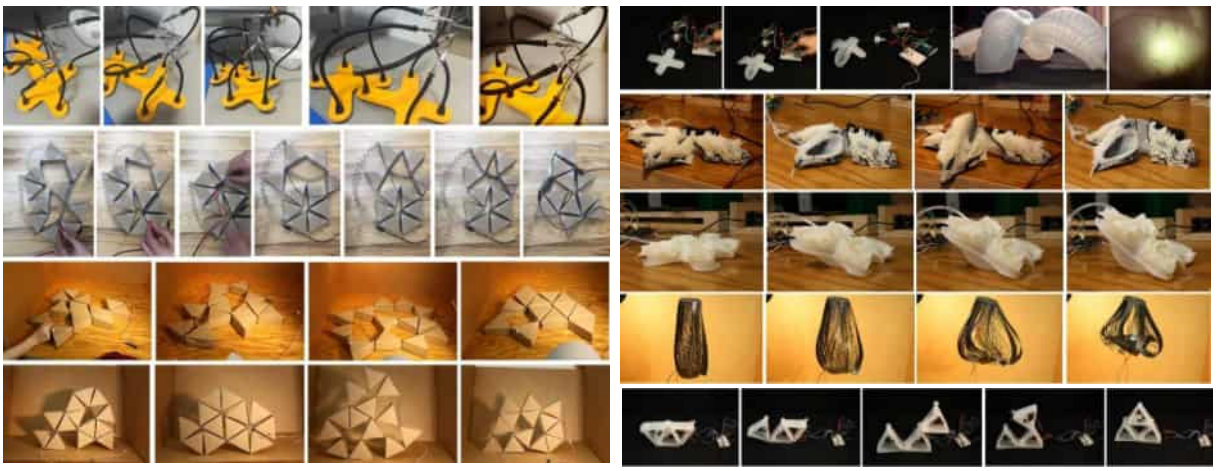

Figure 3. soft robotics and pneumatic system, programmable materials, SMA, and servo studies for actuation and structural transformation.

(vi) Finally, wall sections, and adaptive reconfigurable frame structures that host components are spatially extruded through non-layer based robotic 3D printing processes. (Figure 4)

Figure 4. Explorations of inherit flexible behavior of materials, robotic 3D printing of flexible materials for intended shape changing.

5. Results

Two transformable wall were prototyped, as an example, reconfigures themselves based on programmatic, environmental, and mental needs of its users through following preparations. This embedded responsiveness is represented by a tectonic shift in the skin of the wall (materials), its cells (geometry) and its bone (structure).

5.1 Collecting Physical Data

The first application is to help people with disabilities and elderlies to provide them more control over their environment. Here gesture and motion detectors, eye trackers, voice recognition, and smart devices are used to collect data and transfer it to an adaptive wall/ structure that can reconfigure its shape to the new states that can serve those people better. Users will have the opportunity to create windows based on their desire, change the size of the opening, adjust the view, control the light, and natural ventilation, or change the wall shape according to their programmatic needs. In this part, users can communicate with their built environment through voice, vision, touch, and movement. (Figure 5)

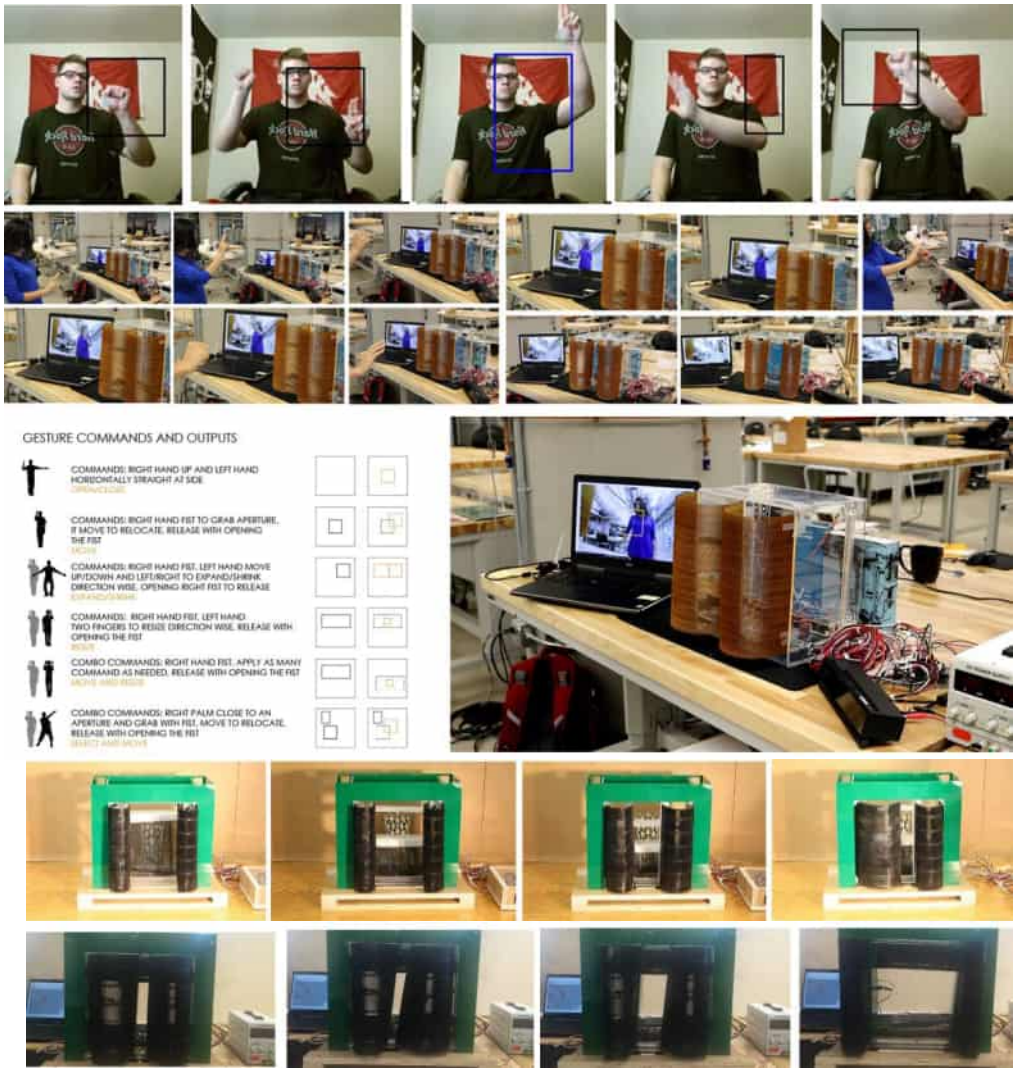

Figure 5. Wall prototype with an adjustable window that has automatic responses to emotional and mental data collected from the user. Users can change the size and location of window based on their needs

5.2 Collecting Emotional Data

The second application is to help people with PTSD and Autism who face deficiency in their ability to express their desire, needs, and feelings. This research can contribute to nurturing the senses and desires, that people have difficulty expressing, and reflecting them in the built environment. Here the built-environment is considered as a medium of interaction. To achieve expression, mood, and emotional recognition, brain activity trackers (EEG Headset), face recognition programs, voice detection devices, and wearable sensors are used to collect the biological data and recognize the moods and feelings of the users based on those data. These devices map users' emotion by gathering any relevant emotional data such as heart rate, electrical changes in the skin, blood pressure, body temperature, etc. This collected data is transferred to architectural components causing them to change and modify. These changes in the structure/wall could be used as a communicative tool or as a means of helping the user to change, heal, or improve existing mood. (Figure 6)

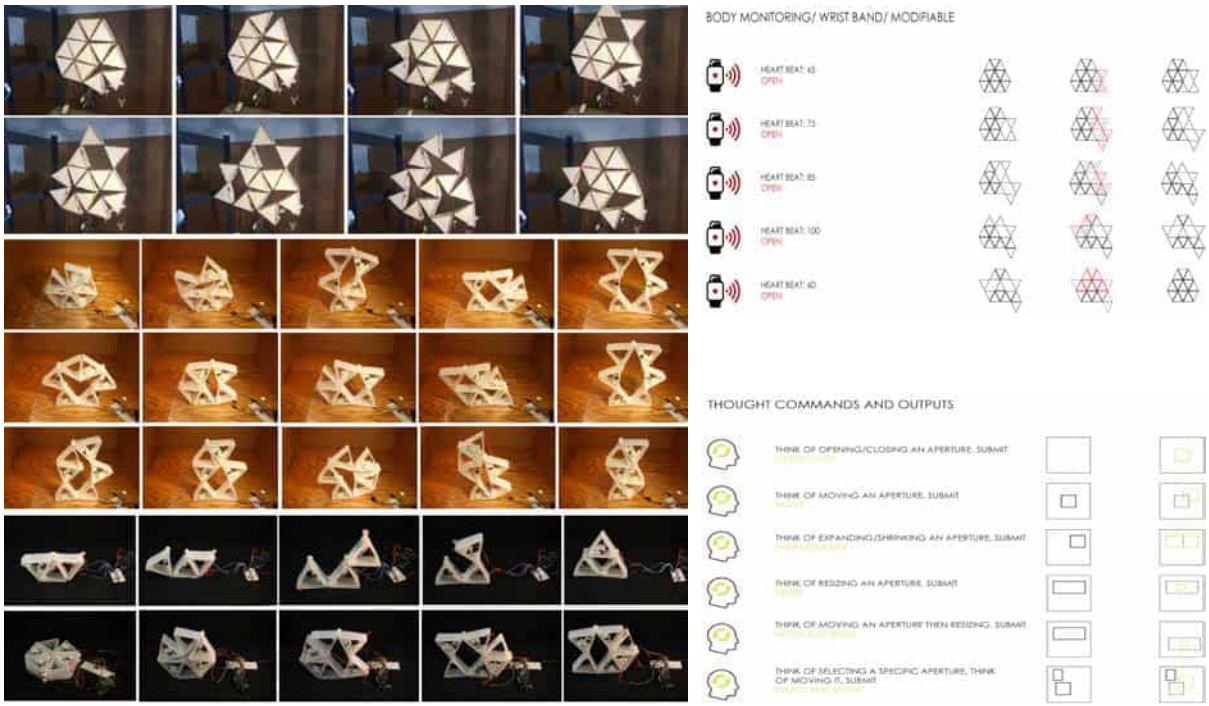

Figure 6. Adaptive Wall prototype with adjustable triangular modules that changes its configuration based on emotional and mental data from the user

5.3 Server Design

Using a function in a Java library called "Stream", data is sent to the server. To accomplish different forms of input to modify the wall, our design centers around having input from all peripherals sent to the server which updates to separate sets of data. The 'master' set of data is what Grasshopper uses to generate the virtual wall. The 'preview set' is where changes are stored as an XML file before the 'master' dataset is updated. Accessed by most web browsers, users can see the changes on the wall before submitting it to the 'master' set and ultimately having those changes reflected in grasshopper.

5.4 Touch

An Android App is designed to collect users' emotional data and transfer those data to apply changes on the wall. Based on the emotional data collected from the user the wall can change

its configuration for more or less light and fresh air. It is also capable of changing the light color embed in the wall or inflate/deflate the skin of the wall (soft robotics) to express those emotions in the built environment. In addition, this app allows users to touch a square that represents the wall and place a window on the wall. The window can be moved based on where the user taps in the square. Users can move sliders that represent the width and the height of the wall for further adjustment or they can choose their moods and feelings to apply changes in the wall configurations. (Figure 7)

Figure 7. App development for user communication with the space

5.5 Voice

Using beyond verbal API we are capable of analysing participants' manner of utterance and recognize the mood of the users based on the changes in the tonation of their voices. This helps us to further confirm participant's emotion from the rise and fall in pitch of the voice in speech. In addition, Amazon Alexa voice service is used to interpret voice commands. Our Alexa Skill works by sending speech converted to text to an application created on AWS Lambda using Node.js. The app first retrieves the current coordinates of the window via HTTP get request, and based on the received speech text, the app modifies the coordinates and sends them back to the server. Certain "utterances", or spoken phrases are used with Alexa as "intents" or actions executed. The intents have utterance mapped to them.

5.6 Gesture

Kinect sensor is used to track human movement through a program that attaches a skeleton to the user. It logs gestures by recognizing 25 joints across the body. The program recognizes specific shapes and movements such as a closed fist, open palm, and the lasso, and the shapes are combined with basic swiping movements to create gesture commands. Moving each hand with one of the shapes moves the box or increases and decreases the dimensions of the box according to how they are programmed. After satisfactory changes, users submit the image and after 5 seconds of inactivity, data will be sent to the server. (Figure 8)

Figure 8. Gesture commands and wall reconfiguration based on collected data

5.7 Vision

Data is collected with Tobii eye tracker to track users' eyeball movement such as gaze point location and blinking behavior to control our models. Data retrieved from the Tobii eye tracker will be translated to various motions to change the location and size of the window, to open and illuminate the selected spots, or to change the configuration of the wall.

5.8 Face Recognition

We used Affectiva face recognition for mapping the moods and feelings of the users through facial expression. The Affectiva SDK is a pure software solution which can run on any computer with a camera built in. The Affectiva SDK uses the built-in camera to detect users' expression (such as happy, anger, etc.) and bundles those emotion state in a JSON object. We write JavaScript code to extract the JSON object from the Affectiva SDK and send it back to our server. On the server side, the received JSON object will be parsed into correlated configuration codes to update the wall to the new status. (Figure 9)

Figure 9. facial emotion detection commands and wall reconfiguration based on collected data

5.9 Emotive Wearable Devices

Development for the bio-feedback mood and feeling tracking using the wearable devices is in the very early stages. Emotive wearable devices are cable of collecting any relative biological data (such as heart rate, electrical changes in the skin, blood pressure, body temperature, breathe rate, Oximeter, cardiac electrical potential waveforms, etc.) to map the mood and feeling of the users. For now, we are capable of mapping three feelings (Happy, excited, scared) to change the configuration of the wall. Developing methods for more data interpretation to change the configuration of the wall is in the process.

5.10 EEG Headset and Brain Electrical Activity

Collecting neurological aspects of the user's emotion for applying changes in the wall based on the users' thoughts is in the very early stages. This research tries to detect emotion from electroencephalogram signals measured with an Emotiv EPOC headset and SDK. Electroencephalography is an electrophysiological monitoring method to record electrical activity of the brain. Emotive SDK is our medium from the physical headset/hardware and the data we need to analyse the user's emotion and attentiveness, given the outputted data values. We collect the neurological signals, then filter and process the signal in order to extract emotion-related features and apply machine learning techniques to classify emotional states into high/low arousal and positive/negative valence (e.g. happiness is a state with high arousal and positive valence, whereas sadness is a state with low arousal and negative valence). By now, we were able to classify five emotions (joy, anger, sadness, fear, and relaxation)

6. Future Development

In addition to re-evaluation and improvement of what has been done, the other development of this research will focus on cognitive and sensory network infrastructure. It seeks automated responses of the architectural entities through the synaptic network effects. Here the

intention is to create adaptive spaces that can learn user's behavior and autopilot the required changes in the environment based on the users' behavioral patterns. Our future development can take advantage of machine learning techniques to offer such spaces. The data collected from the various devices (EEG headset, wearable device, webcam, and microphone) will be processed to provide a true training dataset based on multiple bio-potential signals (EEG, pulse, and skin conductance, etc,) to the algorithm. After a baseline training set is created for each device, each will be applied to a machine learning algorithm. After developing the algorithms to "learn", they will be used to better interpret any new user input data. The interpreted emotional, biological, vocal, and visual data will be fed to the wall. The wall will respond accordingly to any particular input. (Figure 10)

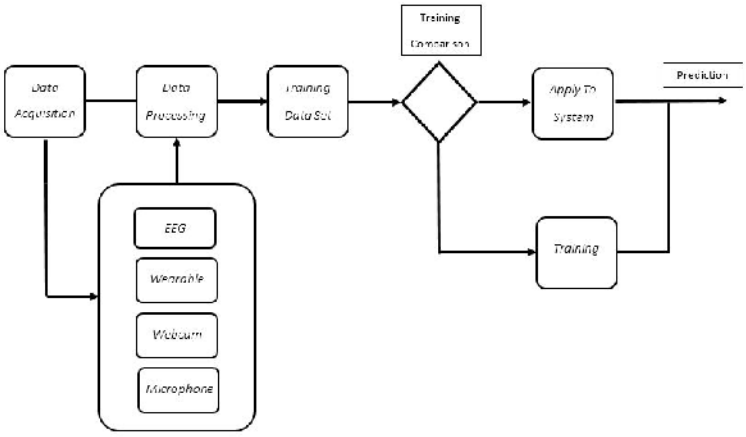

Figure 10. Machin learning implementation for prediction the user's behavior and automation the space configuration

7. Conclusion

By showcasing the application of data-driven design strategies within human-computer interaction in adaptive spaces, this paper presents an example of innovations in architecture made possible by our current technological environment and through an exciting collaboration with computer science, neuroscience, material science, robotics, and other related fields. This paper presents an alternative method by which to transcend the limitations of our physical environment. Existing limitations in our built environment could be challenged by pursuing more user engagement to blur the line between the structure as an autonomous entity and the inhabitants of the space. This project aims to rethink technological ethics in architecture in pursuit of a more just built environment and achieve seamless levels of structural adaptivity based on deeper levels of user engagement. Our approach is a framework for integrating adaptive systems and data-driven approaches into a design and transform the built environment into a living organism that is networked, intelligent, sympathetic, adaptive, and yet under the comprehensive control of the user.

8. Acknowledgments

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COMPLEX DENSITIES
FROM BIG DATA TO A MORE HUMAN AND SENSITIVE CITY

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Abstract

The paper presents the results of the workshop "From big data to a more human and sensitive city" that's associates the studio "Complex Densities" (École Nationale Supérieure d'Architecture de Strasbourg) to the Kamla Raheja Vidyanidhi Institute for Architecture and Environmental Studies (KRVIA) of Mumbai (India). The workshop proposes to experiment a parametric approach for teaching architecture and urban design in high density. So, on the basis of the works committed in the workshop, this article introduces a reflection on parametric modelling as design assistance.

Keywords

French-Indian Workshop, urban density, parametric models, interactive processes.

1 Introduction

The collaboration between the studio "Complex Densities" (ENSAS) and the Kamla Raheja Vidyanidhi Institute for Architecture and Environmental Studies (KRVIA) of Mumbai (India), has led to the workshop entitled "From big data to a more human and sensitive city" that should occur during two weeks each November from 2017 to 2020. At the end of this three steps, a shared publication will be written by the both French and Indian schools of architecture.

The studio "Complex Densities" (Master 1 – Semester 1) aims to make the students sensitive to urban density situations of the contemporary cities. The studio also encourages students to question the notion of density in relation to urban typologies. A thorough analysis of existing urban typologies viewed both from the morphological angle in their socio-economic and demographic content allows the students to link spatial device, encrypted density and the way of living in the city. The studio proposes to train students in using parametric computer design dedicated to architectural and urban design. The parametric approach proposed encourages students to clarify their intentions in relation to all themes of the project. The experimentation is based on the nesting of scales by moving back and forth between micro and macro territory. This approach offers the possibility to integrate very

quickly a lot of data, and to check the "positive/negative" interactions on a territory. This allows in particular early measurement of the project's effects on the urban microclimate and the possibility to correct iteratively space assets considered.

Moreover, the studio "Complex Densities" takes part to an international exchange, based on the collaboration with the KRVIA of Mumbai.

The KRVIA offers a full time Masters courses (M.Arch. - Urban Design). The discipline of Urban Design addresses the areas that lie in between the strict disciplinary boundaries of architecture, Urban Planning, Landscape Planning, Infrastructural Planning and Environmental Planning. Each of this discipline derives its own method of operations while KRVIA Master's in Urban Design endeavors' collective and multi disciplinary approach for public domain where this strict compartmentalization are erased for integrated and complementary exchanges.

The workshop is organized in 2 steps and proposes to experiment a parametric approach for teaching architecture and urban design in high density :

Step 1 – students of ENSAS in Mumbai November 1-12th 2017 : "Learning from India, learning from Mumbai" ;

step 2 – students of KRVIA in Strasbourg November 22-30th : "Learning from Europe, learning from Rhine countries".

The workshop is devoted to collective research and analysis on the cities of Mumbai and Strasbourg. The students identify possible sites for the project. In parallel, they follow specific parametric computer training from didactic exercises directly related to the chosen contexts. From a quantitative dimension, the approach is based on numerous and diverse data transcribed into diagrams and parametric models. So, the data parameters are progressively integrated into the project, which ultimately will have to reach a level of complexity to match the context in which it operates.

The research reflects on parametric modelling as design assistance for architecture and urban design.

2 Step 1 : "Learning from India, learning from Mumbai"

The step 1 of the workshop focuses on studying local densities of various fabrics within the city of Mumbai. This first approach allows to extract parameters, first in order to measure the existing density, secondly to study various densities on other sites.

The end result of the step 1 is a representation of various densities with respect to built space per person, density, floor space index (FSI), ground coverage and the required amenities as per standards using parametric modelling.

2.1 Studying urban sites

The first part of the workshop includes the visit of 3 remarkable sites where the relation between quality of life and density can be considered as ideal examples to learn from. The 3 visited sites were the "BDD Chawls", "Site & Services" and "Old Housing" (Figure 1).

Figure 1. 3 study areas in Mumbai

This approach allows to develop a collective analysis of sites (pictures, drawing, research in the KRVIA library, ...), understanding the location, looking for the specificities, measuring the existing densities, ...

2.2 Identifying parameters

The parameters identified and used for the study of densities appear in Figure 2.

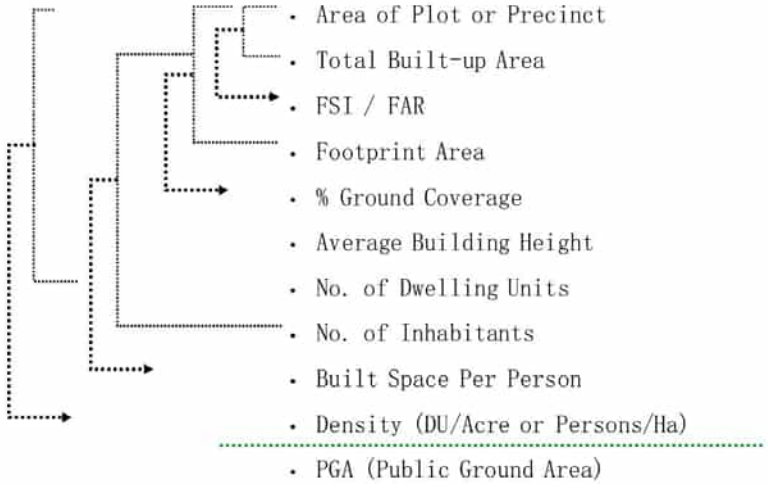

Figure 2. Parameters for analysis

This approach uses two parametric computer tools : the algorithmic software *Grasshopper* which is combined with the geometric modelling tool *Rhino 3D*. The students are gradually introduced to the application of the software. The aim is to introduce the students to new IT tools while experimenting urban project starting from quantitative data in order to produce a qualitative and measurable project. This parametric modelling work involves a re-transcription of the parameters into computer data (Figure 3).

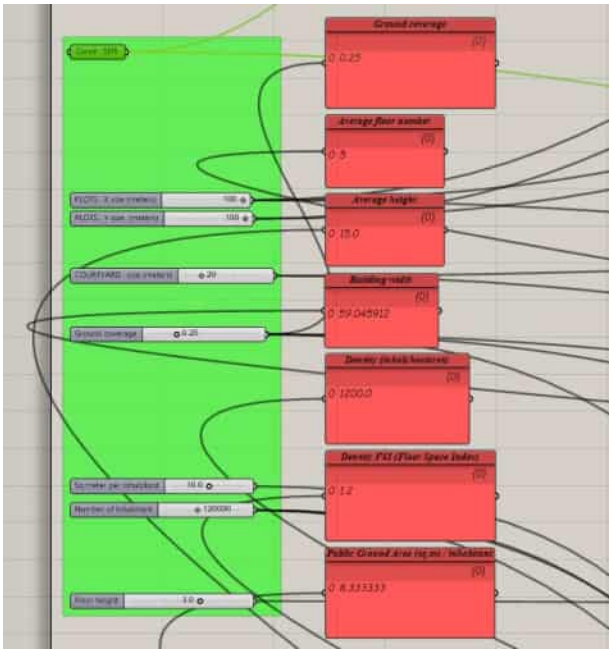

Figure 3. *Grasshopper* script illustrating the input and output parameters

2.3 Analysis of the parameters of 6 sites in Mumbai by 6 groups of ENSAS-KRVIA students

6 different sites (Figure 4) have been chosen for their issues in terms of location, heritage, density, and given for analysis to 6 groups of ENSAS-KRVIA students.

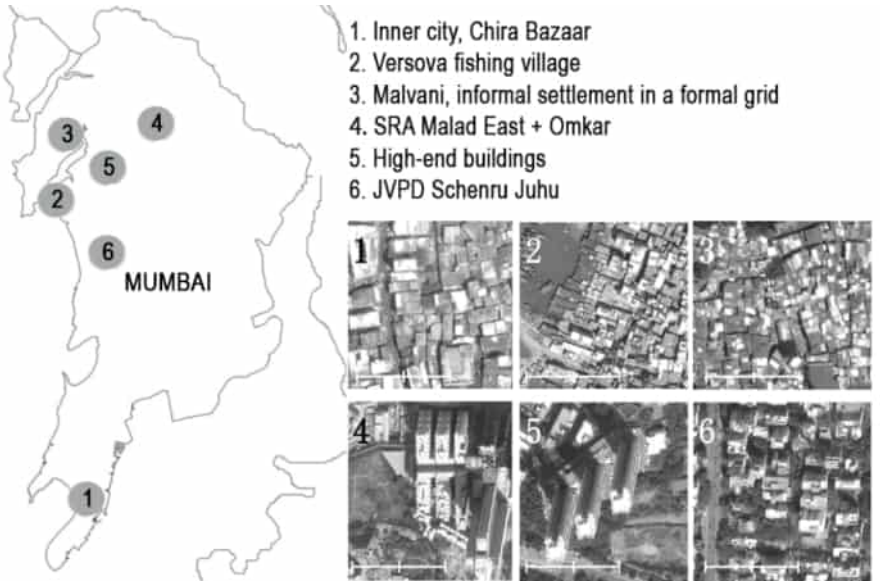

Figure 4. 6 case studies in Mumbai

The sites analysis aims to understand the great quality and diversity of housing's typologies in Mumbai (original fishing villages, colonial and modern heritage, contemporary architecture, informal settlements, …). This case studies allow to take into account the scale of a so huge mega city in terms of climate, Indian culture, street's ambiances, mobility, water, food, waste, building materials, … For each case study, the analysis deals with density in terms of quantities/data and of qualities/ambiances.

- Inner city, Chira Bazaar (Figure 5)

is a 30 acre site located in the west part of Mumbai. The houses are in majority inhabited by Christian and Hindu people. Four main typologies are noticed, really different as far as uses and shapes are considered. Apart the old architecture tribute, the strong community bond is the only historical asset of the site. The site is planned awkwardly with inadequate roads and a huge congestion due to cars. One of the specificity of that site is its mixed use ground floor: shops, offices, apartments. This mixity creates a particular atmosphere. Finally the pedestrian traffic becomes enjoyable, voices of storekeepers and smells of street food make this place a great lively place.

Figure 5. Inner city, Chira Bazaar analysis

- Versova fishing village (Figure 6)

is one of the original fishing villages of the former original Mumbai's archipel. This is a vernacular urban district progressively built by its inhabitants and now equipped with sewage, drinkable water and electricity. The Versova village is a mixed district of housing. Six different typologies of housing produce a great diversity into the neighbourhood adding a kind of village ambiance. The collective in-between spaces are private spaces belonging to the village community. However these urban spaces are open to everybody and used for domestic functions and collective interaction. Bamboos structures dedicated to dry the fish are built in front of the beach, behind the fishermen houses. The strong smell of the fish, the bamboos structures, the wastes coming from the sea, the uses of the beach as playground for children contribute to the specificity of this part of the western Mumbai's coast and reveals the complexity of this urban dense shape.

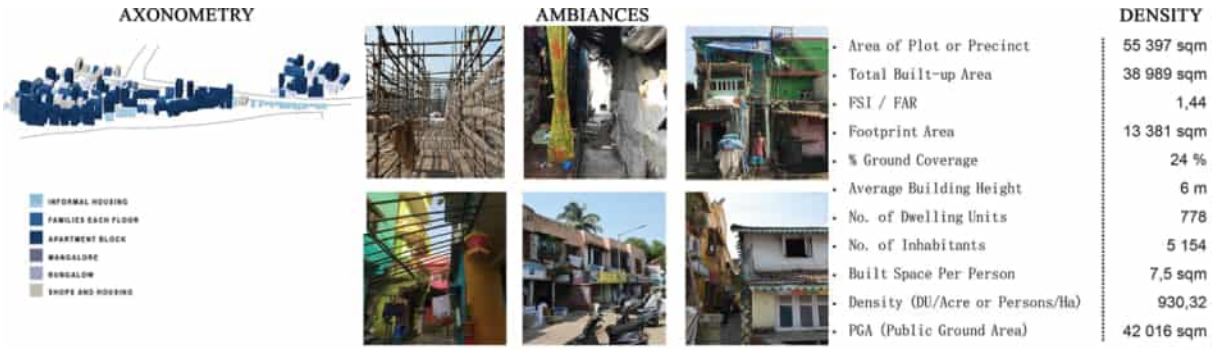

Figure 6. Versova fishing village analysis

- Malvani, informal settlement in a formal grid (Figure 7)

is a high dense district based on a formal grid of blocks of 60 m x 60 m originally dedicated to redevelop slums. At the beginning of this new district, the inhabitants were invited to build

their home by themselves according to proposed models of housing. The ground floor open to the surrounding streets could be occupied by shops. The courtyard was equipped by collective toilets. The inhabitants of Malvani have progressively put by themselves some great mutations in the original diagram. The collective toilets have been abandoned for individual ones. At the same time, the collective in-between spaces have been partially filled up with private stairs for new floors added on the top of the existing houses. The result is a lively district which questions the way of making the city by involving the inhabitants.

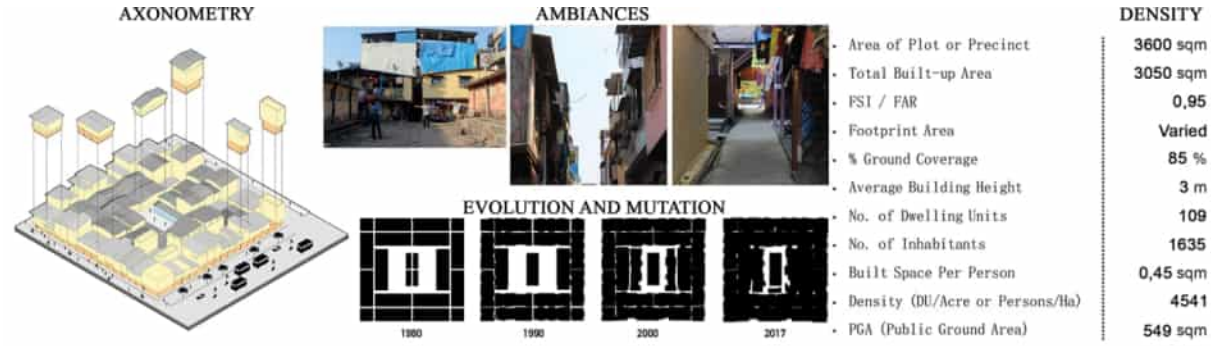

Figure 7. Malvani analysis, informal settlement in a formal grid

- SRA Malad East + Omkar (Figure 8)

questions the relation between two typologies of housing located on the plot of a former slum : SRA Malad East social housing built by the local government for the redevelopment of the slum ; Omkar skyscrapers and car park built by a private developer for upper classes. The impact of the height of the skyscrapers and their proximity to the SRA buildings generate small prospect, direct view, mask effect and drop shadows. The majority of families who lived in the old slums obtained one or more dwellings according to the surface inhabited before the redevelopment, but the site lost its identity, its mixed use specificity and its wealth which characterize the slums.

Figure 8. SRA Malad East + Omkar analysis

- High-end buildings (Figure 9)

is a generic contemporary typology of housing built by private developers for upper classes. The skyscrapers offer big and comfortable housing if possible with view on the sea. The whole plot is closed by walls and built by a great car park of several floors, which disconnects the typology with the pubic space and creates a gated community for rich people. The density is low in comparison with the height and the impact of the building in the landscape and the neighbourhood.

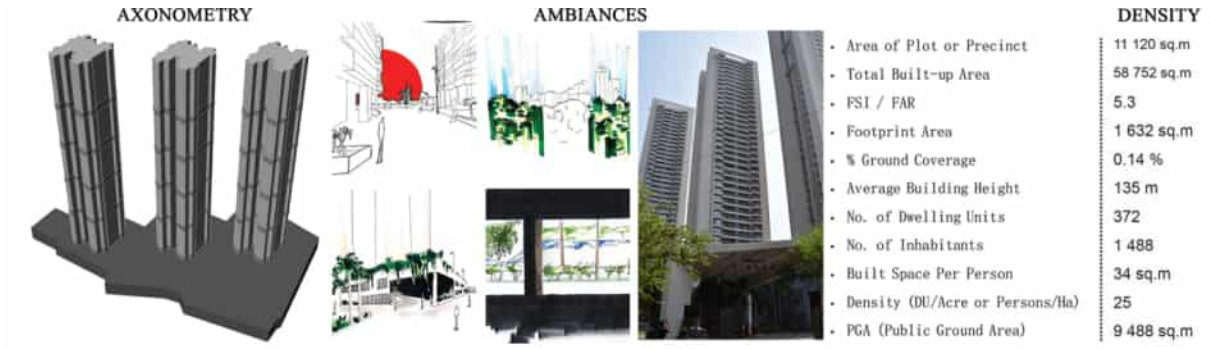

Figure 9. High-end buildings analysis

- JVPD Schenru Juhu (Figure 10)

Juhu is one of the most expensive neighbourhood of Mumbai, defined by its quite low density, in contrast with the average density of Mumbai. The site is part of a grid of quite regular blocks divided in private plots. The residential buildings are at a regular distance of the plot's limits. The firsts floors are usually occupied by (level) car park and the plots are usually surrounded by high blind walls, which disconnects the buildings to the streets. The high trees, planted in the streets or in the plots bring fresh air and shadow to the streets and create a nice microclimate. The quality of the housing is also remarkable as far as the quality of the plan and the natural lighting are considered.

Figure 10. JVPD Schenru Juhu analysis

The final review of the step 1 took place in ENSA Strasbourg. It consisted in the final presentation of the analysis of the 6 sites by the 6 ENSAS-KRVIA groups of students. A global tab presented the comparison between the site's parameters and revealed the contrasts in terms of data and ambiances.

3 Step 2 : "Learning from Europe, learning from Rhine countries"

For the step 2 which took place during one week in Strasbourg, the 6 groups of KRVIA-ENSAS students have had to imagine on a one hectare plot, the most efficient, compact, mixed, dense and generous urban project inspired by the context of the 6 Mumbai's case studies.

For that, the students have participated to an architecture tour in Strasbourg and Basel and have visited some interesting and inspiring housing typologies built between the 19th century and today.

For that step, the project has been directly associated to the parametric computer tool. Each group has had to translate their design intentions into a parametric model. A parametric

model is a set of connected heterogeneous elements [1] [2], describing a visible geometry in *Rhino 3D* called "instance". An instance evolves each time the parameters of the model are modified. So, these instances are in scope of possible geometric solutions. This parametric modelling work gives two levels in architectural or urban design : the design of a parametric model and the design of an instance [3].

The 6 following projects illustrate different density process :

- Inner city, Chira Bazaar (Figure 11)

The project keeps the main parameters of the existing site : mixed use ground floor, traditional housing typologies and proposes an urban matrix that clarifies and improves the quality of the public outdoor spaces and of the indoor collective corridors.

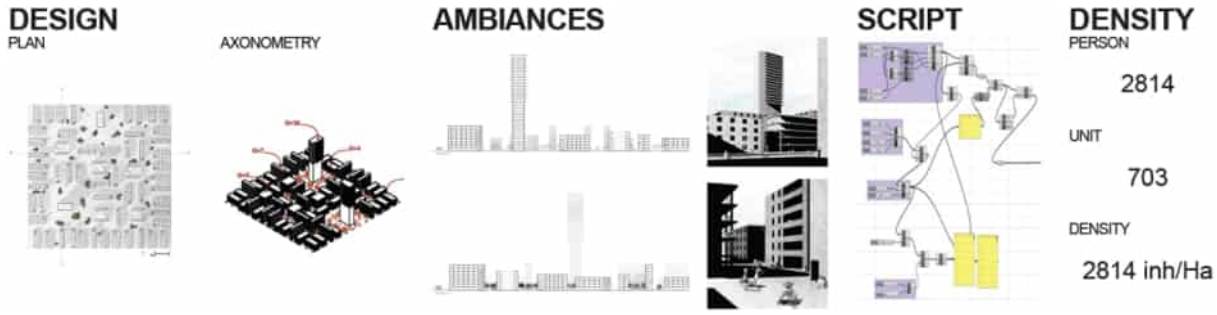

Figure 11. Inner city, Chira Bazaar project

- Versova fishing village (Figure 12)

The students propose to re-use the traditional housing typologies by mixing them together in higher building than the original one, in order to maintain the density at the same time they try to improve the quality of the in-between public spaces.

Figure 12. Versova fishing village project

- Malvani, informal settlement in a formal grid (Figure 13)

The students imagine a play which rules are proposed by the local government to the inhabitants in order to involve them more deeply in the urban fabric. This play re-uses the principal of the dominos. The grid is divided in small and regular plots which could be either a building or a void. Each family has a double plot divided in two areas, one for private housing, the other for collective outdoor spaces. Each family is compelled to connect the void of its plot to the voids of the plots of its neighbours. The public or collective spaces are in that way drawn by the inhabitants themselves.

Figure 13. Malvani, Domino's project

- SRA Malad East + Omkar (Figure 14)

Students doesn't want to keep the principal of the both existing typologies considered as non efficient in terms of ambiances and social relationships. So they try to propose a more balanced typology with an average density, made of several small towers either based on a car park ground floor or associated to a level park tower.

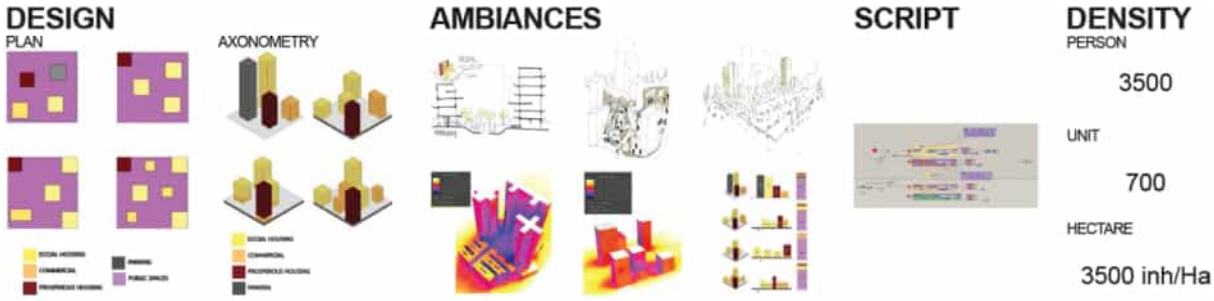

Figure 14. SRA Malad East + Omkar project

- High-end buildings (Figure 15)

The tiny foot print of the skyscrapers is considered as an efficient parameter to improve the renewal of the mangrove. The collective ground floor is abandoned for some bridges creating collective relationship between towers at different levels. The metro line crosses the district and connect it to the city. The result is a more porous and open figure even if its inhabitants should certainly belong to the upper classes.

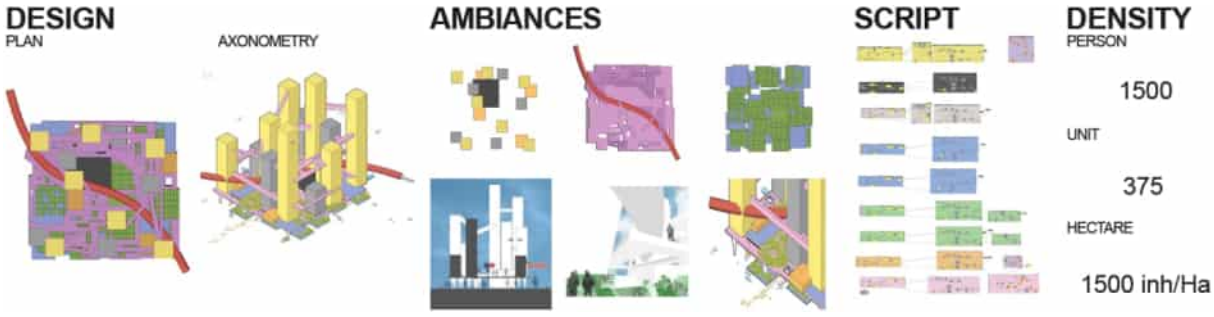

Figure 15. High-end buildings project

- JVPD Schenru Juhu (Figure 16)

The main parameters of the existing typology have been maintained. The students propose to open the private walls in order to create some porosity between the private plots that could be crossed by pedestrians. The roof tops could become urban farms. The car parks

have been put in the second and third floor in order that the ground floors could be given to shops and amenities open to the street.

Figure 16. JVPD Schenru Juhu project

4 Conclusion

The workshop scheduled in two steps has allowed to put in place a training method that mixes analysis and design, data and ambiances in a complementary approach of designing today a project in a complex and dense context.

This approach also has offered the possibility of a more scientific approach of sensitive and human conditions of living. This attitude has allowed to build a rigorous comparison between the different case studies. It has only taken one week to analyse the parameters of six different complex urban situations and less than one week to propose new urban typologies inspired by the best qualities of each existing sites. This has also been the opportunity for the students to measure with precision what is a density, to debate about the question of the citizenship, to identify the qualities of housing, etc …

This workshop has been of course also a huge opportunity for our students and for their teachers to work together along the month of November. The workshop has made possible a great and nice exchange between Indian and European students that have understood that their visions and cultures are not so fare to each other as far as the question of designing the city is concerned.

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ADAPTIVE PNEUBOTICS IN THE SERVICE OF HERITAGE PRESENTATION: THE CEMETERY OF MANASTIRINE, SALONA

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Abstract

The remains of the basilica and cemetery of Manastirine constitute a highly important Early Christian site in Europe. Though unpolluted by layers of the later periods, today it stands as an uninviting and unreadable composition of foundations, sarcophagi and many fragments of walls and columns. Is there an innovative and non-invasive readable way to physically present this archaeological site, apart from protective permanent structures or interactive 3D-VR simulations?

The goal of this paper is to design and evaluate compound adaptive pneubotic structures that can physically present the main layers of the complex. The aim is to investigate the possibilities of pneubotics in the field of heritage presentation. Based on the existing scientific reconstructions of the Manastirine complex, a virtual model of pneubotics is designed, by means of body plans that are constructed using modular unit elements. These structures are analyzed and compared with the elements of the scientifically assumed original design, thus providing a more objective assessment of the achieved implementation.

The virtual compound model successively presents the three main evolution stages of the Manastirine complex. Each stage is presented in its basic spatial concept that contains the surviving original elements. The study shows that pneubotics can provide explicit information about the principal evolution of the complex on its authentic location. They are lightweight and do not damage the remains. The pneubotic structures offer the possibility to perceive inner space in the real scale as well as to use the principal communications. The main areas that need further research are the dependence of pneubotics on weather conditions and the refinements of basic body plans. It is possible to create pneubotic structures that can provide informative and intriguing presentations of heritage ruins.

Keywords

adaptive pneubotic structures, heritage presentation, Early Christian cemetery

1 Introduction

Actively adaptive pneubotic structures are yet to be developed and sufficiently researched in the field of architecture. These structures are interesting because they embody a shift of trends, from hard and static to soft and dynamic design, and they are ideal alternative structures for interventions in dynamic environments that require lightweight, temporary and flexible solutions: i.e. adaptable and interactive architecture, kinetic architecture, responsive architectural envelopes, emergency solutions, expedition structures, etc. The question is whether they could be as suitable for built heritage presentation, as well as whether they can materialize scientifically proven knowledge and present a heritage multi-layered site, such as the cemetery complex in Manastirine. These structures have the potential for a creative approach to heritage, distant from standard protective structures or interactive 3D-VR simulations.

Figure 1. The cemetery of Manastirine

2 Background

Pneubotic structures are a special type of structures created by bringing together pneumatic structures and robotics-active computer control. They are soft architectural bodies capable of changing shape and stiffness through which they achieve transformation. They represent a recent field in research that is insufficiently explored. Early pneubotic structures from the 1960s and 1970s were not digitally controlled, but still they were somewhat automated, like the *Dynamat* installation by Mark Fisher and Simon Conolly which consisted of a series of pneumatic box-shaped cushions. The cushions inflated or deflated in accordance with automated sequences on pre-recorded cassettes [1]. It was a programmed morphodynamic structure. Another example of experimentation with adaptable pneumatic structures from the same era is a cellular air beam which could change its morphology done by José Miquel

de Prada Poole [2]. Today, pneubotic structures are still in an early development and research phase and they are developing through different structural solutions and approaches to structural adaptability. For instance, pneubotic structures can be programmed to sustain shape, like the *Airtecture* pavilion in Eslingen, Germany, made of pneumatic columns and beams with soft air muscles, which it uses to actively adapt to dynamic actions on its structure [3]. Or, they can have more of an amorph form with more rapid movements and high interactivity with users such as the *NSA Muscle* pavilion that exhibits biomimetic behaviour [4]. Pneubotic structures can have rigid parts actuated pneumatically, or they can also be completely soft and actuated through the amount of air within the body. They can spread and contract like telescopic or folding roofs [5]. They can behave like soft robots capable of bending movements similar to living creatures [6] or unfold like paper origami or accordion [7], or they can achieve complex motions through a combination of basic movements. They can self-erect like the posttensioned modular pneumatic structures proposed by Romuald Tarczewski [8].

By no doubt, pneubotic structures have been considered for contemporary designs and theoretically deliberated, but it would be challenging to test their possibilities in the built heritage domain. To take it to the extreme, it would be productive to test these structures on an archaeological site that requires a comprehensive approach to site reconstruction. Furthermore, it would be interesting to examine them on a fragile and non-renewable cultural resource, to control them in order to prevent destruction of archaeological heritage and to preserve monuments *in situ*.

The remains of the basilica and cemetery of Manastirine present an appropriate archaeological site to analyze and test adaptive pneubotic structures and their suitability for heritage preservation and presentation. The Manastirine complex is a highly significant Early Christian site, outside the city walls of Salona near Split. Its importance has been recognized worldwide among experts on Early Christianity, ever since Frane Bulić, one of the pioneers of Early Christian archaeology, organized the First International Congress of Early Christian Archaeology in 1894 [9]. The site has been researched and interpreted for more than a century, so important archaeological surveys have already been done. The complete area of the Manastirine cemetery is a good sample due to the fact that it is not polluted by layers of later periods or contemporary construction and it has been maintained. Today, the presentation of the site consists in a single informative panel, which offers a succinct interpretation of the current state of knowledge, and the site stands as an uninviting and unreadable composition of foundations, walls, columns, and sarcophagi. The presentation of the complex is far from its powerful multi-layered history, which was marked by the tomb of martyr Domnio and Early Christian memorial chapels in the 4th century. Later, in the middle of the 5th century a large basilica was built. In the early 7th century both the basilica and cemetery were looted and destroyed [10, 11].

3 Aim and Goals

The aim of this paper is to show the capacity of adaptive pneubotic structures to develop into a useful heritage presentation, and therefore preservation, device, which offers a correct reading and understanding of architecture and the archaeological site of Manastirine.

The goal of this paper is to design and evaluate compound adaptive pneubotic structures that can physically present the main layers of the complex. The specific objectives of this paper are:

- To determine and reconstruct the main stages of the Manastirine complex development.

- To create virtual adaptive pneubotic structures based on the reconstructed stages and modify them in accordance with the existing remains of the archaeological site.

- To evaluate the resulting compound pneubotic structures and their ability to present the main historical layers of the Manastirine site.

4 Methodology

The original main stages of the Manastirine complex are determined and reconstructed based on the latest published archaeological research and survey [10] in consultation with the main scientific work published on the subject [11, 12, 13].

Based on the existing scientific reconstructions of the Manastirine complex, a virtual model of pneubotics is designed, by means of body plans that are constructed using modular unit elements. The model is built in the *Rhinoceros 6* program using *Grasshopper* plugins and consists of three parts. The first part presents a three-dimensional model of the site's current state. The second one is a three-dimensional ideal reconstruction of the site, in all its main phases, built upon the first model. The virtual compound model successively presents the three main evolution stages of the Manastirine complex. Each stage is presented in its basic spatial concept that contains the surviving original elements. The third part is a simulation of the erected pneubotic structures, on the model of the current state in accordance with the ideal reconstruction of the site's main phases. Similar parts of the ideal reconstruction model are extracted and used to construct the majority of the buildings in the pneubotic modelling process. Thus, pneubotic bodies can be reconstructed with as little as possible different parts. Since basic elements of pneubotic bodies are soft and pliable, they can be strapped and interconnected in such ways to fit desired forms and formats and also to form stable structures.

The adaptive pneubotic structures are analyzed and compared with the elements of the scientifically assumed original design, as well as with the current state of the site, thus providing a more objective assessment of the achieved implementation. The comprehensive analytical method used in this paper has already proven to be helpful in providing the essential attributes of a work of architecture that facilitates any type of comparison [14]. The method starts with a project task analysis which represents certain conditions: program and context. Following the task, a basic space concept is analyzed. The space and form, movement and technology of the complex are elements that enable an objective and impartial analysis. Finally, there is an impression made on a user or an observer by a work of architecture, so perceptual and conceptual readings need to be analyzed. The analyzed and evaluated attributes will show the overall architectural contribution of the pneubotic structures to the Manastirine archaeological site.

5 Results

5.1 The essential phases of the Manastirine cemetery complex

The analysis of the archaeological survey and scientific research indicates three essential phases of the Manastirine cemetery complex: the Roman pagan cemetery phase, the Early Christian memorial chapels' phase and the Early Christian basilica's phase (Figure 2).

The starting point of the complex was the Roman pagan cemetery, from the 1st century AD. The cemetery was on the higher eastern part of the site. It had a simple form of a fenced cemetery plot on an irregular trapezoid plan, approximately 14 x 15 meters in size. Two entrances were secured in the north and west wall. The height of the walls was around 3 meters. At Manastirine, various methods of burying the dead were shown, from the simplest and most modest in amphorae and wooden or leaden caskets to walled tombs and expensive sarcophagi. Many of the tombs can still be seen *in situ* [13]. Even though the south-west angle of the plot was destroyed by the later construction of the basilica's apse, the other parts of the wall still remain, so the basic reconstruction process is simple and in accordance with the recent hypothesis and referent examples [10, 11].

The second Early Christian memorial chapels' phase started at the beginning of the 4th century. The Salonitan bishop and major martyr Domnio was executed in 304 AD, and buried in an existing vaulted tomb south-west of the plot [10]. Later on, a simple cult structure was raised over his tomb and the tombs of martyrs Venantius and Septimius. Finally, a simple rectangular building, a memorial chapel (I), was probably built on the site [11, 13, 10]. Due to the extensive archaeological excavations and lack of scientific data, it is impossible to hypothesize the basic shape of the chapel. An altar structure above the Domnio's tomb is modelled to mark a focal point of the further development of the site.

One of the very interesting Early Christian burial customs was the tendency to bury the dead as near as possible to the relics of a martyr [13]. Therefore, many private memorial chapels (II – XII) were built on the site, accommodating the graves and sarcophagi of the wealthier Christians. The chapels were organized in a curved, linear sequence of repetitive spaces onto the slight south slope. They enclosed a new cemetery field and their spaces were oriented towards the martyrs' tombs. The memorial chapels were positioned in the functional proximity of the martyr's tombs of approximately 25 meters in radius. The main approach to the complex was from the south side, so chapels were not built there. The memorial chapels varied in their spatial forms. The simple chapels (II, III, V, VI, IX, X and XII) consisted only of an apse, presumably vaulted by a semi-dome. The elaborate chapels (IV, VII, VIII, XI) consisted of a nave and an apse. Their naves could have been vaulted. The widest chapels on the north part of the complex (VII, VIII), were probably not vaulted, yet covered by a timber roof structure instead. They were open to the cemetery space with a tribelon structure. The simplicity of the chapels' form and their dimensions (5 – 7 meters in diameter, 6 – 8 meters in height) made them appear monumental and sublime, with optimal access, light and views toward the martyrs' tombs.

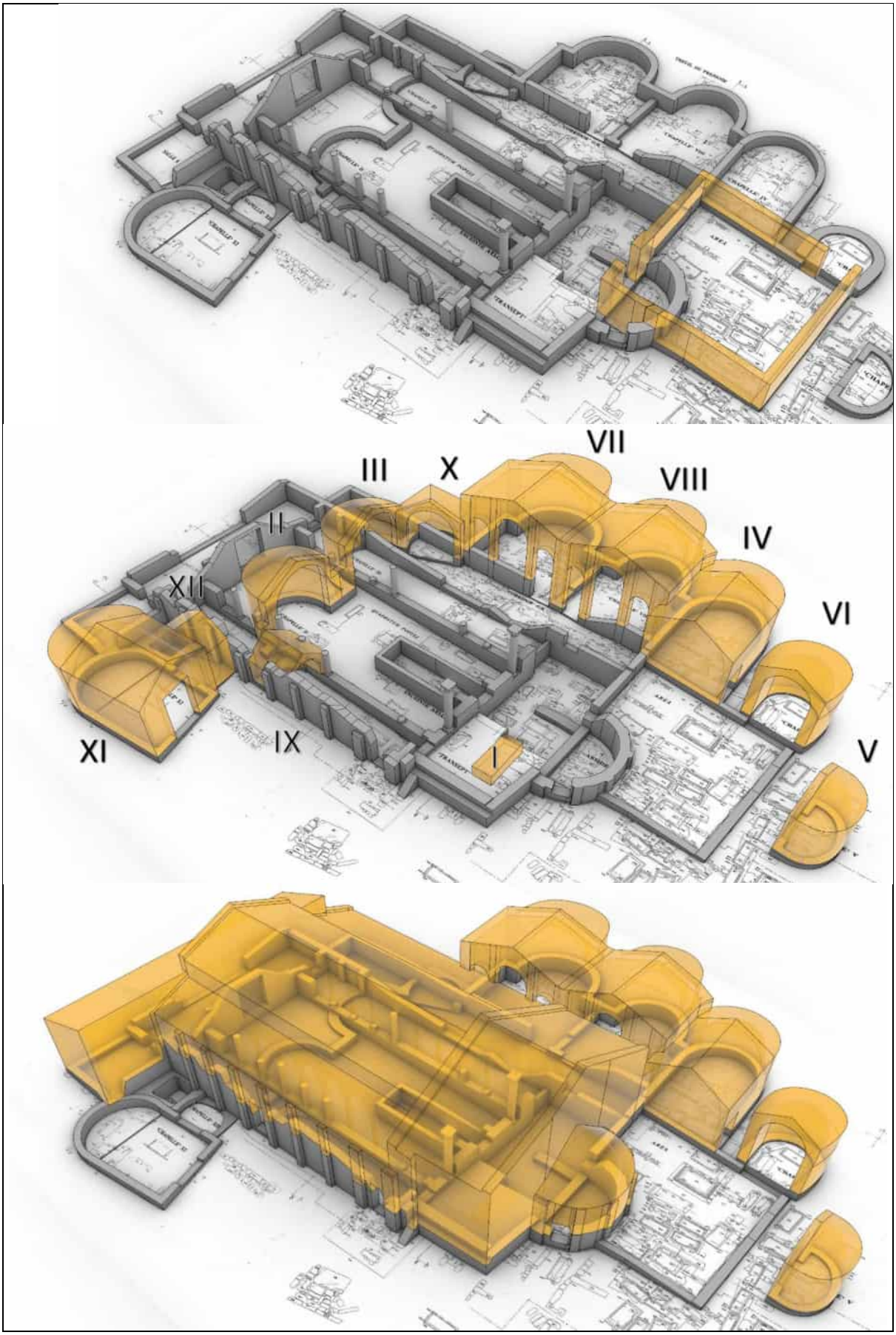

Figure 2. The three main phases of the Manastirine complex

The reconstruction of the memorial chapels (II – XIII) is done in accordance with the recent hypothesis [10]. The overall appearance is harmonized with the referent examples, especially with the nearby similar structures [11, 12]. The floors have not been reconstructed, so that the sarcophagi and built tombs could be presented and remain in their current position.

At the end of the 4th century, during the German invasions, the entire complex was partly destroyed. In the middle of the 5th century a large basilica with a transept and an apse above the martyrs' tombs and a north corridor were built. In the 6th century a western narthex was annexed, and the interior of the basilica was fitted with new furnishings, like the *solea* enclosed by *plutei* which provided a space for the church choir. In the early 7th century the basilica and the cemetery were looted and partly destroyed. The church was subsequently reconstructed once again, and the presbytery was adapted for pilgrims visiting the tombs of the martyrs. Later on, the site was abandoned [10, 11].

The main part of the third phase is a basilica. Its spatial concept recalls basilicas of the Constantine period. A tall, long nave and flanking aisles were met by a higher transept which terminated in a huge apse. The apse and transept formed an area separated in function and marked off as a distinct part of the basilica, which enshrined the tombs of the martyrs. Here, the relics of St. Peter were also laid, a gift sent by the Pope himself [13]. The transept and the apse presented a focus of the entire construction and a vast space for pilgrims to venerate the shrine, as well as a chancel for clergy during commemorative services. The basilica's nave was a rectangular structure (10,5 x 7 meters in plan), flanked by side aisles. The nave was higher than the aisles (16 vs. 8 meters) and probably contained clerestory windows. It was separated from the aisles with arcades. The transept and nave spaces were separated by a triumphal arch. The apse in its form and dimensions followed the simpler memorial chapels. A northern corridor was a secondary burial space and allowed the connection with the northern chapels. A low western narthex extended the entire width of the nave and aisles. The nave, aisles, transept and north corridor were covered by a timber roof structure, while the apse had a semi-dome. The basilica had four entrances: the main western entrance, the two southern entrances which allowed access to the south aisle, and the eastern apse's entrance. The exterior of the building was simple and was rarely decorated; only the buttresses reinforced the south and apse's walls. The interior contained surfaces suitable for elaborate ornamentation. The construction of the basilica led to the final demolition of the western memorial chapels (X, III, II, IX, XI, XII). The reconstruction of all these basilica's elements was done using the archaeological survey and scientific hypothesis [10, 11, 12]. Once again, the floors have not been reconstructed in order to respect the current disposition of the sarcophagi and other archaeological excavations.

5.2 The adaptive pneubotic structures of the Manastirine complex

The adaptive pneubotic structures are created based on the reconstructed phases of the complex and modified in accordance with the existing remains of the archaeological site (Figure 3.). The structures rest on the remaining walls. They are regarded as soft parts of a greater body plan. They materialize individual elements of the complex and consequently the phases of its development. Each pneubotic unit is designed to follow its basic form and to collapse onto the smallest possible area, preferably onto or close to the existing walls so that the existing conserved archaeological site is maintained. The informed decision has been made concerning the overlaps of the excreted phases, as well as the overlaps with the

existing remains. In order not to block an operation of two pneubotic structures, some major cuts have been done. The pneubotic structure of the Roman pagan cemetery wall has been cut in contact with the apse's wall, so a clearance for the apses' pneubotic wall structure is achieved. Furthermore, a major cut and subtraction has been made in the western part of the basilica, in order to provide space for inflation of the four western chapels (X, III, II, IX). These informed decisions have allowed an adaptable lifting of each element succesively, in accordance with the phases.

The pneubotic structure of the first phase is simple and consists of two main parts. The first part is put onto the remaining walls and simply lifted, and the second part is positioned in the apse's area and also lifted.

The pneubotic structure of the second phase is more elaborate. It contains eleven main units. Each unit materializes one of the memorial chapels. These units range from simple structures to compound structures. The simple ones are designed in accordance with the form of a large apse. First, the form of the walls is achieved and later the semi-dome's form is unfolded in a fan-like manner. The compound structures consist of the simple apse structures complemented with nave structures. The nave structures contain three elements. The frontal one is designed according to the reconstructed appearance and lifts up easily. The other elements have two parts that meet along a ridge line. The rising of their walls is followed by the unfolding of a half-vault structure in a fan-like manner.

The last adaptive pneubotic structure of the third phase contains five major elements: an apse, a transept, a nave with aisles, a corridor and a narthex structure. The apse structure is designed equally as the pneubotic structures of the simple memorial chapels. The transept pneubotic structure is defined by two elements. The eastern unit is divided into two parts, which meet along the ridge line. The south and north part of the unit contain five elements which unfold subsequently and materialize the eastern wall and the roof. The western unit is carefully elaborated and contains five parts on each side of the axis. They also unfold and meet at the ridge, shaping the western wall and the triumphal arch. The remaining columns need to be secured from accidental tipping in case of structure failure. The nave and aisles are reconstructed and shaped in three parts. The parts follow the same lifting logic and unfold the roof structures like the chapels' naves, but now they are supplemented with arcades on each side. The corridor pneubotic structure is merged with the basilica's northern aisle structure and the starting point of its inflation is the north aisle's wall unit. The west wall of the basilica is a simple pneubotic structure put onto the remaining walls and lifted when necessary. The pneubotic structure of the narthex is defined by two major parts. The first part consists of the pneubotic reconstruction of the north, east, and south walls. The pneubotic structure is put onto the remaining walls and simply lifted. The west part of the narthex is elaborated with five units. It rises and unfolds in the western wall and roof structure. The fully developed structure leans on the basilica's western wall.

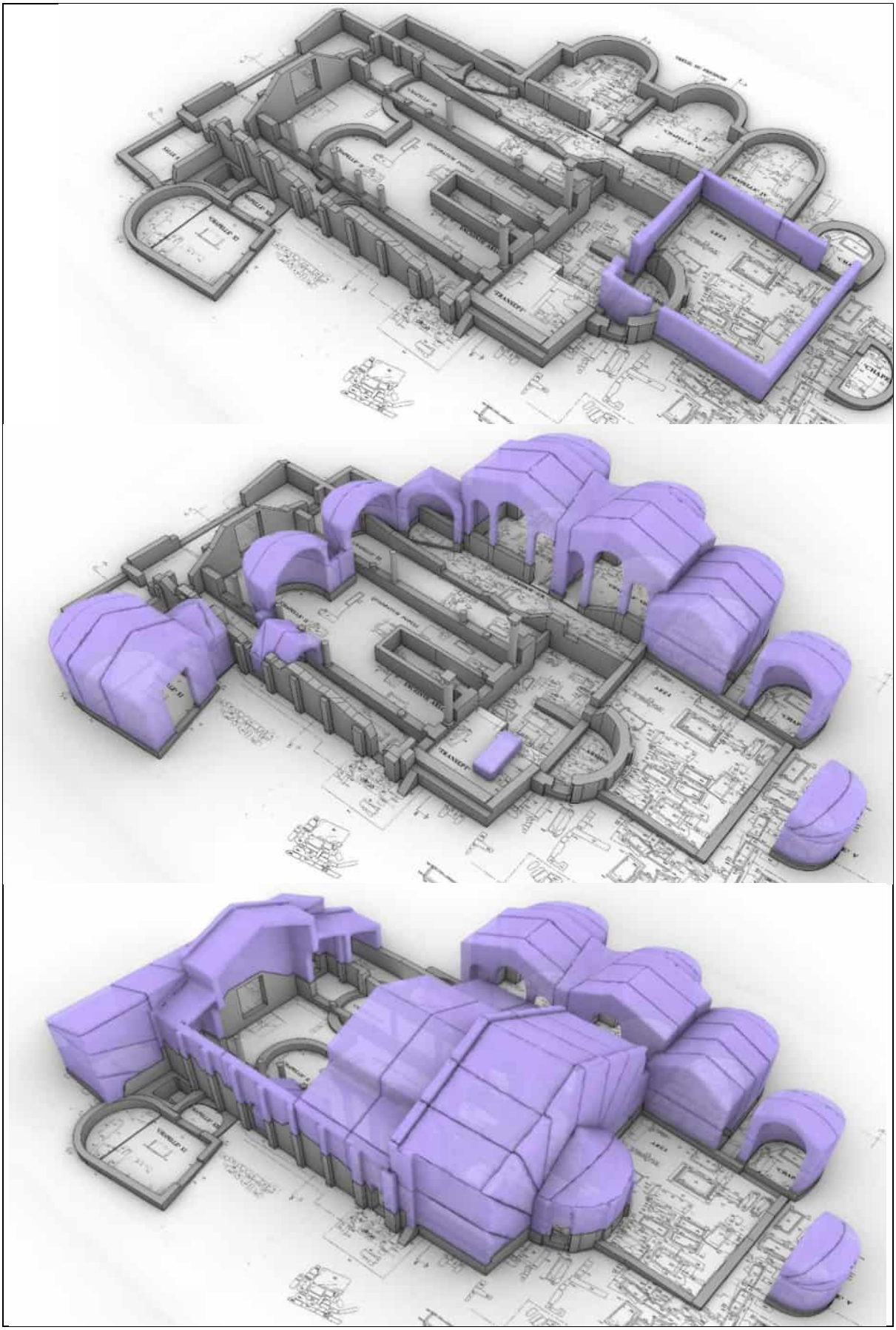

Figure 3. The adaptive pneubotic structures of the Manastirine complex

5.3 Evaluation of the adaptive pneubotic structures of the Manastirine cemetery complex

The pneubotic structures compared to an ideal reconstruction of the phases provide positive results. The structures provide accurate space frames for those who come to research and venerate the Early Christian Salonitian history and culture; therefore, they are compatible with the original program. The structures are set on the original site, developed in the same religious context, even though the political, social and economic context has changed in 1700 years. The basic space concepts and movement paths are respected. These structures materialize the scientifically assumed spaces and forms, but a significant deviation from the original appears in the lack of refinements and in the pneubotic textures. The structures are made of units which allow inflation to a certain form but consequently differ from the original. The original movement paths and entrances are respected and only slightly modified by the archaeological remains. The non-invasive adaptive pneubotic structures are based on modern and experimental technology in contrast to the original stone masonry walls and vaults or timber roof structures. The pneubotic translucent forms facilitate perception of the original spaces and shapes, in a dynamic alteration of the essential phases. They provide comprehensive information of the Manastirine's rich history and complex development. The memorable pictures of a monumental and sublime Early Christian site in the age of martyrs' veneration are created.

The adaptive pneubotic structures offer additional value to the archaeological site. The structures provide covered areas to the site and can host Solin's rich cultural program [15]. They also provide a dynamic tourist attraction and preserve the remains, thus they can support the continuous local interest and initiate further scientific interest. The special value of these structures consists in the ability to dynamically present and provide explicit information of the principal evolution of the complex, its basic concept in the elaborated spatial forms on the authentic location. Their textures clearly define the new added forms; therefore they do not misguide the observer. The structures allow all the present movement paths and insights into the archaeological excavations. They are lightweight and do not damage the remains but they have to be protected from undesirable weather conditions. The existing columns have to be secured. The structures can easily be reshaped in accordance with new scientific findings. These translucent forms provide an experience of the original three-dimensional spaces and mold recognizable and explanatory images of the stratified archeological site of Manastirine.

6 Discussion

6.1 About the methods

The ideal reconstruction is based on the contemporary archaeological research and survey and therefore it is scientifically justified. Nevertheless, there is not enough data for some elements, so hypothetical reconstructions have been done.

The adaptive pneubotic structures could easily be designed to achieve various light shapes, even in complex surroundings. Automation and active control make them ideal for the reconstruction of different phases of development on site. They have a "soft touch" and therefore pose a low risk of damaging the site. They can easily be removed without traces of use, repaired and stored because they take up little space. However, there is room for some

improvements of the method. Soft pneubotic structures are a new type of structures which exhibit properties quite different to classical structural systems. They are more like soft robots in their soft body structure and adaptable topology, thus they share similar opportunities and challenges regarding their design and actuation. Soft robots open new design spaces and provide higher safety and mechanical compatibility with their surroundings, they lack in simulation and design automation tools, as well as in actuation methods [16] and the same can be applied to pneubotic structures. Therefore, a further investigation and research of structures as well as development of design methods and active control procedures are needed.

The analysis of a multi-layered archaeological complex is a highly complex system. An advantage of the used analysis method is in a comprehensive approach where all aspects of the Manastirine complex and the adaptive pneubotic structures are covered. However, some less than perfect aspects of the method have been indicated. The results of the analysis usually overlap due to the attributes' interaction. The perceptual and conceptual reading of a building is a subjective approach. Nevertheless, the analytic attributes contain unavoidable elements and approaches defined by international charters and guidelines [14].

6.2 The quality of adaptive pneubotics in comparison to contemporary preservation and presentation of an archaeological site

It has been noticed that various provisional or permanent protective structures at archaeological sites interrupt the integrity of a site and viewing its authenticity and entirety, while archaeological parks do not provide sufficient insights into the real values and meanings of the site [17]. The *Charter for the Protection and Management of the Archaeological Heritage* [18] clearly emphasizes that the overall objective of archaeological heritage management should be the preservation of monuments and sites *in situ*. It stresses the need for proper conservation and presentation conceived as a popular interpretation of the state of knowledge. The pneubotic structures have the ability to dynamically present the site and provide explicit information of the multi-layered complex that could become popular (Figure 4.). Their effective interpretation and presentation can enhance personal experiences, increase the public understanding, and advocate the importance of the Manastirine's heritage. The pneubotic structures can stimulate further interest, learning, experience, and exploration, and therefore they follow the *Access and Understanding principle* of *the ICOMOS Charter for the Interpretation and Presentation of Cultural Heritage Sites* [19].

Figure 4. The current state of the Manastirine archaeological site and its pneubotic reconstruction

The adaptive pneubotic structures materialize a creative and unique expression of an Early Christian community and at the same time they present a place of relevant cultural context and provide a high-quality accurate concept on the original remains. Thus, they preserve a universal value, one of the key values to obtain in modern conservation practice [20].

Authenticity is a complex issue in conservation activities. According to the *Charter for the Protection and Management of the Archaeological Heritage* [18] reconstructions serve for experimental research and interpretation, and should be carried out carefully as to preserve archaeological evidence and consider evidence from all sources in order "to achieve authenticity". *The Nara Document on Authenticity* [21] has declared that our ability to understand heritage values depends on the degree to which the relevant information sources may be understood as credible or truthful, and therefore authentic. The critically assessed sources may include factors such as form and design, materials and substance, use and function, traditions and techniques, location and setting, as well as spirit and feeling. The Manstirine's pneubotic structures are based on the scientifically confirmed original form and design of the site, and present the basic space concept in its three essential successive phases. The structures are set on the original location and correctly correspond to the settings. The structures support the original feeling and the spirit of the site, creating memorable pictures of a monumental and sublime Early Christian site in the age of intense martyrs' veneration. On the other hand, the structures do not follow the original materials and structure techniques. So in this case, thorough authenticity is not achieved. Those interventions have been called "accurate reconstructions" [20]. The pneubotic structures represent the accurate erstwhile forms of the complex based on the scientific documentation, thus they are credible and truthful to the heritage values, even though they are not thoroughly authentic.

The value of integrity presents an intrinsic problem in modern conservation, referring to undivided or unbroken state, material wholeness, completeness and entirety [20]. It has been identified by elements that make up an "organic" whole, such as location, design, setting, materials, workmanship, feeling and association. But one has to be careful because a work of art is not only the physical phenomenon, presented by its material; its presence is in the human consciousness [20]. The adaptive pneubotic structures are different in material, but present the "organic" whole because they define the original design, settings, paths of movement, and also initiate the feelings and associations of the Manastirine's historic structures. The structures are recognizable and identifiable as a modern intervention based upon a detailed and systematic analysis of the archaeological and architectural data, and therefore follow the advocated conservation principles [18, 19, 22].

Finally, the pneubotic structures in this paper are not set as a simple tourist attraction with some "didactic" values, but are controlled structures made to facilitate the understanding of the monument and to reveal it without distorting its meaning. They do not stand out of the archaeological context and upset the relationship with it; instead they facilitate the interpretation and use of the site in a dynamic and interactive way.

This paper addresses a method of generating theoretical and practical models of coexistence of architectural systems in landscapes of the past [23]. The Manastirine's pneubotic structures apostrophize the issues of presence and absence of matter in the archaeological site and can initiate a more rational use of the site, which is less destructive, more pragmatic, better adapted to the remains and more informative. Modern times require an active approach to archaeological sites, preforming restorations and ideal reconstructions of

structures, as well as building new structures on archaeological sites, so that they could be utilized in a more active fashion. In activating archaeological sites and their inclusion in modern-age activities, an interconnection of cultural and natural heritage could be manifested as the foundation of an identity of a place [17].

7 Conclusions

This paper has shown that it is possible to create pneubotic structures that can provide informative and intriguing presentations of heritage ruins. The three essential stages of the Manastirine complex development are reconstructed using the compound adaptive pneubotic structures and modified in accordance with the existing remains of the archaeological site. The structures highlight the exceptional quality of the site. They have the ability to dynamically present and provide explicit scientific information of the site's principal evolution, enhancing personal experience. The structures preserve the universal value of the site, materializing a creative expression of an Early Christian community and providing a high-quality, accurate, credible and truthful concept of the original remains. They also support the integrity of the site. The pneubotic structures can initiate a more rational use of the site, which is less destructive, more pragmatic, better adapted to the remains and accurately informative, and in accordance with the Manastirine's true value.

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A MORPHOLOGICAL STUDY ON THE INFRASTRUCTURE-PUBLIC SPACES IN HIGH DENSIE URBAN COMPLEX

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Abstract

Although urban density has become one of the hot topics in Architectural research, and sustainable city has been implemented in city policy even longer, there is lack of in-depth research on the theoretical understanding on the new forms of urban complexity. There is few studies on the on the spatial quality of newly built high dense urban cases. This paper first introduces a theory of urban morphology, and Infrastructuralism in Architecture in particular. On the methodology of the research, the observation is based classification of spatial levels, focusing on the performance of the public space. This paper then investigates a recent large scale project Wuhan InCity completed by BEA Hong Kong. As a participatory research, the paper analysed the circulation system, the prototype of the elevated public spaces in different scales, the interaction between inside and outside of urban spaces. It addresses the importance of atmosphere of the public space in the design. The research concludes that there is morphological difference between traditional high-dense urban complex and new ones. It demonstrates that high-density does not automatically create program mixture if the architecture does not obtain character of *infrastructure*. However, the spatial atmosphere is still the key to create walk-able, accessible, and eventually sustainable city.

Keywords

Sustainable Architecture, Urban Complex, Public Space, Infrastructure, Atmosphere

1 Introduction

A high urban density implies that a low amount of undeveloped land converted to urban area with large amont of floor area. This is favorable for the maintenance of of high efficiency of land use, high market value, and preserving greater areas of biodiversity and biological resources.

A high population density also implies lower requirements of transport and facilitates the use of public and non-motorized modes. Thus a high density reduces traveling distances and promotes the use of energy efficient means of transport, both leading to lower energy use (Norman, 1996) . High-density development in Hong Kong allows economies of scale for public transportation and infrastructure. As more people are accommodated through it, the natural resource per capita consumption and costs for infrastructure provision is proportionately lower. It helps to make public transport systems such as the Mass Transit Railway (MTR) more efficient and financially viable. (Zaman, p. 261) At the same time, it lowers down demands on private cars as in the case of Hong Kong, one of the high dense cities in the world.

Urban compaction enables residential buildings to be located within, or close to, the central areas and allows residents easy access to the various urban facilities and commercial centers within the housing estates. High density urban forms help fulfil the prerequisite of the provision of pedestrian links, since compact developments reduce the distance between different activities. Because of the degree of compaction of the city, open space and country are within walking distance. A rich array of urban amenities, recreational and natural environments are within easy reach, and contribute greatly to the quality of life. Thus, a compact city form has obtaoned social and economic advantages. (Jia, 2003) It brings about the concentration and cultural opportunities. Through the history many cities around the world have developed a different morphologial patterns characterized with mixture of functions in high density. Retails, offices, restaurants and residential space are overlapped vertically in one building block. The significance of dynamism in cities remains an undiscovered treasure for the success of these cities: How these mix use of land and buildings bring life to the street and intensified capital flows among the citizens today and in the future?

These gigantic complexity came into being without a single architect's intention (Rem Koolhaas, 1998, p.321). After almost twenty years since Koolhaas made such observation, architectural discourse has not been changed much. Large scale urban complext is still by-product of a collective metropolitan subject that refused to adopt a discourse at odds with the realities of actual practice. The key issues missing arhcitectural discuss are the infrastructres and public spaces both inside and outside.

The problems of urban development after Second World War II were largely caused by the design pedagogy which was over dominated by function. As the program changes fast, the buildings built in this period are inflexible and inadaptable, and proved too costly to be upgraded from both ecological and economical point of view. The rapid and large scale urban development in China has to avoid the similar mistake by learning the mistakes find new design pedagogy which should address the essential quality of sustainable cities and

long lasting buildings. . Architecture is a question of managing resources. When we speak of quality, therefore, the biggest challenge for a building today is longevity.

There is a need to generate a new discourse of long lasting buildings and cities independent from any specific programs, and deeply rooted in the thinking of time frame. The primacy of fulfilling a use has to be replaced by beauty as the central objective of architectural design, because beauty is the quality which leads to the social and cultural acceptance of a building (Eberle & Simmendinger 2007). Social and cultural acceptance are the most important premises for a building's longevity. In the public spaces, the beauty is beyond visual although including visual. It is the atmosphere related to multiple senses of human get more important.

2 Theory : Architectural as Infrastructure

Sustainable urban complex needs to address at least two issues beyond programs and energy efficiency:

The issue of time: To ensure that a building can last as long as the physical structures allows, it has to be flexible and adaptable enough to accommodate changes of uses, circumstances, and as many as unforeseeable matters as possible, arising from the building's service period.

The issue of people: the real people beyond any statistics, function or program of use made by programming. If pluralism is the word characterizing the conceptions and behaviours of the people of today, no building can ever be satisfactory without interaction by everyday use. People collectively and individually look for opportunities to change and adapt to their environment.

These two elements leads to architecture with a character of infrastructure. Stan Allen has summarized 7 characters of infrastructure, with which he believe new architecture interventions can corporate (Allen, 1999, p.54-55). Infrastructure prepares the ground for future building and creates the conditions for future events. The provision of services to support future programs; and establishment of networks for movement, communication, and exchange. They are flexible and anticipatory. Infrastructure work recognizes the collective nature of the city and allows for the participation of multiple authors. Infrastructure creates a directed field where different architects and designers can contribute, but it sets technical and instrumental limits to their work. Infrastructures accommodate local contingency while maintaining overall continuity. Although static in and of themselves, infrastructures organize and manage complex systems of flow, movement, and exchange. They create the conditions necessary to respond to incremental adjustments in resource availability, and modify the status of inhabitation in response to changing environmental conditions. Finally, infrastructures allow detailed design of typical elements or repetitive structures, faciliting an architectural approach to urbanism.

However, Infrastructuralism does not answer quality of perception of space, if not challenging the atmosphere the traditional urban spaces such as streets and squares. Atmosphere is the perception of a space. Although an urban space is a highly complex web of many individual components, we usually absorb it immediately and with all our senses:

when we step into the space of a street or a square, we form an intuitive impression of its appearance and scale, which triggers a subconscious chain of associations without having consciously grasped every detail. Atmosphere involves a mix of sensory perceptions, i.e. hearing, smelling and touching etc. However we develop a sense of the space largely from visual perception. However, this preconceived mood will often determine whether we use it intuitively relaxed and feel comfortable in relation to it. All these is based on a sensory code, through which we communicate with the space. (Eberhard,2015 p36)

A good urban space is more about human scale, the identity the local community can associate, and relaxation of pedestrian movement, the attractive place where people can stay, the protections from climates, and most importantly, the surrounding activities where people can participate. The density buildings and intensity activities both contribute to the shape and liveliness of a place.

If we assume a useful life of more than a hundred years for a building, then it makes sense to divide its individual architectural elements into levels by the various useful lives of these subsystems (Habraken,

- Public Spaces: The surroundings of a building which define the place – consisting of topography, meteorology, infrastructure, culture and the people who shape the place.
- Structure: The supporting system and the safety ascribed to the supporting system, including escape stairs, circulations, cores and so on, have useful lives of more than a hundred years. The focus here is on organizing and ordering a city and buildings.
- Shell: façade and roof, as well as the main lines of the building services, last fifty to a hundred years. These can be seen in the exterior spaces, building types and infrastructure networks of the particular districts.
- Programme: the way in which a building is used – residence, work, leisure and retail – is subject to changes which are on a scale of twenty years. A building with an ambition to become a hundred years old or more will not be achieved if the relatively short life of its intended use service as the point of departure for the architectural approach.
- Infill - The elements, materials and surfaces of the inside of a building are the parts most obvious to the users of the building, but because of the mechanical demands on them they usually have useful lives of just ten years.
-

3 The case: Wuhan InCity

This paper is based on participatory research from Architectural design point of view – the designer is also the researcher. According to the understanding of the clients and design concept InCity is about " a city " in a city where the buildings and public spaces create dynamic possibilities of function, and movements, energy constantly changing.

Given the prominent location of the site along a major traffic axe to Wuhan city centre, facing to a park and its proximity to the Yangzi River to the North, and large new housing development to the South and east, the design proposal emphasizes the middle and lower income neibourhoods of iron and steel industy in the area. It is characterized by the flowing open space offering multiple possibilities of dynamic functional arrangement and unobstructed movement.

With its soft curved lines and bold volumes, the "InCity" city reveals strong formal and spatial characteristics which clearly distinguish it from other developments and parts of the city and durably imprint it in the memory of residents, users, visitors and by-passers. The formal innovation in design was one of the factors leading to selection of the project in a limited competition (Figure.1) .

Three high rise towers emphasize the landmark character of the project and mark the most prominent outer edges of the triangular shaped site. The super high rise on the North- west corner will correspond to the planned superstructure on the opposite side and form a gate like situation to designate the location and to integrate the neighbourhood behind. In the core of the complex, the thrilling sequence of flowing retail space and in – and outdoor open green areas makes the shopping or just the visit an unforgettable experience.

Figure 1 Master Plan of Wuhan InCity

The objectives of this project is not problem solving, but a process of transformation involving an investigation into specific properties of the site. These properties includes *open*

structure, complexity, neutrality, integrity, temporary, mobility, infrastructural rather than architectural, etc. In this project the architects investigated an alternative approach in building design. They remain critical to a deductive reasoning that presuppose particular solutions according to preferred modes of building plan.

Firstly they were doubtful of compositional unities that affirm order and stability. They encourage multiplicity and indeterminacy with all their forms of divergence, ambiguity and process of transformation. Secondly, the building is portrayed as an accumulation of information, material substances, and time, forming compacted or loosely arranged agglomerations. Thirdly, they emphasize less on the notion of place-making as genius loci than on the producing of space. Producing space is characterized by a dispersion of events remains strategically open. Here, Architecture design does not submit to finite conditions, but begins to circumscribe fields of possibilities, open to entice other forms of "reading and writing".

There is not so much a matter of reconstructing the original *genius loci* as it is a matter of creating a distinctive and characterful place through the viewer's active participation in the interpretation. A contextual architecture is conscious and aware of its carious relations, whether these have to do with the proximal physical surroundings or with a building culture in a more general sense. Places do not exist all by themselves; they are created through a contextualization

Architectural subjects are users as well as spectators, participants as well as readers. In practice, this implies intensive programming, but also an elastic yet precise relation between spatial accommodation and formal invention; a loose fit between event and structure. The interaction between the events and structure is constant phenomenon, which invites active transformation of form and spaces. Architecture is not monument, but the process of operation.

The constitute relationship of the people's activities, time flowing and spatial operation is hard to be reflected directly in the traditional plans, sections, and elevations as Stan Allen considered. Therefore, it is important to use the mapping analysis and data statistics to illustrate the comprehensive and delicate operation system. The synthesized multi-attributions and multi-Level framework for mapping different kinds of spaces in sites can help to locate the essential gene of the spatial structures. Both the tangible and intangible factors can be reflected in one mapping result essentially. Three pairs of attributions are used for defining the different public spaces: (1) outside and inside, (2) public owned and privately owned, (3) accessible for the public without permission and with permission. Following that eight major types of public spaces can be defined. The accurate and elaborate description of the spatial system can be helpful to lean adjustment and management in the presupposed design and future modification of a diversity constitution, sustainable atmosphere, and ever-bright spatial spirit. The special characters of spatial form with these excellent genes can be strengthened and enlarged in the following use process. Then, the unique image of the space can be maintained for a long time.

4.Morphological Analysis : Atmosphere of Public Spaces

Preliminary and foreseeable study of the project of clients resulted in integrated and high dense development concepts before the architecture completion was invited. These

concepts were further enhanced by the Architectural design concepts. The project is required to be integrated into the city. The multiple levelled and smooth flow of pedestrian and open spaces connects and opens to surroundings in various directions, including the Pease Park in the north. The distribution of open areas results out of the profound analysis of the surrounding neighbourhood. The outdoor space takes up major existing axes and creates a carefully staged movement network on the site. Continuously flowing, it opens towards the Wuhan Peace Park and extends the green belt into the site, while it varies in width between the single buildings to form a sequence of exiting spaces with different character, ranging from large plazas to intimate secluded gardens (Figure 2).

Figure 2 Public spaces of multiple levels inside and outside

The formal quality of the design was also required and objected in the conceptual design. Divided by the open and green public areas, the retails space introduces a new shopping concept. The shopping mall is not any more, as otherwise usual, an introvert mega structure. On the contrary, it stretches out and over the outdoor areas and merges with the surrounding. The commercial complex divided by open and green public spaces, and connected by bridges and pedestrian networks, is an ideal solution for the business of the retails and quality of public life. Retail shops are open and easily accessible from outside to inside, and from inside and outside. Multiple levelled bridges take the pedestrian flow of the ground and elevate it in the vertical. Playfully connecting the different volumes, the maze of bridges interlaces the in- and outdoor space, turning the architecture into a thrilling background for public space. The characteristic public space shaped by the retails on multiple levels invite people to stay (Figure 3) .

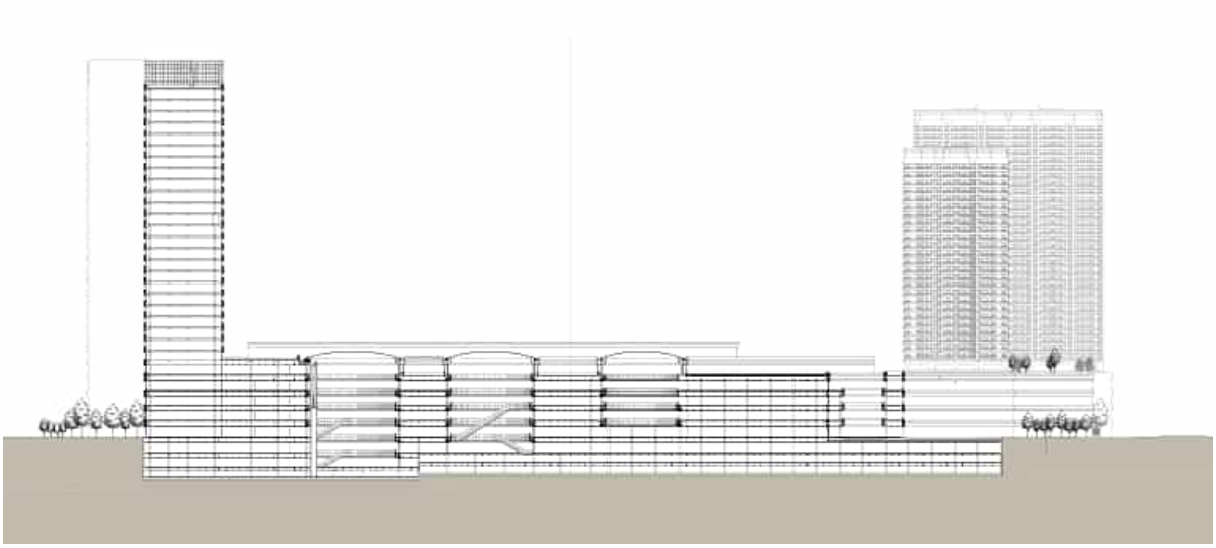


Figure 3 The section of the multiple levels of public spaces in the complex

Each of the buildings has its own geometry and a different typology resulting out of it. Unique on their own, they form distinguishing, personal addresses for residents, occupants and users with strong identity. At the same time, carefully arranged to correspond to each other, all together they grow into a supersized sculpture and form a strong sense of community (Figure 4).

The long term flexibility which was both required by the clients and encouraged by the architects is also implemented in the conceptual design. One of the dynamic concept creates an “alive” building - not only because of the interlaced in- and outdoors spaces, built and natural environment, but mostly because of its flexibility and openness towards future requirements. The open floor plans based on a rationally gridded load- bearing structure allow the buildings to easily adapt to and adopt changes such as adjustment of size or function. On functional level, the retail space could easily turn into office or public building, the residential tower into office or vice versa. A long lasting urban complex attractive and comforts especially in

- Well Integration of traffic, infrastructure and pedestrian
- High quality and long lasting material are to be applied in public space.
- High thermal comfort and lighting in public spaces inside and outside the buildings.
- Creation of high quality of to public space and greenery
- The structural and service cores are positioned to allow on open floor plan.
- Introduce a functional neutrality on the façade
- Space designed for multiple purposes
- Circulation design provides multiple choices to access a space. A typical application of this principle is found in the circulation of the retail (Figure 5).

Figure 4. Multiple levelled public spaces inside and outside (in construction)

Figure 5 Public spaces and elevated walkway (partial)

To understand better the infrastructure and public space design in Wuhan InCity, a comparative case in Mongkok, a most lively and high dense urban district in Hong Kong is used in following analysis. By using the multi-attribution mapping and data statistic to comparing the Wuhan and Mongkok case, (Figure 5) several apparent differences and similarities between the two ground spatial systems are unfolded.

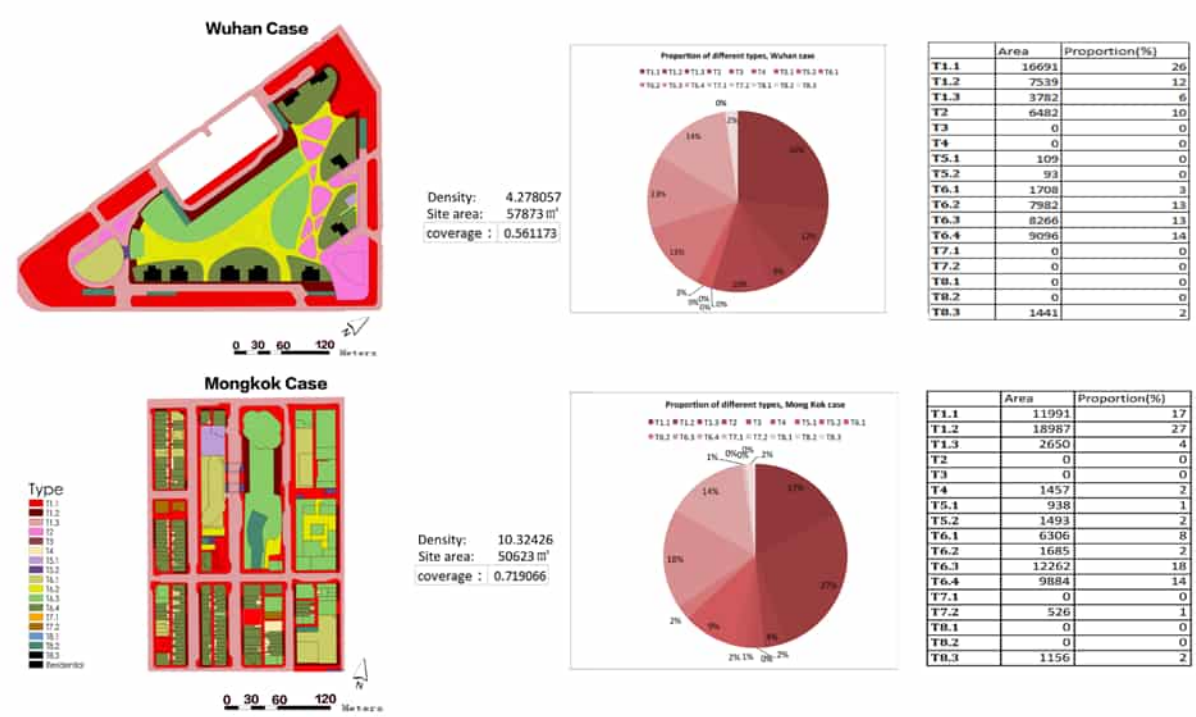
(1) The two cases have similar site area and coverage, while the building density of Mongkok case is the twice of Wuhan case. The difference is because of the construction area of the residential building. Mongkok case is influenced by the remained residential towers with higher building density and traditional neat texture, while Wuhan case benefits from full site development with multileveled circulations and terrace integration.

(2) The interchange of the proportion of T1.1 and T1.2 in Wuhan and Mongkok case. In the Wuhan case, the proportion of T1.1 is the twice of T1.2, while in the Mongkok the proportion of T1.2 is the twice of T1.1. This is because of in Wuhan case the pedestrian is considered as the priority on the ground floor and elevated walkways by moving the vehicle traffic to the underground, auxiliary parallel layers. In Mongkok, the traditional street structure remains for vehicle transportation while the pedestrian is encouraged and guided to using the auxiliary layers such as underground channel.

(3) The interchange of T2 and T4 in the two case. In the Wuhan case, there are about 10% total ground area of T2 space, while the T4 is zero. On the other hand, there are about 2% of total ground area T4 in Mongkok, while the T2 is zero. The obvious contrast is because of the private yards (T4), and the private owned yards/plazas (T2) for the public are switched their locations. In the Wuhan case, the private owned yards/plazas for the public are largely set on the ground floor, while there are only located in podium floor in Mongkok case. As for the private yards, the opposite is true.

(4) The proportion of the projected area of public commercial space and auxiliary facilities (such as underground garage entrance) in the ground floor is similar. The total proportion of T6, including T6.1, T6.2, T6.3, and T6.4, is 43% and 42% in Wuhan and Mongkok case respectively. And the proportions of T8.3 all similar. These similar data illustrate that although the density of Wuhan case is the half of Mongkok case, they have a similar amount of public commercial spaces and supporting areas.

In a summary, the advantages of limitations of the Mongkok cases are all original from the traditional strict texture and priority for the traffic efficiency, while with the similar coverage, the Wuhan case achieves the same advantages and breakthrough these limitations by exchanging parts of the urban open space on the ground floor and auxiliary floors (including underground and podium floors). As a result, the high publicness spaces are concentrated on the ground floor, the high quality of configuration and operation of space can help to reach a sustainable space system.



	Area	Proportion(%)
T1.1	16691	26
T1.2	7539	12
T1.3	3782	6
T2	6482	10
T3	0	0
T4	0	0
T5.1	109	0
T5.2	93	0
T6.1	1708	3
T6.2	7982	13
T6.3	8266	13
T6.4	9096	14
T7.1	0	0
T7.2	0	0
T8.1	0	0
T8.2	0	0
T8.3	1441	2

	Area	Proportion(%)
T1.1	11991	17
T1.2	18987	27
T1.3	2650	4
T2	0	0
T3	0	0
T4	1457	2
T5.1	938	1
T5.2	1493	2
T6.1	6306	8
T6.2	1685	2
T6.3	12262	18
T6.4	9884	14
T7.1	0	0
T7.2	526	1
T8.1	0	0
T8.2	0	0
T8.3	1156	2

Figure 5. Comparing of Wuhan and Mongkok cases

5. Concluding Comments

Despite all the advantages of high dense urban complex, the quality of urban space and methodology of design need further research based on both practice and analysis. High dense and multiple purpose demands placed on architecture become increasingly complex, while the critical points become more significant as a result of differing interests. This is contrasted with a didactic principle which is sharply reduced to the visual perception of architecture and pays little attention to the real scope of assessment.

The introduction and analysis of Wuhan InCity project above highlights importance of concept of architecture as Infrastructuralism, centered by pedestrian networks and public space. Emphasizing on the quality of atmosphere, the paper leads to new perspectives of architectural discourse:

- As the most important means of architectural expression, the structure of the building generates public space. Public space is, at the same time, the space which gives the building its specific quality and characteristics.
- The infrastructural concept ensures that the building's value is preserved as network of public spaces and possibility to convert and adapt to intensive changing uses.
- Separating inside and outside leads to different disciplines, architecture and urban design. Infrastructuralism intended to combine them into a whole which is more significant in high density urban complex.
- The quality of open spaces both inside and outside relies on the atmosphere created in the design and participation of users. The human scale, dignity of building surface,

and intensity of programs are as important as relaxation of pedestrian movement and thermal comforts.

- Refined spatial configuration and lean management can provide an accurate analysis perspective for spatial diversity, flexibility and sustainable, especially for the irregular forms and new forms of comprehensive urban spaces.
- Departing from traditional high dense complex, Mongkok in Hong Kong for example, new urban complex tends to introduce many types of movements, urban open spaces, and stronger integration of inside and outside, maximize the safety and comforts, and most importantly triggering spontaneous community. To achieve these goals, a larger proportion of public spaces than those in traditional cities is needed.

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CONCEPTUAL FRAMEWORK FOR ENVIRONMENTAL DESIGN AND MANAGEMENT OF RESIDENTIAL COMMUNITY FOR ENHANCING ELDERLY WELL-BEING

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Abstract

This article presents the modeling of a conceptual framework related to factors of the environmental residential community for enhancing elderly well-being in Thailand by using the Delphi technique. Research method began with observations and interviewing management teams at three case studies in terms of management processes and environment designs of existing residential community projects in Thailand. The interview results were taken to summarize with related theories and literature. A group of experts (7 people) in the related field were employed to confirm the framework. The result found factors of elderly characteristics have a positive direct effect on elderly's requirements in a residential community. The elderly's requirements comprised of three factors including (1) location, (2) facility, and (3) activity. Each factor of the elderly's requirements have effects on the willingness of the elderly to join the residential community. The framework will be used for quantitative analysis and the outcome will be a policy for environmental design and management of the residential community for enhancing elderly well-being in Thailand.

Keywords

Elderly, environmental design, residential community, conceptual framework.

1 Introduction

The United Nations reported the number of people more than 60 years old will be two billion by 2050, making global aging a concern for countries both rich and poor. Thailand is a country facing the problem of increasing senior population. In the yearly report of Thai elderly situation, 2012 [1] resulted that Thai elderly (60 years and above) will be 19.1%, 26.6% and 32.1% of the Thai population in 2020, 2030, and 2040 respectively. The result led to a question that how can the Thai government will handle when the situation is reached. However, the National Committee for the Elderly under the Ministry of Social Development and Human Security Thailand [2] defined a policy for Thai elderly as follows:

- "The elderly persons with good living standards are: physically and mentally healthy; happy family, social care, enabling and friendly environment; stable security, access to appropriate welfare and service; lead a valuable life with dignity, independence, and autonomy, and serve as central reliability and participate in the family, community, and social activities; keep access to data, information and news.
- The family and the community serve as a strong institution and key sector of efficient support for the elderly.
- The welfare and service systems shall ensure a high-quality life and full participation of the elderly both in their family and community.
- All parties and sectors shall take part in the welfare and service system accessible and usable by the elderly where safeguards are needed to protect the elderly as a group of consumers.
- The proper undertakings and settings shall be performed to enable the elderly persons who face difficulties and in need of care to be recognized and included as members of their community in all areas".

The policy led to a next question that where a big number of the elderly will live after their retirement while they have to face degeneration of their body inevitably. They need assistance from their children or others when they have to go hospital or clinic. By these reasons, residential community for enhancing elderly well-being is the answer. The researcher was committed to studying that "a place where has all facilities for Thai elderly living and needs, there are people taking care when they get sick, there is good social environmental management, a place can be part of society with happiness, and a place where is convenient and safe until their final day of life". How the place should be like. Therefore, the objective of this research is to study and formulate a conceptual research framework of Thai elderly's characteristics and their requirements to environmental design and management of the residential community. In order to achieve this objective, this research had done the following: identifying components of the Thai elderly's requirements and their measurement; developing a conceptual framework that demonstrates the relationships between the elderly's characteristics, the elderly's requirements, and the elderly's willingness to join the residential community. The framework will be proved by collecting empirical data and used for quantitative analysis. The outcome will be a policy for environmental design and management of the residential community for enhancing elderly well-being in Thailand.

2 Literature Review

The National Committee for the Elderly under the Ministry of Social Development and Human Security Thailand [2] defined "the elderly are not a vulnerable nor social burden, but able to take part in the social development resources, so they shall be entitled to recognition and support by the family, community and the state to lead a valuable life with dignity and sustain their healthiness and living standards as long as possible". World Health Organization [3] has stated on their website that most developed world countries have accepted the chronological age of 65 years as a definition of elderly or older person, but like many westernized concepts, this does not adapt well to the situation in Africa. While this definition is somewhat arbitrary, it is many times associated with the age at which one can begin to receive pension benefits. At the moment, there is no United Nations (UN) standard numerical criterion, but the UN

agreed cut off is 60 years up to refer to the older population. In this research, Thai elderly was defined by age of 60 years and above, together with health condition of the elderly were classified to 5 levels including (1) strong, can help themselves everything, (2) sometimes need some assistance, (3) mainly need assistance, (4) need assistance all the times, and (5) unable to move and need assistance all the times.

Plunz [4] stated that environment design is the process of addressing surrounding environmental parameters when devising plans, programs, policies, buildings, or products. Environmental design can also refer to the applied arts and sciences dealing with creating the human-designed environment. These fields include architecture, geography, urban planning, landscape architecture, and interior design. Environmental design studies the physical surroundings that provide the setting for human activity, ranging in scale from buildings and parks, green space to neighborhoods, the local community. Environmental design is defined as the physical and constructed environment in which people live, work, and recreate on a day-to-day basis. In addition, environmental design is concerned with the way these places are experienced and used, as well as other aesthetic elements that contribute to the quality of community environments. The environmental design would be considered in this research in terms of the Thai elderly's requirements.

Jonas and Chez [5] believed an emphasis on healing is a key to the future medical management of chronic illness and the establishment of sustainable approaches in health care. Defined as the process of recovery, repair, and return to wholeness, healing is the foundation for a vision of medicine that integrates diverse approaches from around the world for the alleviation of suffering, the enhancement of well-being and the treatment of chronic illness. Healing is facilitated through the development of proper attitudes and intentions in both the provider and the recipient, use of personal self-care practices, creating healing relationships, applying the knowledge of health promotion and maintenance, and the appropriate integration of complementary and conventional medicine practices. Nelson et al. [6] described that "healing environment" is synonymous with the therapeutic environment. The therapeutic environment is one that is "designed to not only support and facilitate state-of-the-art medicine and technology, patient safety, and quality patient care but to embrace the patient, family and care providers in a psychosocially therapeutic environment". The healing environment would be checked and compared between the mentioned literature and existing cases in Thailand. Then, the concluded result would be used in the questionnaire design.

Paul et al. [7] stated that a community is a social unit of any size that shares common values, or that is situated in a given geographical area (e.g. a village or town). It is a group of people who are connected by durable relations that extend beyond immediate genealogical ties, and who mutually define that relationship as important to their social identity and practice. WHO Regional Office for Europe [8] defined "a community residential health facility as a non-hospital, community-based mental health facility that provides overnight residence for people with mental disorders". The facilities include supervised housing unstaffed group homes; group homes with some residential or visiting staff; hotels with day and night staff; hostels and homes with 24-hour nursing staff; halfway houses; and therapeutic communities. Both public and private not-for-profit and for-profit facilities are included. Perkins et al. [9] stated in a textbook of "building type basics for senior living" that common facilities within a skilled-nursing facility serving all of the nursing units may include: multipurpose room, coffee shop/snack bar, gift shop, library, outdoor terraces and recreation areas, art/activity, clinic, rehabilitation. In the textbook also stated that, in adult communities, landscaped and natural

areas should be developed for walking, contemplation, golf, lawn sports, shuffleboard, gardening activities, fishing, and other recreational activities.

Jabareen [10] defined a conceptual framework as a network or a plane of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena. Each concept of a conceptual framework plays an ontological or epistemological role in the framework. Jabareen [10] also suggested that 8 phases in procedure of conceptual framework analysis including (1) mapping the selected data sources, (2) extensive reading and categorizing of the selected data, (3) identifying and naming concepts, (4) deconstructing and categorizing the concepts, (5) integrating concepts, (6) synthesis, re-synthesis, and making it all make sense, (7) validating the conceptual framework, and (8) rethinking the conceptual framework. In this article, for the phase (1) to (4) would be the literature review and observing the three case studies. And then, a group of experts would be employed in the phase (5) to (8) through the Delphi technique.

3 Methods

Research method in this article comprised of two main parts including:

3.1 Case Studies

This part began with observations and interviews at three case studies in terms of management processes and environment designs. The three cases are existing elderly community projects and still operating in Thailand. The three cases included:

- A private project: 600 single houses, 3 condominium buildings, and facilities related to the elderlies. The project is suitable for elderlies with family, patients with chronic diseases, people who need special care or need rehabilitation. The project is located in Chang-Lek, Bangsai, Ayutthaya.
- A governmental foundation project: 163 rooms of a building (8-story), 300 rooms of 8 buildings (6-story), and facilities. This project is suitable for the elderlies at the beginning of their retirement, living alone, strong, can help themselves everything. The project is located in Pathumwan, Bangkok.
- A religion foundation project: 164 rooms/beds of 5 buildings (2-story), facilities related to the elderlies, nursing wards. The project is suitable for low-income elderlies, elderlies with amnesia, elderlies are unable to help themselves. The project is located in Sampran, Nakhon Pathom.

Managers or management staffs of the three case studies were appointed and interviewed at their own community places in the topics of managements, environments, facilities, and activities in their community. After the three case studies had been observed and interviewed, facilities and activities in the cases were classified and defined as an item list. The item list result of this part was taken to summarize with the related theories and literature in the next section.

3.2 Delphi Technique

The Delphi technique was developed by Olaf Helmer and Norman Dalkey in the 1950s. The technique is a widely used and accepted method for achieving convergence of opinion concerning real-world knowledge solicited from experts within certain topic areas [11]. The technique is designed as a group communication process of the experts that aims at conducting detailed examinations and discussions of a specific issue, the process can be continuously iterated until a consensus is determined to have been achieved. This research used this technique for confirming the factors and the framework of the environmental residential community for enhancing elderly well-being in Thailand. Steps of the Delphi technique were:

Step 1. Identifying the factors: From the observations and interview (section 3.1) at the three case studies in terms of management processes and environment designs, the interview results were taken to summarize with related theories and literature (such as textbooks research articles (in the emerald insight and science direct database) and the related annual reports in Thailand). All factors were summarized and listed for the next step.

Step 2. Confirming the factors: The listed factors would be confirmed by experts through the Delphi technique. A group of 7 experts in the related field was employed. The 7 experts were selected by their experienced professions including:

- 3 experts in managements of the residential community for elderly from government and the private sector.
- 2 experts in elderly studies from academic institutions.
- 2 experts in designs of the residential community from private companies.

The listed factors were confirmed consensus from opinions of the 7-experts directly and individually started from the expert 1, 2, 3..., 7 and returned to the expert 1 circularly (Fig. 1). All experts were carefully and individually considered the listed factors without meeting at least 3 times/expert until the consensus were saturated. Once the listed factors were confirmed and categorized by the 7-experts, the listed factors would be constructed the conceptual framework in the next section.

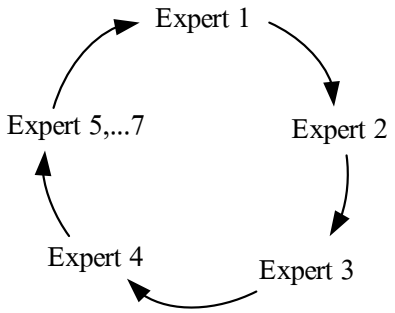

Figure 1. Circulating the experts

Step 3. Drafting the conceptual framework: According to the expert opinions, the confirmed factors were categorized and arrows were drawn between the factors in a draft conceptual framework. The draft conceptual framework would be confirmed by the 7-experts through

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the Delphi technique as step 2 again. The final framework would be the conceptual framework for this research.

4 Results

According to the three case studies (section 3.1) and opinions of the 7-experts, the confirmed factors and items/their indicators for the Thai elderly's requirements and their measurement items in environmental design and management of residential community were listed in Table 1.

Table 1: Factors for Thai elderly's requirements and their measurement items

Factors		**Items**
Elderly's characteristics		CH1 :Age
		CH2 :Health
Elderly's requirements	Location	Q1 :Calm and natural place
		Q2 :Near religious places
		Q3 :Near hospitals
	Facility	Q4 :Health food shop
		Q5 :Convenience shop
		Q6 :Beauty salon
		Q7 :Laundry service
		Q8 :Cleaning service
		Q9 :Building maintenance service
		Q10 :24-hour security guards
		Q11 :24-hour medical center
		Q12 :care center for the elderly
		Q13 :Sauna and spa
		Q14 :Training center for improving quality of life
		Q15 :Library
		Q16 :Computer and internet room
		Q17 :Karaoke lounge
		Q18 :Swimming pool
		Q19 :Fitness
		Q20 :Outdoor stadium
		Q21: Garden and outdoor patio
		Q22 :Indoor activities
		Q23 :Religious place
		Q24 :Sidewalks and bike lanes
		Q25 :Fence and gate guards 24-hour
	Activity	Q26 :Religious activities
		Q27 :Recreational activities
		Q28 :Important day activities
		Q29 :Training activities
		Q30 :Excursions programs
Willingness		W1 :Interesting in the community
		W2 :Willingness to live in the community

Factors	Items
	W3 :Willingness to recommend the community to others

In Table 1. The factor of the elderly's characteristics comprised of 2 items CH1 and CH2). The factor of elderly's requirements comprised of three subfactors including 1) location; 3 items (Q1 to Q3), 2) facility; 21 items (Q4 to Q25), and 3) activity; 5 items (Q26 to Q30) respectively. Finally, the willingness comprised of 3 items (W1 to W3).

Once the factors for Thai elderly's requirements and their measurement items were listed, the conceptual framework was constructed and the result frameworks were shown in Fig. 2. Moreover, the framework was extended in detail of the items or their indicators as shown in Fig. 3.

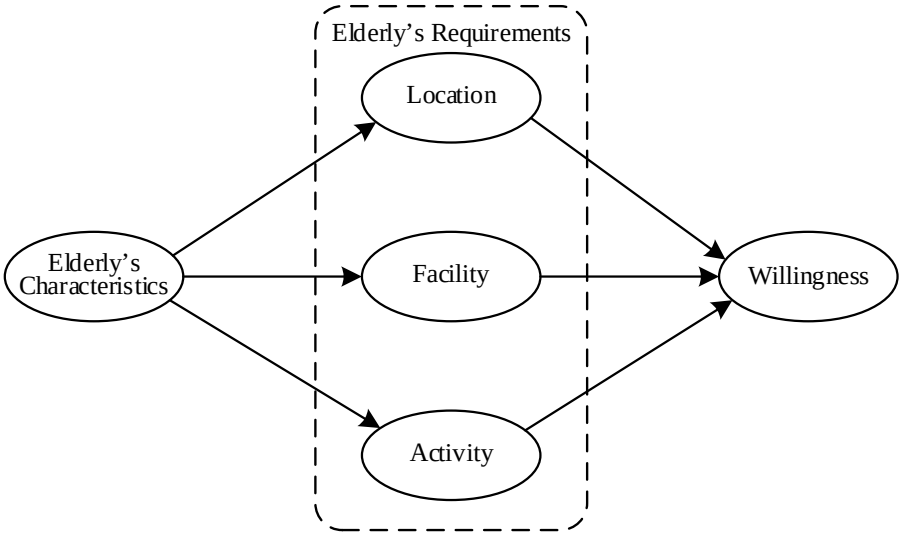

Figure 2. The conceptual framework

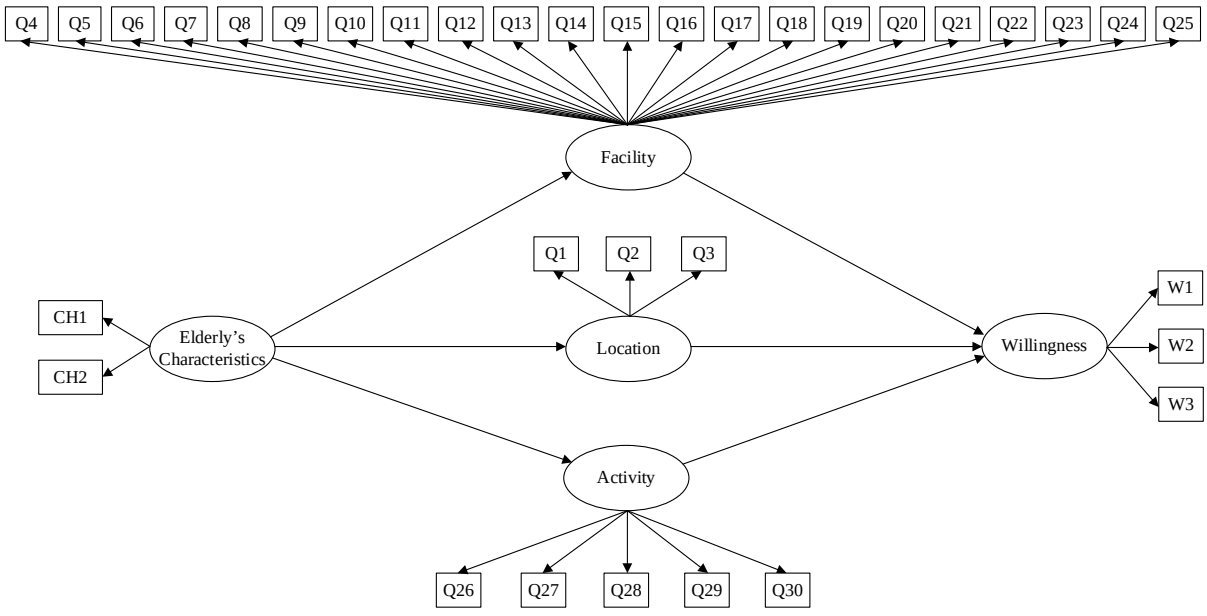

Figure 3. The conceptual framework in details

5 Conclusion

This research studied factors related to elderly's requirements of the environmental residential community and modeling of a conceptual framework to study the factors for enhancing the elderly well-being in Thailand. The three case studies were observed and interviewed in terms of environmental design and management. A group of factors was listed from the three case studies and confirmed a by the experts using the Delphi technique. According to the results of this research, it could be concluded that the factors related to elderly's requirements of environmental residential community including the factor of elderly's characteristics (CH1 and CH2), the factor of elderly's requirements which were location (Q1-Q3); facility (Q4-Q25); and activity (Q26-Q30), and the factor of willingness (W1-W3) as shown in Table 1. The outcome from the Delphi technique was the conceptual framework (Fig. 2). The framework showed the factors of elderly characteristics have a positive direct effect on elderly's requirements in a residential community. The elderly's requirements comprised of three factors including 1) location, 2) facility, and 3) activity. Each factor of the elderly's requirements have effects on the willingness of the elderly to join the residential community. Finally, the framework in Fig.2 was extended in detail of the items or variables or indicators as shown in Fig. 3. The framework will be used for quantitative analysis and the outcome will be a policy for environmental design and management of the residential community for enhancing elderly well-being in Thailand.

Acknowledgement

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AN ASSESSMENT ON HOUSING SATISFACTION IN POST DISASTER HOUSING: YALOVA SUBASI CASE

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Abstract

Turkey is a country suffering from disasters, especially earthquakes, because of its location. Disasters cause physical damage as much as economically. One of the most important physical injuries is that the houses become destroyed and cannot be seated. For this reason, the need for housing is very important after a disaster. To cope with this problem, permanent houses, post disaster housing in other words, are built in many areas to provide accommodation for households whose houses cannot be seated. Post disaster housing is important to vulnerable households so that they will be able to return to a better living condition before the disaster. However, since permanent housing is completed by constructing it very quickly, it is important that the life standard of permanent housing is compatible with the previous experience of the users. In this sense, post-use assessments of permanent housing, especially produced after the destructive impact on a disaster, are getting important to subsequent applications to be more successful. Within this scope, permanent residences in Subaşı Village, Yalova Province in Turkey have been examined within the context of post-earthquake transformation applications on 17 August 1999. In the study, the construction of the houses built in Subaşı Village, the general evaluations about the design, the criteria of entitlement, the planning process of the permanent houses, the demographic characteristics of the participants were assessed.

As a result of the study, it was seen that the permanent residential areas in Subaşı village could not integrate with the existing city. With the socialization processes of households with different characteristics, it was observed that different qualities of contribution were made to living areas. Neighbourhood relations and care for open spaces and ownership arrangements affect social relationships together. Individual solutions to designs and lack of ownership regulation in common areas also prevent the formation of management units in permanent residential areas. Thus, an integrated life in the areas of new housing does not come into being. This has led to the conclusion that in the process of integration of permanent residential areas with existing urban areas, social facilities and non-residential uses, business and shopping areas, schools and green spaces should be constructed within a more comprehensive framework.

Keywords

Earthquake, poe, permanent housing.

1 Introduction

Permanent housing is defined by AFAD (2014) as constitutional residence built by state or private institutions for those who suffered severe damage from disasters [1]. Permanent housing, post disaster housing in other words, is also defined by United Nations (1982) as housing policies and applications following a disaster for meeting the urgent, temporary and permanent sheltering needs of the survivors of the disaster [2].

Permanent housing production after quakes is carried out with various alternative approaches ([3]. According to FEMA (1998) there are four different overlapping phases in the housing recovery process: (1) spontaneous shelter (first 72 hours), (2) emergency shelter (first 60 days), (3) interim housing (first year and beyond) and (4) permanent housing. Permanent housing is the last stage to provide long-term, permanent housing solutions for disaster victims [4]. Short and long-term housing recovery is thus a critical aspect of post-disaster reconstruction [5, 6].

Permanent houses are not housing that are produced in a very different way from those produced before the earthquake. However, one of the most important differences is that post-disaster housing is produced very quickly and supports to return to normal course of living conditions. As it should be in residential buildings produced under normal conditions, many factors such as social, environmental and economical factors should be planned in post-disaster housing.

Permanent housings are to meet the psychologically, socially and economically damaged people's different expectations from the constructed surroundings in which they will live for a long time as well as meeting the basic shelter need [3].

Within this scope, permanent residences in Subaşı Village, Yalova Province in Turkey have been examined within the context of post-earthquake transformation applications on 17 August 1999. In the study, the construction of the permanent houses built in Subaşı Village, the general evaluations about the design, the planning process of the permanent houses, the demographic characteristics of the participants and post-use evaluation of the households were assessed.

2 1999 Marmara Earthquake

Turkey is one of the countries facing earthquakes very often because of its geological and topographical qualifications [7]. Between the years 1900-2010 in Turkey, 285 medium and large earthquakes have occurred in which 100,000 people lost their lives, 170,000 people were injured and 650,000 housing has suffered severe damage [8, 9]. The 1999 Kocaeli earthquake that shook Marmara Region caused immense loss of life and property, damaged the social and economic structures of this country in a nearly irreparable way, and found its way into the earthquake chapter of history books [10].

Epicenter of the earthquake occurred on 17 August 1999 with an intensity of 7.4 was on the North Anatolia fault line, 12 kilometers southeast of Izmit. According to Turkish Prime Ministry Crisis Management Center the earthquake caused the death of 17.479 people and 43,953 injured by the earthquake [11]. The earthquake also damaged 213,843 housing units, the most number of housing units damaged by any earthquake in Turkey [12].

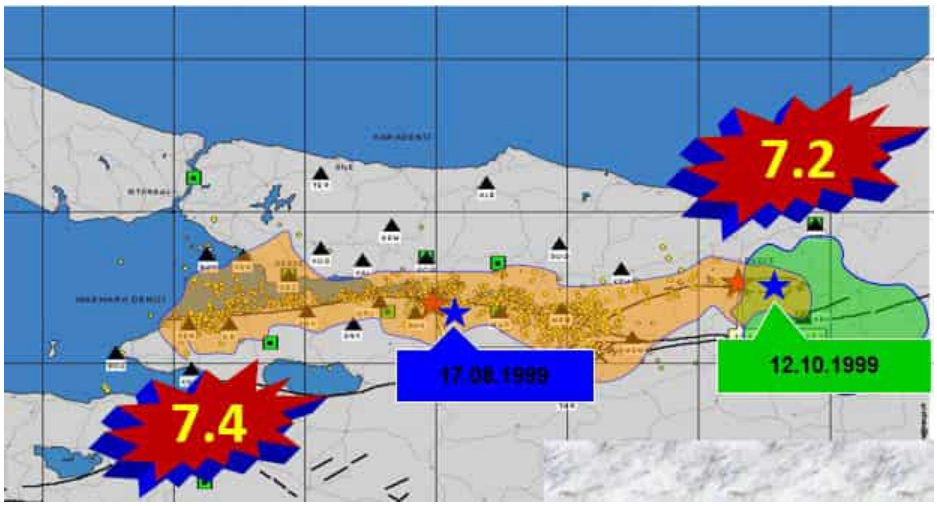

Figure 1. Affected areas damaged in 17 August Marmara Earthquake (Source: Kadıoglu, 2005)

The earthquake affected an area of nearly 64 thousand square kilometers [13]. The cities of İstanbul, Kocaeli, Sakarya, Bolu, Bursa, Zonguldak, Eskişehir and Yalova were significantly affected by the earthquake (Figure 1-2) [14]. 48% of the heavy damage caused by this earthquake occurred in Kocaeli province, 29% in Sakarya province and 14% in Yalova province [11]. After the earthquake, there arosed the need to construct many temporary or/and permanent housings [14].

Figure 2. Location of provinces damaged in 17 August Marmara Earthquake (Source: Tas et al, 2011)

Following the earthquake, the Turkish government began to undertake housing reconstruction as a result of the then mandate requiring the central government to provide units to home owners displaced by the earthquake [12]. Accordingly, the earthquake area Disaster Construction General Coordination was set up as a new regulation in order to be able to execute an effective application in permanent housing production stage and to deal

with the problems instantly; and the Project Management Unit was set up for the construction of the permanent housings financed by external sources [14].

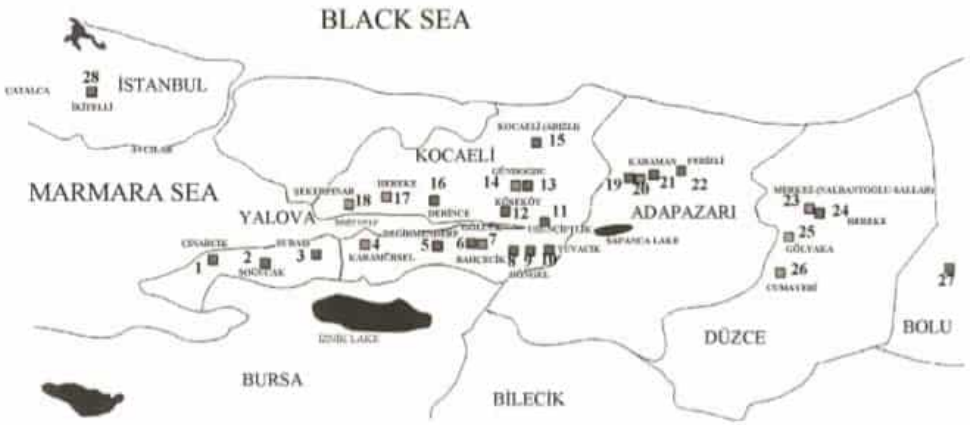

Figure 3. Permanent housing settlements damaged in 17 August Marmara Earthquake (Source: Tas et al, 2011)

After the earthquake, a total of 43,053 permanent housings were constructed in various provinces (Figure 3) and regions, in 27 different settlement areas (18 of Turkey's Ministry of Public Works and Settlement, the remaining 9 of the Prime Ministry Project Implementation Unit) [14, 15].

3 Yalova Province and Post Disaster Housing After the Earthquake

3.1 Yalova Province

Yalova, on June 2, 1929, according to a law issued upon the request of Atatürk, became a district connected to Istanbul (Figure 4). In 1995, Yalova was separated from the province of Istanbul as being a province [16]. Yalova is located on the northern shores of the Armutlu Peninsula and on the northern skirts of the Samanlı Mountains.

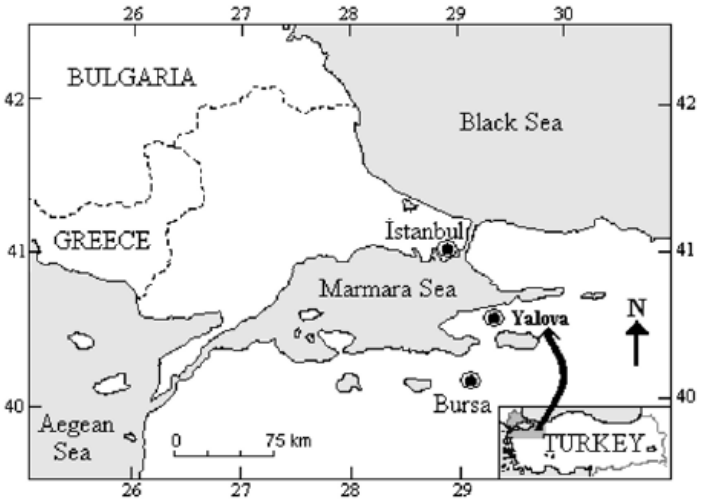

Figure 4. Yalova province (Source: Altunoglu vd., 2008)

Yalova is a province that situated in the eastern coast of Marmara Sea. It is comprised of 6 districts, 14 municipalities and 43 villages with a population of 251.203 [17]. Yalova province is the smallest city in Turkey with a total area of 847 km² [18]. It is affected by the seismic movements towrads the arms of the North Anatolian fault zone as shown in Figure 5 [19]. Yalova is also under the risk factors that arise from geologic and geomorphologic features such as flooding, liquefaction, mass movements [20].

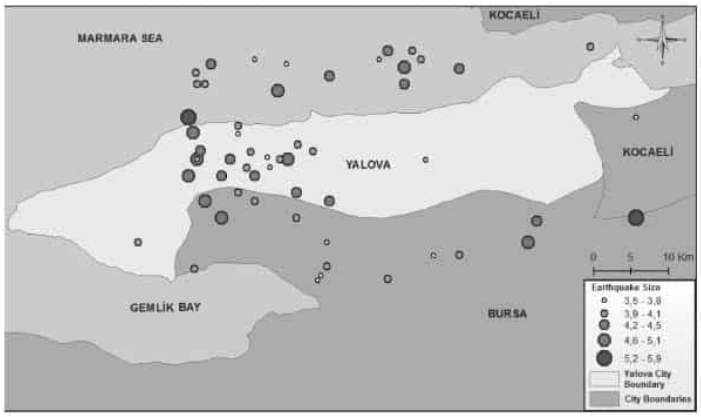

Figure 5. Earthquakes that were effective in Yalova and its surroundings (1900- 2013) (Source: Kurt ve Haybat, 2014)

3.2 Post Disaster Housing After the Earthquake in Subasi Village

After the 1999 Marmara earthquake, 2,504 people were killed and 6,042 people were wounded in Yalova. 9.462 houses and 727 workplaces severely; 7.917 houses and 1.036 workplaces moderately; 12.685 houses and 1.881 workplaces were slightly damaged [11].

Figure 6. Subaşı permanent residences site plan (Source: Google maps)

The Yalova Provincial Directorate of Public Works carried out permanent residential area studies in three areas in Yalova and determined suitable areas for construction. Permanent housing construction has been contracted by the Ministry of Public Works. 858 permanent residences were built in the center of Soğucak to reside 4.000 people. In Çınarcık and Çalıca,

1.618 permanent residences were built to house 6.500 people. In Altınova (subprovince), Subaşı (village), 3002 permanent residences were built to settle 12.000 people (Figure 6).

On the other hand, earthquake victims that did not solve the problems such as lack of social equipments, education institutions, work places, health centers, roads, water and electricity did not show much interest in permanent residences. As of 2010, the occupancy rate of permanent residences in the city was 65 percent in the summer and 30 percent in the winter.

The preparation, implementation and control of the projects of permanent residences have been carried out by UBM + Peta + Hira joint venture. There are 6 types of permanent residences produced after the Marmara earthquake. While 6 housing types were produced after the Marmara earthquake throughout the quake-affected region, only 2 different housing types were used in Subaşı. The first type has 12 residences, and the other has 6 (Figure 7). Both block types are composed of ground floor and 2 floors, 95 m2 residential area, 3 rooms and 1 living room.

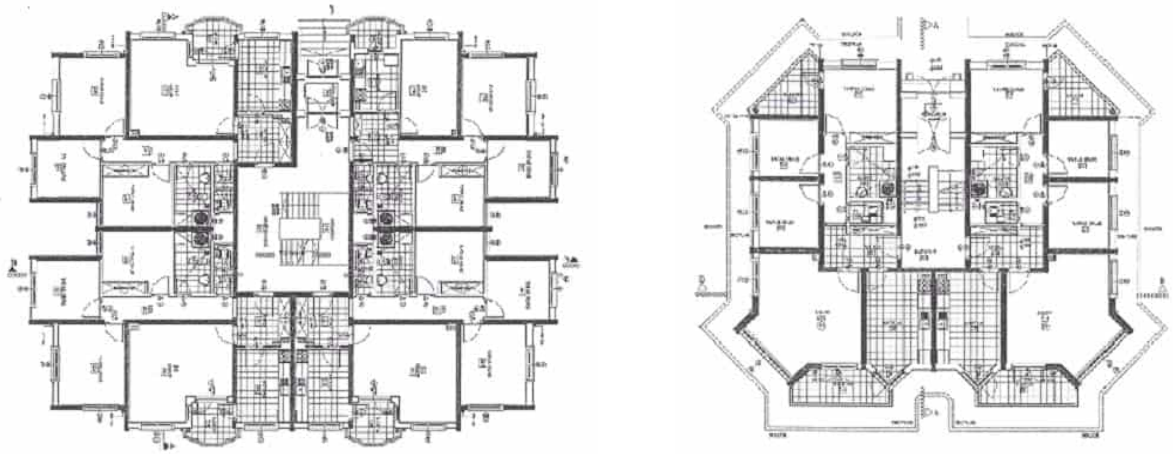

Figure 7. Floor plans of Subaşı permanent houses (Source: Personal archives)

The contract for the projects was made on 16.06.2000. It was delivered to the contractors by the Ministry of Public Works and Settlement on 28.06.2002. Accordingly, the dwellings, which are expected to be completed in about five months, can be completed in about nine months from the place of delivery. Eventually, 3002 houses were built in Subasi.

4 Findings and Evaluation

4.1 Findings

The universe of the research is the permanent residences produced in Subaşı Village. The sample was randomly selected from the residences. A total of 17 surveys were conducted. More than half of the participants have an income between 1000 TL and 1900 TL (equivalent to US$ 249.48- US$ 474.02) [21]. Before the earthquake, they mostly reside in the center of Altinova subprovince. Pre-earthquake housing is mostly apartment buildings. The size of the pre-earthquake dwellings is mostly between 80-100 m2 (29%) and 100-130 m2 (41). 75% of

the participants are owners of the pre-earthquake dwelling. Before the earthquake, all the houses were damaged or destroyed severely in the earthquake.

Participants explained the size of living room, kitchen, bathroom and wc sizes as medium (40%) and small (40%) while they found the size of room and balcony as mostly medium. A view from Subasi permanent residences is shown in Figure 8.

Figure 8. 2 different types of Subasi permanent residences (Source: Personal archives)

Some of the families living in Subasi permanent housing come from Yalova and some from Central and Eastern Black Sea Region of Turkey. Families whose homes have not been damaged also live here because of more convenient housing rent. Almost every family is satisfied with the size and the place of their houses in the city that they have lived before. Participants explained that if it were possible they would live in their old home, some of them would live in the city center near to their old home.

94% of the families believe that the residences are resilient to the earthquakes. Respondents have answered the room sizes mostly “medium and small”. A large proportion of the families is satisfied with the location of the rooms. 94% of the families stated that they did not see an unnecessary area in their new houses. Out of the six families, they stated that they needed more storage or a large bathroom (1 person) apart from the existing units. 88% of the families think that visual confidentiality was achieved between houses while 71% think that no auditory confidentiality was provided.

More than half of the participants are satisfied with the warming. 65% of the respondents answered “yes” to the question “Is your window sufficient for lighting and ventilation?”. Participants (except 1 person) said that there was no humidity in their homes. 88% of them does not have a complaint about their bathroom. In response to the question “Is there a transportation problem to the city center (Yalova)?”, 59% of respondents indicated that they were away from the city center and answered “yes”. 94% of the participants have access to the city or district center by minibus.

53% of respondents said they were satisfied with neighborhood relations. When asked “How have you experienced your interviews with your relatives and friends here?” 59% of the respondents gave answers as “I have fewer interviews”, 29% have “never seen” and 12% have “not affected”. In response to the question, “Are you satisfied with the arrangement of the green area on the periphery?” 41% of respondents answered “satisfied”. The “hospital” is among the answers shared by every family member in the question “What facility do you feel lacking in the environment?”. The participants also expressed that there is a lack of

shopping center (47%), business center (41%), entertainment center (52%), mosque (29%) and sports hall (52) in the area. Every family complains that the waste is not taken in time.

4.2 Evaluation

Post disaster housing is important to vulnerable households so that they will be able to return to a better living condition before the disaster. However, since permanent housing is completed by constructing it very quickly, it is important that the life standard of permanent housing is compatible with the previous experience of the users. In this sense, post-use assessments of permanent housing, especially produced after the destructive impact on a disaster, are getting important to subsequent applications to be more successful. Within this scope, permanent residences in Subaşı Village, Yalova Province in Turkey have been examined within the context of post-earthquake transformation applications on 17 August 1999.

As Erten (2003) points out, permanent residential areas can not integrate with existing cities, nor can they integrate into new residential areas. For this reason, it is necessary to construct permanent housing areas in the process of integration with existing urban areas, social facilities and non-residential uses, business and shopping centers, schools and green spaces within a more comprehensive framework [15].

As stated above, Subasi permanent residents are not involved in the design process in the context of user participation. The fact that the residential designs were made before the site selection did not allow for the design of housing types suitable for the land and the region. Houses have not been produced in a way to meet the real needs of users. The dwellings consist of two types of solutions as three rooms and one living room. Different sized families live in the same type of residences. Houses do not have the opportunity to extend if needed. The fact that residential buildings do not have flexible plans does not allow the housing units to be transformed into possible needs.

Some mistakes made in the planning phase cause problems in practice. The problem often raised by contracting firms in practice is that the distribution of housing on site plans does not generally vary from applications for different regions, and does not take into account factors such as the location and slope of the land. As a result, in some areas it leads to the problem of implementation for some apartments. The location of the apartments on the project sometimes increased the cost and caused infrastructure problems. It can be said that these problems are mainly caused by the fact that the housing units can not produce solutions according to the land in the first stage in their designs.

5 Conclusion

As a result of the study, it was seen that the permanent residential areas in Subaşı village could not integrate with the existing city. With the socialization processes of households with different characteristics, it was observed that different qualities of contribution were made to living areas. Neighbourhood relations and care for open spaces and ownership arrangements affect social relationships together. Individual solutions to designs and lack of ownership regulation in common areas also prevent the formation of management units in permanent residential areas. Thus, an integrated life in the areas of new housing does not come into being. This has led to the conclusion that in the process of integration of

permanent residential areas with existing urban areas, social facilities and non-residential uses, business and shopping centers, mosque and sports halls should be constructed within a more comprehensive framework.

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INVESTIGATION OF OUTDOOR THERMAL COMFORT WITHIN THREE DIFFERENT SCHOOL BUILDING FORMS IN THE INDONESIA

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• Abstract

Outdoor thermal comfort in school spaces has an important influence on students' health. However, there are only limited studies about thermal comfort of students in the Indonesian school. Nevertheless, after their home, school is where children spend most of their home. Therefore, a study to understand the existing condition of thermal comfort in Indonesian school buildings is needed. Starting from elementary school buildings in the urban area, this study aims to identify its outdoor thermal comfort. The case study is located in Bandung, Indonesia. Three different typical school building configurations in Bandung -namely courtyard configuration, linear North-South configuration, and linear East-West configuration- were simulated using ENVI-met and RayMan software. Data resulted from the simulation, such as outdoor air temperature, mean radiant temperature, wind speed and relative humidity was used to obtain the value of Physiological Equivalent Temperature (PET). The results demonstrate that the wind has a huge impact on the thermal comfort because it can flow the air from the outdoor space of the school. This study also shows that linear E-W provides the most comfortable microclimate for the school form in Indonesia.

• Keywords

Outdoor thermal comfort, School building, ENVI-met, Tropical climate, Indonesia

• Introduction

Schools are important places for children to develop their intelligent along with the social and cognitive skills improvement [1][8]. Children spend most of their time at school, thus schools must provide a healthy and comfortable learning environment [15]. Outdoor spaces in school area are important to support the social interaction of the children, by providing places for

playing, discussion and other outdoor activities. Landsberg [9] reported that outdoor space quality contributes to the livable quality and generate social interaction. This statement is supported by similar results obtained by several authors [4][12].

Outdoor thermal comfort has a huge relevance to thermo-physiology, i.e. physiology and the heat balance of the human body [5]. These factors had important rules in developing thermal comfort indices such as the physiological equivalent temperature (PET) [10] and the universal thermal climate index [3][13].

The difference of climate forces the country to adapt to the environmental condition. Northern countries consider four seasonal and tropical countries face lots of sunshine along the year. With this condition, Indonesia, as a tropical country with a wet, hot, humid climate, has a high temperature often in the 32°C during the day and the steamy 20°C at night. In this climate, open spaces are used during the year and they must provide proper levels of thermal comfort [6].

The research about outdoor thermal comfort studies in the tropical climate is still uncommon, particularly in the educational environment. Tropical climate region cities have some challenging conditions: everyday life during the year faces abundant sunshine, solar radiation, high rainfall and high humidity in the tropical climate region cities [6]. The study about outdoor thermal comfort in school leads architects and engineers to explore the potential of transitional space and attached outdoor space, through the use of architectural elements to help improve the school environment in both its indoor and outdoor spaces, while providing students with appropriate pedagogical places where they can experience and interact with nature [7]. Thus, investigation for the thermal comfort of the school in the tropical region is required.

• Method

For this study, three school building forms were selected to be assessed for the purpose of thermal comfort in the hot humid climate. The school building forms used in this study is simplified and taken from the survey (Fig. 1). This study aims to investigate outdoor thermal comfort of the school in the middle of urban forms. The vernal equinox days is considered for the simulation with ENVI-met. This program simulated the microclimates' data (e.g. mean radiant temperature, air temperature, wind speed and relative humidity) and the output was 'measured' in points at 1.5 m height in the center of the urban forms. The next step is to calculate the physiological equivalent temperature (PET) based on the sky factors of the reference point using RayMan [11]. The point to be measured is defined by the middle of center school's field. As mentioned above, the school's field has a huge influence on the students to play and interact.

• Selected School

The selected schools have fulfilled the national standard of the good environmental condition in the schools named *Adiwiyata*. This program aims to improve environmental protection and management through pollution control, damage control and environmental preservation

activities in schools. Therefore, the government conducting this program as an effort to develop the knowledge, norms, and ethics according to sustainable development.

There are three schools that have been selected into this study, i.e. SDN Banjarsari, SDN Merdeka and SDN Rancaloa. These schools are located in the middle of Bandung downtown. The main characteristics of these schools are having heritage building and surrounded by housing.

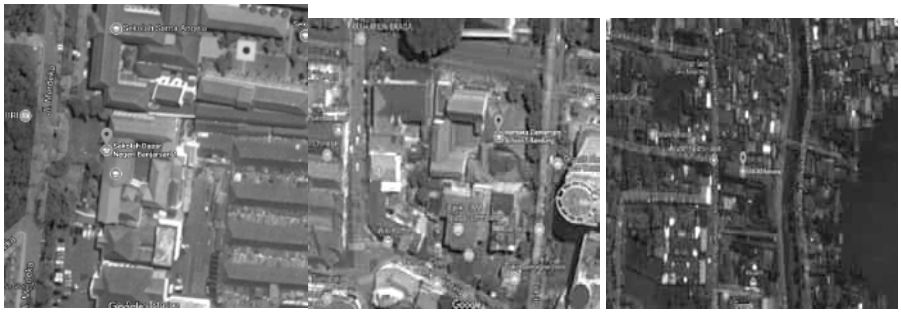


Figure 1 Courtyard (left), linear North-South (middle) and linear East-West (right)

According to Indonesia regulation, a classroom requires 64 m^2 (7x8 m^2) as a minimum size. For this study, a block of classroom used 72 m^2 (8x8 m^2) with 4 meters of height (2 stories). The receptor (a point to be measured as thermal comfort) is located in the middle of the canyon or courtyard at a height of 1.5 meters. These school forms are:

- A courtyard block (this form consists 8 blocks modules with the internal courtyard of about 10 m^2.
- Linear N-S
- Linear E-W

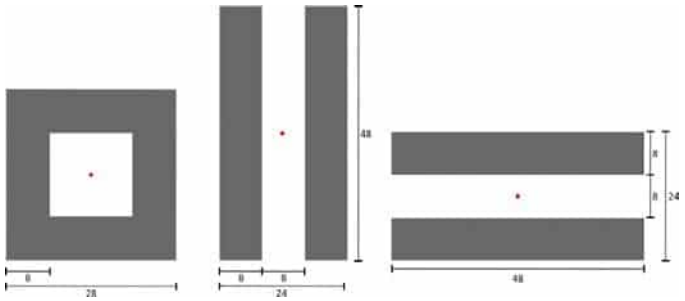


Figure 2 The reference point (red circle) and models used in the simulation: courtyard (left), linear N-S (middle) and linear E-W (right)

- Simulation

Two conditions and three models were run for the simulation. Each condition was simulated on the vernal equinox for the equatorial country, i.e. March 21 and September 23. On this day, the duration of the day and night is 12 hours respectively. The time was used on this simulation is 13:00 Western Indonesia.

ENVI-met is a three-dimensional microscale climate model, which is capable to simulate the interactions between the urban design and the microclimate with relatively high temporal (10 min) and spatial (0.5−10 m) resolution. The ENVI-met model is chosen because it is the most complete model in terms of the calculation of human comfort and this software can generate output contains the four main thermal comfort parameters: air temperature, mean radiant temperature (Tmrt), wind speed and relative humidity [13]. ENVI-met automatically set the air boundary three times height of the tallest building. Therefore, all the simulations have the height of boundary is 24 meters.

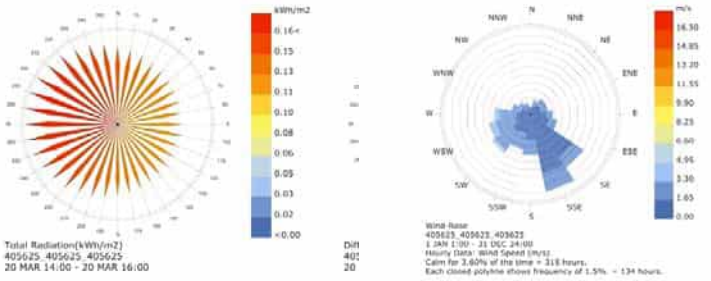


Figure 3. Total radiation (left) and wind direction (right)

Fig. 4 illustrates a schematic overview over the ENVI-met model layout (a) with Z the height of the main 3D model, H the height of the 1D model providing the vertical profiles of all model variables for the inflow boundary of the 3D model and D the depth referring to the base of the soil model. Soil properties are modeled separately in the soil model. The soil model is one dimensional except the first grid point below the soil where the temperature is calculated three-dimensional to avoid unrealistic sharp temperature gradients at the surface. (b) The vertical grid layout of the main model is equidistant with the identical vertical extension of all grids except the first grid that is split into five sub-boxes [14].

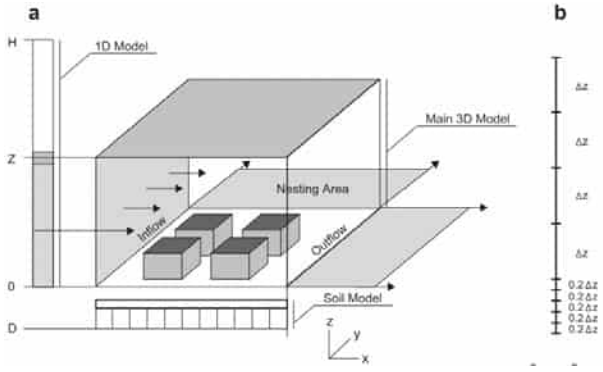


Figure 4. A schematic overview of the ENVI-met [14]

The model area has a simulation size of 100x100 meter with a resolution of 1 m horizontally and 2 m vertically. The average building height is about 8 meters ranging for common two stories school building. For both cases (March 21 and September 23), winds with 0.15 m/s in were used. The relative humidity of the air at the start of the simulation was set to 80% for the first case and to 70% for the second case (See Table 1)

Table 1 Conditions used for the simulations with ENVI-met

Condition	**March 21**	**September 23**
Simulation Time	13:00 UTC +7	13:00 UTC +7
Spatial Resolution	1m horizontally, 2m vertically	1m horizontally, 2m vertically
Wind Speed	0.15 m/s	0.15 m/s
Wind Direction	157.5	157.5
Relative Humidity	80%	70%
Temperature	24.9	26.5
Vegetation	No	No

RayMan 1.2: this program considers outdoor conditions and calculates human thermal comfort. In this research, human comfort was analyzed through the calculation of PET. Several parameters can be added to calculate following analyses, i.e. Tmrt (the most important factor during the hot condition when calculating PET). Using Rayman Tmrt can be also estimated by global radiation (Gr), cloud cover (Cd), fisheye photographs, and albedo [6]. Sky views are also generated to provide a better understanding of the relation between the amount of insolation and thermal comfort. As input for these calculations, personal data (height, weight, age, sex), clothing (clo) and activity (W) are needed. Tables 2 and 3 give the climate conditions and other input data for the simulations [13].

Table 2: Conditions used for the simulations with ENVI-met

Condition	**Value**
Simulation Day	21.03.2018 and 23.09.2018
Geographic data	1070’ E, 70’ S, 768 m, UTC +7
Cloud coverage	0 octa
Personal data	1.75 m height, 75 kg, 35 year-old, male
Clothing	0.5 clo
Activity	80 W

Clothing insulation and metabolic rate activity have used the value of ASHRAE 55 2010 [2]. In this case, clo clause use typical school uniform in Indonesia, 0.42. For the metabolic rate, dancing/social activity took into account as activity value with 140 W/m^2.

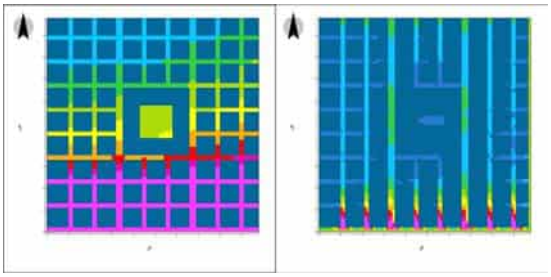
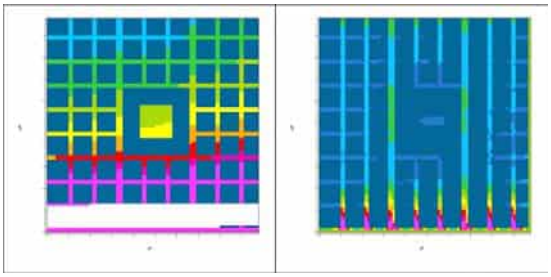
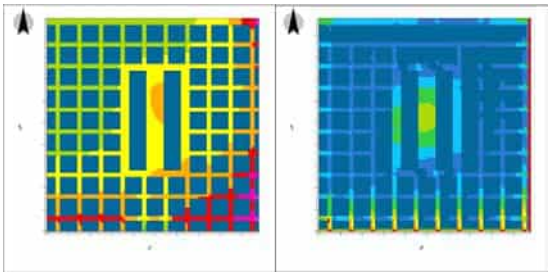
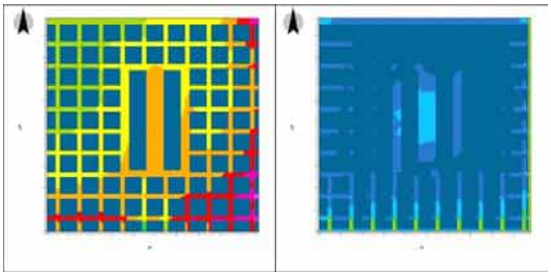
• Results and Discussion

As mentioned above, third forms of school building were simulated for the middle of the longest sun exposed day, i.e. March 21 and September 23. The time selected for the simulation is 13:00 UTC +7 as considered a peak of heating from the school.

Table 3 shows the simulation results of the air temperature and wind speed on March 21 and September 23. On March 21, by comparing these models, courtyard (a) are tended by highest air temperature with about 46.1°C on the reference point. Lowest air temperature is the linear N-S (b) model with about 30.6°C.

According to Table 3, linear N-S (b) have the highest number on wind speed comparing by the other models with 0.6 m/s from the East (86.4). Linear E-W (c) model has slightly below the linear N-S model with 0.5 m/s from the South (180.8). The last model has very different speed among the models with 0.2 m/s from the Southeast (140.6). Furthermore, all of the wind direction is coming from the East to the South. This means that model with an opening on that sides will likely obtaining the wind more often.

Table 3: Air temperatures (left) and local air velocities (right) at 13:00 h on the 19th of June

Simulation on March 21	Simulation on September 23
(a) Courtyard	(a) Courtyard
	
(b) Linear N-S	(b) Linear N-S
	
(c) Linear E-W	(c) Linear E-W

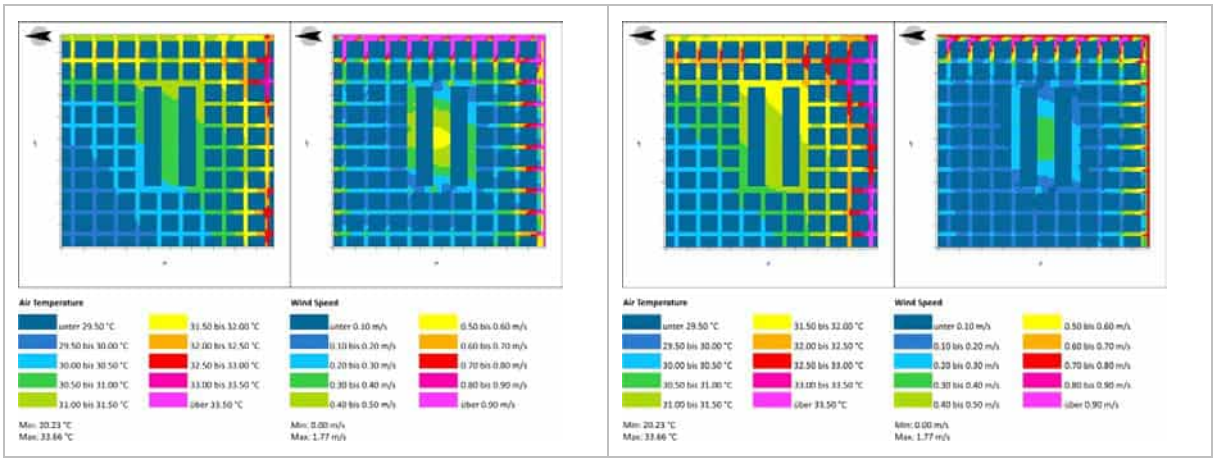


Table 3 also shows the air temperature and wind speed on September 23. The linear N-S model has the highest air temperature with 31.5°C to 32.5°C, whilst courtyard and linear E-W have lower air temperature with 31°C to 32°C.

Nevertheless, the air temperature in this time does not have any relevance to the wind speed. The linear N-S model has the highest number of wind speed at the time with 0.6 m/s from the South (181) following by linear E-W (0.5 m/s) from the East (85.5) and courtyard (0.1 m/s) from the Southeast (143.9). These numbers show that building with the opening on the North or South will obtain more wind than other forms. This is due to the wind direction in Bandung that mostly coming from the East to the South.

Referring to the Table 4, the center of the courtyard model (a) has the highest number of mean radiant temperature on March 21 and September 23 with 74.7°C and 76.6°C respectively. This model is obtained more heat even though its building mass blocked for all direction. On the other hand, linear N-S and E-W have the lower number of mean radiant temperature with about 53°C to 55.9°C.

Table 4: Results for the simulation

Date and Time	Models	**Tmrt (°C)**	**Ta (°C)**	**v (m/s)**	**RH (%)**	**SVF**	**PET**
March 21 13:00	Courtyard	74.74	46.13	0.20	19.94	0.19	64.6
	Linear N-S	53.92	30.56	0.61	43.88	0.46	42.2
	Linear E-W	53.70	30.82	0.51	43.24	0.40	42.1
September 23 13:00	Courtyard	76.58	48.31	0.07	15.69	0.19	66.7
	Linear N-S	55.60	30.71	0.63	38.27	0.46	42.1
	Linear E-W	55.90	30.94	0.50	37.70	0.40	43.5

Mean radiant temperature has a high influence on the physiological equivalent temperature (PET). Table 4 shows that PET values are extremely high with the value above 43°C, especially

for the courtyard model. This is mostly influenced by the Tmrt and the wind in the outdoor space of the school. As the result shown, the courtyard model has the lowest wind speed with 0.20 m/s on March 21 and 0.07 on September 23. The sides of this form are closed and blocked the wind from all direction. The air was trapped inside and exposed by the sunlight all the day so the temperature is significantly increased. Airflow is one of the crucial factors influencing thermal comfort in outdoor spaces [8].

However, the other models of the schools (linear N-S and linear E-W) show the possibility to be applied as a school building design. This is because the opening could let the wind through the open space. The PET results of the simulation still have very hot for thermal perceptions. This case might be balanced with vegetation and material used.

• Conclusion

Three school forms were compared to generate the guideline for school design. Three school forms (courtyard, linear N-S, and Linear E-W) were studied to provide different conditions of their climate. The simulations were used to obtain such data related with outdoor thermal comfort. Mean radiant temperature and wind velocity have a huge impact on the building school form regarding the thermal comfort.

It is shown that linear N-S is tended highest air temperature and wind speed both on March 21 and September 23. This model also has lowest mean radiant temperature along with linear E-W. Considering the physiological equivalent temperature (PET), this model has a good design for thermal comfort for both times.

The linear E-W has slightly difference comparing to the linear N-S model. This model has mean radiant temperature as low as a linear N-S model. This model also has a good value of physiological equivalent temperature (PET).

It can be concluded that school building mass with an opening of its block on the East or West side is more suitable as outdoor space rather than without opening in the tropical climate, especially in Bandung. This opening means to inlet the wind into the space area and reduce heat inside.

• Acknowledgements

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FROM RESEARCH TO CLASSROOM : TEMPORARY SHELTER IN KHON KAEN, THAILAND

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Abstract

Nowadays, rapid development and growth of the economic and social changed the ways of living in the community. For low income people, they try to adjust themselves to survive in this changing world. One of the main problems for this group of people is the lacking of living places. A temporary shelter in a rural area as well as in an urban area is socially a direct solution in responding to their fundamental needs. In the past, in the northeast of Thailand, I-san, a temporary shelter was built to serve a new family, which is financially not ready for a permanent house and for living temporary in the rice field. The temporary shelter can be specified by its temporary materials, incomplete of its functions and built to be replaced by a permanent house in the near future by owner.

This study surveyed 20 temporary shelters in KhonKaen province. These case studies are used to analyze two main topics which are, function analysis and construction analysis. The guideline of this study can be used as basic information for future design of temporary shelters.

Based on the guideline, four groups of students have been designed and built a 2.5 m. x 5 m. temporary shelters. This summer class began with attending lecture series to set up basic knowledge on design and construction. Then, a design competition among students was held. Four different designs were picked for construction detail development. The limitations of the temporary shelter were set by cost, materials, time and number of student participation in each one.

Four temporary shelters have been successfully built in the faculty of Architecture. As a result, the students had the opportunity to deal with real life design and construction situation, facing various problems from designing, to construction, to budget allocation and time frame.

Keywords

Temporary Shelter, Design Built, Architectural Class

1 Introduction

Economic grown affects ways of living in every society. Dwelling is one part that cannot avoid the change. As population rapidly increase, demand for residential becomes very high. Low income people, especially, need to have an affordable living place or temporary shelter when they set up their new family. In the part, a new couple in Isan, north eastern of Thailand, traditionally builds their temporary living place in different ways such as extend from their parents' house, extend from rice storage shacks, build a temporary shelter, etc. In addition, a temporary shelter in I-san also is also used for other purposes such as for staying overnight in the rice field during the harvest season or for workers' temporary living shelter in construction sites.

The Isan House [1] is divided into 3 types, which are HaunYai (a big house), Toob (a cabin) and Tiang Na (a temporary shelter for farmers). Srisuro [2] categorized an Isan House to be a permanent house, a semi-permanent house and a temporary house. A temporary living place is traditionally built to serve low income people, a new family or a farmer in Isan for a long time. Purposely, temporary shelters in Isan community are built to serve their basic needs. Most of their shelters lack the knowledge base in functions organization, construction materials and process, environment effects and others. The low-income people are a big part of I-san community. They live both in urban and rural area. Therefore, their living places, temporary shelters, should be in concern before they cause more problems to their surrounding and within the shelters themselves.

From reviewing case studies within Thailand and other countries, it has been found that temporary shelters for low income people or people in disaster area normally use low cost local materials and have a limited space for serving users' basic needs only. [3] [4] [5] [6] [7]

Recently, Thai government takes more action in community development. There are a number of studies and projects organize or fund by the government proposed to study and improve a quality of living for poor people. [8] [9] [10]

This research proposes to collect information of the temporary shelters, then use this information for analyzing and building a design guideline of temporary shelter for the Isan community.

Base on this survey research, the architectural students in the summer class at Khon Kaen University, Thailand, had developed their ideas from sketching to building the shelters. The objective of the course is to help the students understand the process in designing and building a temporary shelter by themselves.

2 Research on Temporary Shelter in Khon Kaen, Thailand

The research focuses the study on temporary shelters in Khon Kaen province located in the north eastern of Thailand. (Figure. 1) Twenty shelters in the urban and rural area were surveyed for their user information and architectural information. The user information includes number of occupancies, age, etc. The architectural information includes building materials, space and function. (Figure. 2) The information was then used for analyzing.

The conclusion of this research guided to a prototype shelter, which suit the simple need of low income people.

Figure 1. Map of KhonKaen, Thailand

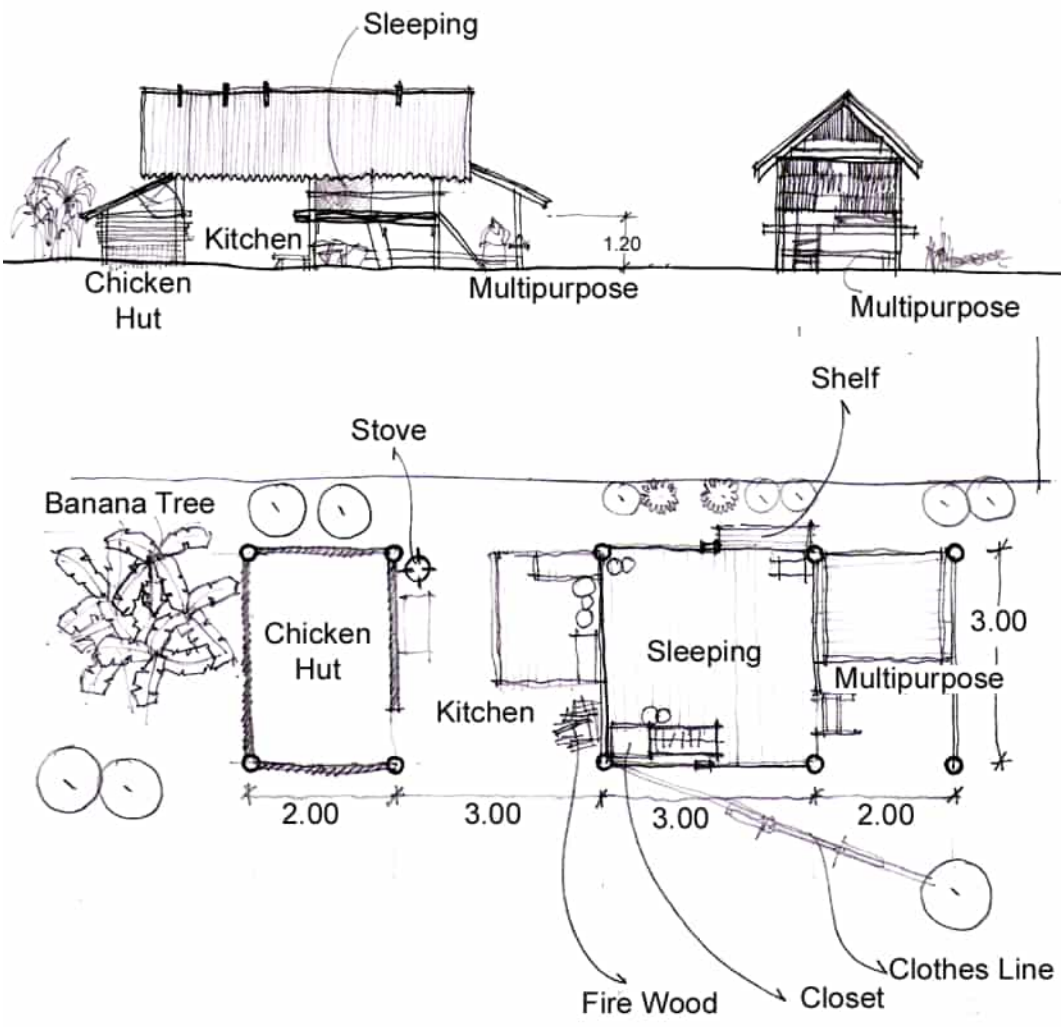

Figure 2. An example Sketch from the surveys

3 Information from the Surveys

3.1 Users

From the surveys, it showed that each shelter is occupied by 1-3 people. Each family has an income around 50-300 bath per day or 1500 – 9000 bath per month. They are considered as a low-income people in Thailand.

Most of shelters have been occupied for 4 months to 3 years before they build permanent houses. Those shelters older than 3 years were renovated at least one time. The family members and relatives are built the shelters by themselves.

3.2 Functions and Space

Space within the shelter mostly includes a multifunctional space and sleeping space. These two main spaces are close to each other. In some shelters, these two spaces are divided by furniture or curtain. The multifunctional space is used as family gathering and dining. This

space is connected directly to the front door of the shelter. A kitchen and other facilities are either attached or separated from the shelter. The toilet is built separately from the shelter.

Most of the shelters from the survey are one story, which raised the floor about 0.60 m. from the ground for a multipurpose and sleeping space. The attached kitchen is mostly on ground. (Figure. 3)

The three main function area of the shelter, multipurpose, sleeping and kitchen can be compared as showed in the fig. 3. It has been found that the sleeping and multipurpose area is about 6 sq.m. (2.3 x 2.6 m.) , while the kitchen area is about 5 sq.m. (2.0 x 2.5 m.) Thus, the shelter has an average area of 12 sq.m.

3.3 Materials

The materials used for the shelters are mostly recycled materials. The wall is part of the shelter that used various different materials combine. Some shelters use 3-5 recycled materials for their walls, which included wood, fabric, plastic, grass, bamboo, etc. Columns and beams of the shelters are mostly recycled hard wood, while the cheap soft wood becomes more popular lately. Materials for the shelters' roofing are cement tile, corrugated iron, and grass. The corrugated iron and grass are the most popular ones.

Figure 3. Case Studies from the surveys

4 Shelter Prototype

From the surveys, it can be concluded that sleeping, multipurpose and kitchen are the three main functions for the shelter. The relationship of these three functions can be drawn as Figure. 4. The toilet is separated from the shelter. This information is used for planning a shelter prototype for this area.

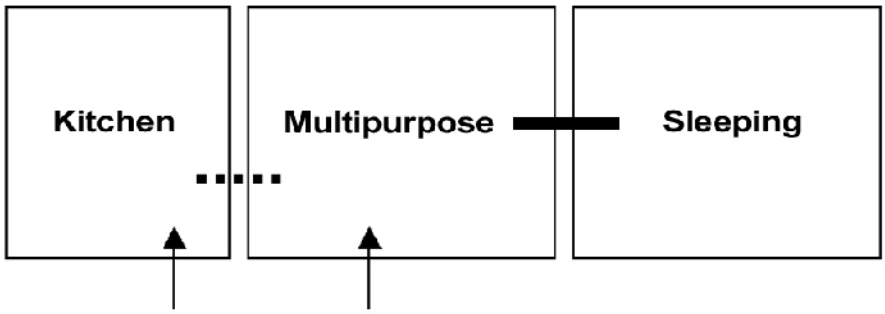

Figure 4. Function Relationship of the shelter

For the prototype, the multipurpose and the sleeping area are designed to be 2.5 x 2.5 m. and raised 0.60 m. from the ground. These two areas are divided by curtain or furniture depending on the users. The kitchen is an open space attached to the building and sited on the ground.

The building materials for the shelter varied from case to case depending on the budget and materials available in the area. However, the main structure should be more permanent than the other parts. The cement tile or the corrugated iron is suggested for the roofing materials. The shelter can be varied depend on the users.

5 Process of the Studying

The study begins with the lecture of basic knowledge for designing, construction drawing, cost estimation, construction materials, and case studies of temporary shelters.

Then, students have a chance to show their idea of designing the temporary shelter base on the specific requirement which has to included 2 main spaces, multipurpose space (2.5 X 2.5 m.) and sleeping space (2.5 x 2.5 m.). The shelter requires to use local and recycled materials with minimum budget of 8,000 bath. Students had one week for researching and presenting their design before showing their idea to the class. After their presenting and discussing, instructors selected 16 works based on students and teachers vote.

8 Proposals were selected for further development. The students had to be equally grouped with the one that they like to develop their idea with. These 8 groups had 2 weeks to re-design the temporary shelter. The final products for this round were plan, elevations, section, perspectives and physical model. Students had to present their idea to the instructors, who made the decision to select 4 works for the final round.
Finally, 4 works were selected for real construction. The students had to re-group again. However, the groups that were not selected had to join the new group based on their

interest. These 4 final works had to be re-designed base on the commendation of the instructors. Each group had to do a small research of materials selection that was available in local and suitable with the budget. Moreover, they had to look for recycled materials that possibly match with the shelter design. The basic function and building structure were developed along with the management of time schedule. After one week, each group had to present the final idea to the instructors before starting the actual construction process. (Figure. 5)

Figure 5. Students present their final idea before construction process

For the first step of construction, each group selected the location within the faculty of architecture for the construction site of their shelter. The selected site had to suit with the design. However, the environment or nature had to be minimum disturbing. The local and recycled materials were surveyed for their availability and price.

The construction works were managed based on each member's skill, time and interested. Some students took different summer classes. Therefore, each group had to set up their time schedule for each member. Teachers regularly advised, questioned the process and provided the budget for each group.

Finally, after the students finished their shelter construction, they had to present their works to the instructors and invited guests. The presentation includes the design concept, materials selection, construction process, budget management and problems solving.

The final works are opened to the public and used as case studies for architectural students before dismantling and reuse part of the materials for other temporary shelter in the future.

6 Learning from Shelter Construction

6.1 Design

The design process is the most important for architectural students. However, for other design classes the student ended up with presentation product such as plan elevation, section, perspective and model. The different is that the final product for this class is real construction work. The students have to concern more with the design process. Each detail and idea has to answer with the real life situation. This class purpose is to simulate the small version of architectural design that the students will face in the future. Each student has a

chance to show their design idea in the competition and learn how to share their idea with others when they have to develop the product together. The final designs are presented in different way with their regular studio classes. Importantly, since this class is a free elective course, different level and different majors of students were able to enroll and got a chance to work together. This class included in student from 2nd to 4th year and student for the Department of Architecture and the Department of Industrial Design. So, they can share different experiences in the class.

6.2 Materials

Although, the temporary shelter compose of less materials than other building that students study in design classes, but the students have to learn how to build by themselves instead of relying on building by construction workers. Moreover, the students in the class are forced to concern with local and recycled materials under limited budget. (Figure. 6) Firstly, students checked for used materials available in their daily lives and then they looked for recycled materials from stores or expecting places that can provide them the materials.

Figure 6. Local and recycled materials selected for the shelter construction

6.3 Cost Estimation

In the process of architectural design, cost estimation is one of the key factors that architect has to be concern about. However, in the classroom, it is not easy to teach architectural students in cost control for their design. This class provides a good chance for the students to carefully manage their budget. They have to know materials price and availability before they continue design. Decision making in the group were set up with information of each cost from their surveys around the city. The teachers helped providing some information and parts of the materials transportation. Importantly, the cost estimation has to approve by the instructors before the student could purchase them for construction.

6.4 Construction Management

The design product of each group is discussed and planned for it construction. One class was set up aside for this topic solely, even though some students, the 4th year students, have taken the class already. The class taught construction management in general and included specifically, “construction management for the temporary shelter” which the students will have to deal with. The students have to manage their time, their budget, their materials and their workman to suit their design. They have to record and take photos of their daily works.

Each group has to set up the team leader who has responsibility to report the group's work to the instructors. The time schedule for the works was rechecked by the instructors.

6.5 Construction Work

Two classes were taught about construction works including case studies that purpose was to give the students a wide idea of the construction work specifically for small and temporary building. The structure is the issue that the student had a good chance to test their theory. The process of learning by doing teach them from their daily works. (Figure. 7) Some groups founded that their structure had to redesign after they composed the elements of materials together. Some students had their experience in doing job that they have never done before. This lesson provides the student with the understanding of post design work greatly.

Figure 7. Students learn from their daily construction works

6.6 Team Work

Finally, "Team Work" is a big lesson for architectural students. From the beginning the students have to learn to accept the result of the competition and respect others' idea. They have to know their member skills and learn how to put the right one on the right job. The team work opportunity of this class is different from their regular classes because the architectural students have a small chance to work and design with the team members in different levels from 2nd year to 4th year students, which in real practice, working in the field will have to face much more different background members.

7 Conclusion

7.1 Research

From the survey research, it found that the temporary shelters in Khon Kaen are built to serve a basic need for living with a limitation of budget and space. The shelter's functions are limited to be three main parts, which are multipurpose, sleeping and kitchen. The toilet is built separately from the shelter. The multipurpose and sleeping space has very close relationship, while the kitchen is attached to the shelter but has less relationship with the other two main functions. The materials are the obvious part that identifies its temporary used. The wall is the part of the shelter that has more mixed recycled materials than other parts, while the columns and beams used more permanent materials.

Also, this study proposed a prototype shelter that can be a beginning point for low income people to build a simple place for living. The prototype shelter aims to improve a comfort situation within living space by introducing a cross natural ventilation to the room and under the shelter. Furthermore, the prototype proposes to provide a standard safety structure for temporary shelter, which is found in less concern from the case studies. The owner can add more space or materials later on to support their individual needs. This prototype can be used by a related government unit for building a temporary shelter for the poor or for people in disaster areas.

Finally, although the information of this study is based on the shelters in Khon Kaen area, it can be a guideline for study in related topics for another area, especially in the North Eastern part of Thailand or Isan.

7.2 Classroom

After this summer class, the four temporary shelters (Figure. 8) are presented to the public for sharing the knowledge as case studies of simply built structure. The students of the class gain one of their experiences of working on one small architecture from the beginning to final construction. This will teach them a numbers of lessons which they can apply for other classes and for their professional works in the future. However, to set up this class, there are a few problems to face. Firstly, the budget managing for the class is different from traditional ones. So, it took time for the process of paying that delayed the budget providing for the students to buy their materials. Secondly, some students took different classes during the summer, so they had a hard time of managing their time to suit others. Finally, there were expected team works problems that instructors have to carefully give and advise. However, this class showed another way of teaching architectural student within the campus. The class teaches the students a numbers of lessons in architectural design and construction process before they will design and build a small building for the community in the future.

Figure 8. Four final shelters

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THE EFFECT OF RAPID URBANIZATION ON THE PHYSICAL MODIFICATION OF URBAN AREA

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Abstract

Today rapid urbanization is a major challenge for many cities. In 2007 urban population started to exceed the rural population. Increasingly, scholars and governments discuss the effects of this trend on future development of cities. It is obvious that any kind of urban development should be controlled and regulated, otherwise the outcome could lead to a chaotic and unsustainable development. Besides, it may result in environmental problems like air pollution, heat islands, urban climate and etc. Unfortunately, this kind of physical modification practically have not been considered by the planners and designers.

The current study is grounded on recent literature review and tries to concentrate on this problem mainly from the development and construction performance perspective. Moreover, the current study attempts to classify the effective variables under the urban form, urban geometry, and urban population.

Keywords

Urban Form; Urban Material; Urban Population; Sustainability; City Planning

1 Introduction

The world urban population for the first time in 2007 exceeds the rural population. The United Nations (2015) based on the current trend believe that by 2050 about two third of the world population will live in the urban area [1]. Besides anything else, the economic growth itself contributes to the increase of the urban population and associated with the urban development too. It is obvious that any kind of urban development should be controlled otherwise the outcome could lead towards a chaotic and also unsustainable development.

Unfortunately, especially in developing countries due to the rapid population growth, cities developed without a planned and regulated development policy. Obviously, this sort of

developments has several severe negative effects, which somehow are solved by engineering, medicine, agriculture and etc. However, the physical impacts like urban climate, air pollution, Urban Heat Island (UHI) etc. practically have not been considered by planners especially at microscale [2].

Fundamentally, dozens of variables include geographical location, regional meteorology, urban morphology, surface materials, vegetation/water bodies, human activity, and etc. are responsible for the physical implication in the urban area [3, 4]. The current study based on contemporary literature tries to figure out the effect of these variables on the physicals modification of the urban area. Apart from that, unlike any other study, in this study, the main concern is microclimate and neighborhood scale.

This study aims to explore the role of urban development with a focus on the microclimate and the neighborhood level to the physical modification of the urban area. Therefore, firstly recent transformation of the urban area considering the role of the modern built environment is discussed. Secondly, dimensions for the physical modification of the urban area are discussed. Afterward, the association of these dimensions are represented by the physical modification of the urban area.

2 The urban development and role of the built environment

In the current era, the increase of population and demand for housing etc. rapidly increase the construction of buildings inside the cities and spreading outwards the boundaries of cities. As a consequence, the *hard* surface of construction materials such as concrete, street pavement, roof material and etc. are expanding and replacing natural surfaces and green areas.

However, the transformation of the natural surface into construction platforms such as modern built environment has several negative impacts on the existing thermal balance. When vegetation and green surface is minimized and large surfaces are covered by rough and less permeable surfaces, it contributes to the decline of evaporation and increases the heat storage as the construction surfaces e.g. are not dense as the natural surfaces [5]. Moreover, the notable amount of solar radiation is stored by construction material with rough surface, dark color and less albedo [4, 6, 7, 5, 8].

This situation directly influences the overall air ambient temperature of the urban area. As a result, the urban area becomes warmer in comparison to the surrounding area. At the moment, this phenomenon is well-accepted and known as Urban Heat Island (UHI) effect (Figure 1). The UHI clearly defined as a temperature difference between the urban and rural (ΔT_{u-r}) areas [2, 6, 9].

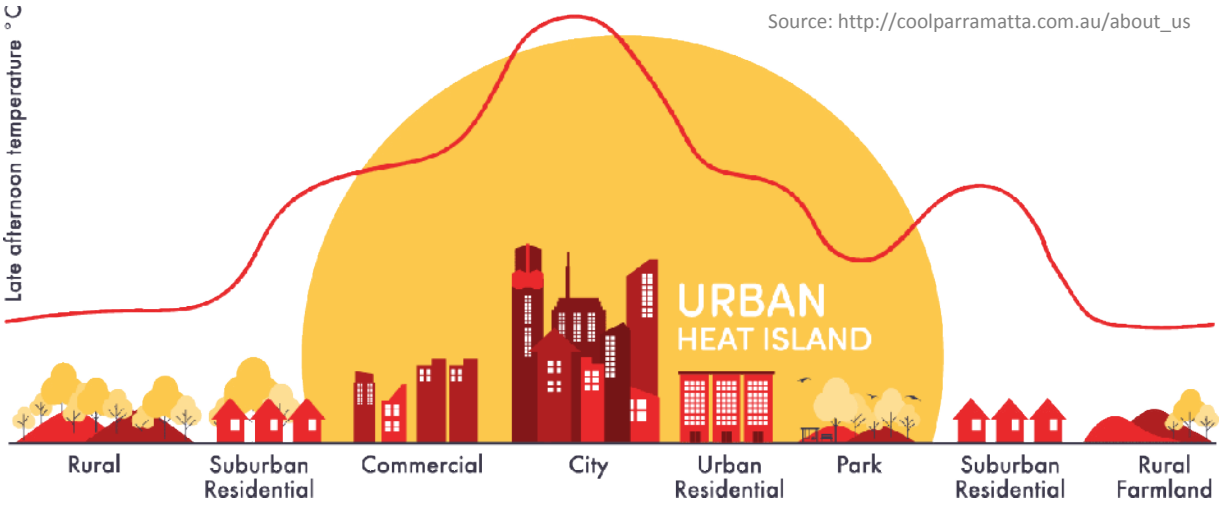
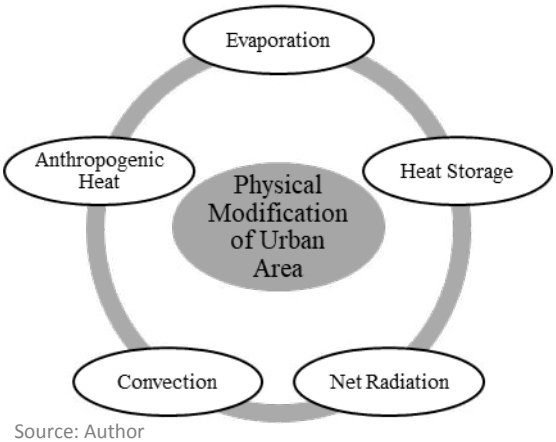


Figure 1. The effect of Urban Heat Island (UHI)

As stated before, the wide range of the natural and the man-made factors include seasons, cloud cover, wind speed, sunlight, urban canyon geometry, surface material, anthropogenic heat, and etc. are responsible for emerging of this phenomenon.

Up to now, countless studies consider this issue from different perspective, for instance Dimoudi & Nikolopoulou (2003) and Leuzinger, Vogt & Körner (2010) consider the vegetation impacts on urban environment, Taha (1997) consider the material, evapotranspiration and anthropogenic heat, Stone Jr. & Rodgers (2001) study on form of city and urban design and Jamei, Rajagopalan, Seyedmahmoudian, & Jamei (2016) review the impact of urban geometry on outdoor thermal. Unlike all of them, the current study firstly grounded on the primary physical properties – Evaporation, Heat Storage, Net Radiation, Convection and Anthropogenic Heat – which are represented by Gartland (2008). Secondly, the main concern for this study is the microclimate and the neighbourhood level.

According to the Gartland (2008), reduced evaporation and convection from one side, increased heat storage, net radiation, and anthropogenic heat from another side tremendously influences the physical modification of the urban area [10].



Source: Author

Figure 2. The energy balance and the physical modification of the urban area

The above given dimensions (Figure 2) together represent the energy balance equation Eq. (1) too. The terms of energy balance in this topic represents the transformation of energy on the earth. In other words, based on the first law of thermodynamics, the energy never

created nor destroyed. While, it can be transferred from one location to another or it can be converted from one form to another form of energy.

Net Radiation + Anthropogenic Heat = Heat Storage + Convection + Evaporation (1)

To have a better insight into the energy balance and association of it with physical modification of the urban area, each of its dimensions are explained below.

2.1 Evaporation

The evaporation process is responsible for transforming a liquid into a gas form. In the atmosphere the available water on the wet surface, runoff, moist soil, and etc. by sun heat is converted into the vapor. Within this process, the sun's energy from the atmosphere transmitted to the earth surface. Whenever it collides to the wet surface, it turns into the vapor. The evaporation increases when the moisture and the fast wind available. The evaporation intensified in the warm-dry climate condition. Loss of evaporation results in increase in the heat storage capacity during the day, and then the stored heat is released at night. Therefore, the loss of evaporation can turn the construction platform into a place for the energy store [5, 10].

2.2 Heat Storage

The ability of the substance to absorb an amount of heat to increase its thermal temperature, known as the heat capacity. Therefore, a material with a high amount of heat capacity can store more amount of heat. Of course, the role of thermal conductivity is also important to measure the physical ability of the substance to transfer the heat by its molecular motion [11].

The heat storage with moisture has an inverse relationship too. In fact, the construction material which is minimized on the wet surface has negatively effect on physical modification of the urban area. In addition to that, most of the building material has good thermal conductivity and storage capacity. In simple word, the material with high thermal conductivity quickly transfers the heat inside itself, and if the material has the thermal capacity it can store more amount of heat in its body [10].

2.3 Net Radiation

The net radiation on the earth surface is shaped by following four distinct radiations: 1) The solar radiation is an amount of the energy radiated from the sun. The solar radiation can be affected by metrological properties such as season, cloud cover, air pollution, and etc. 2) The solar reflectance (albedo), the amount of solar energy reflected from the surface is the solar reflection. The amount of solar reflectance is highly dependent on the surface materials. 3) The atmospheric radiation is an amount of the heat emitted by particles in the atmosphere. A warm atmosphere with the dense particles contained more energy to emit. 4) The surface radiation is the heat radiated from a surface itself. The surface radiation highly depends on the temperature of the surface and its surrounding [10].

In the urban area, dark-colored materials include road, roof, pavement and etc. are minimized on albedo. Besides that, the urban geometry and level of air pollution as a catalyzer are contributing to increase of the amount of net radiation in the urban area.

Based on the given statement, it can be expected to see a high amount of net radiation in an urban area in comparison to the rural context.

2.4 Convection

The convection is a vertical interchange of the energy. It can occur in the liquid and gas forms. The convection can be intensified in the high wind speed and the turbulent air over the rougher surface. It can be intensify too when there is a temperature difference between the surface and the air [10, 11]. It is interesting to know, the physical modification of the urban area like emerge of the UHI phenomenon can be intensified in the calm and clear meteorological context. For instance, loss of air turbulence increases the heat capacity in the daytime. Apart from that, the urban geometry significantly contributes to the air turbulence and wind speeds. It can be stated that an urban area is responsible for decrease and increase of the convection [5, 10].

2.5 Anthropogenic Heat

It is mainly released as result of the human indoor/outdoor activities. The source of it can be found in many urban and rural contexts. The primary sources for the anthropogenic heat release are the heating system, the engine combustion, the creature's metabolism, and etc. [2, 10, 11, 12]. The human activities significantly contribute to the release of the anthropogenic heat [10]. Apart from that most of these activities are located in the urban area [13]. In this sense, Marsh & Grossa (1996) believed that population density from one side and the land-use from another side are important parameters for the amount of anthropogenic heat. Based on their own study in the urban area the amount of the particulate matter was five times higher than the rural and at least three times greater than the suburban area [12]. Furthermore, the traditional study concludes that the gains of anthropogenic heat in the winter is more than the summer. Unlike, the recent study found that the air conditioner dependency can intensify the gains of anthropogenic heat in the summertime [10].

3 Discussion

The current explanatory study in its own scope figures out that, the unmanaged rapid urban development is mainly responsible for the physical modification of the urban area. This modification can vary from urban climate, air pollution, UHI and etc. So far, several studies have focused on the buildings, materials and/or regional scale, while there is no agreed method and tools to examine the physical modification at the neighborhood and/or the microclimate scale.

For instance, most of the regional study scale done by the use of remote sensing data technologies. Likewise, different programs based on the study objective developed for the building scale. However, this situation is different for the neighbourhoods and/or the microclimate scale. Lack of a comprehensive method for measurement makes process complicate. Therefore, most of the study try to use specific dimension for their study and they offer their own model. Of course, recently some institutes and communities started to develop the program such as Envi-Met and Grasshopper plugin. However, these programs are at begging or trial stage. Apart from that, mostly able to study in specific dimensions,

while the physical modification of the urban area at local scale has several dimensions and this provides a great challenge to cover all of them [3].

Therefore, to solve this problem, based on the energy balance equation Eq. (1) the following criteria should be considered for assessing the modifications of urban areas: *The Urban Form*, *The Urban Material* and *The Urban Population*. The given dimensions are highly associated with the energy balance equation Eq. (1) and any modification on each contributes to the physical modification of the urban area.

Urban Form

In the urban form to define a space, the building used as a wall and the street used as a floor. The repetition of these elements together creates the urban form [2, 6, 11, 14]. The urban climatologist tries to classify the form of city based on the buildings height, street width, density and scale of the local neighborhood. The combination of these elements from one side contributes to the loss of longwave radiation at night time and from another side increase the solar absorbance at daytime. Apart from that, the urban form significantly contributes to modification of the airflow and wind speed [2, 3, 15, 16].

Furthermore, the height of building and width of street together define the aspect ratio and sky view factor (visibility of sky as a fraction from the middle of the street). This is an important factor to adjust the amount of solar radiant penetration. Moreover, the street orientation itself significantly associated with the solar radiation and air movement [3, 6, 15]. The following Figure 3 provides a better vision to the urban form.

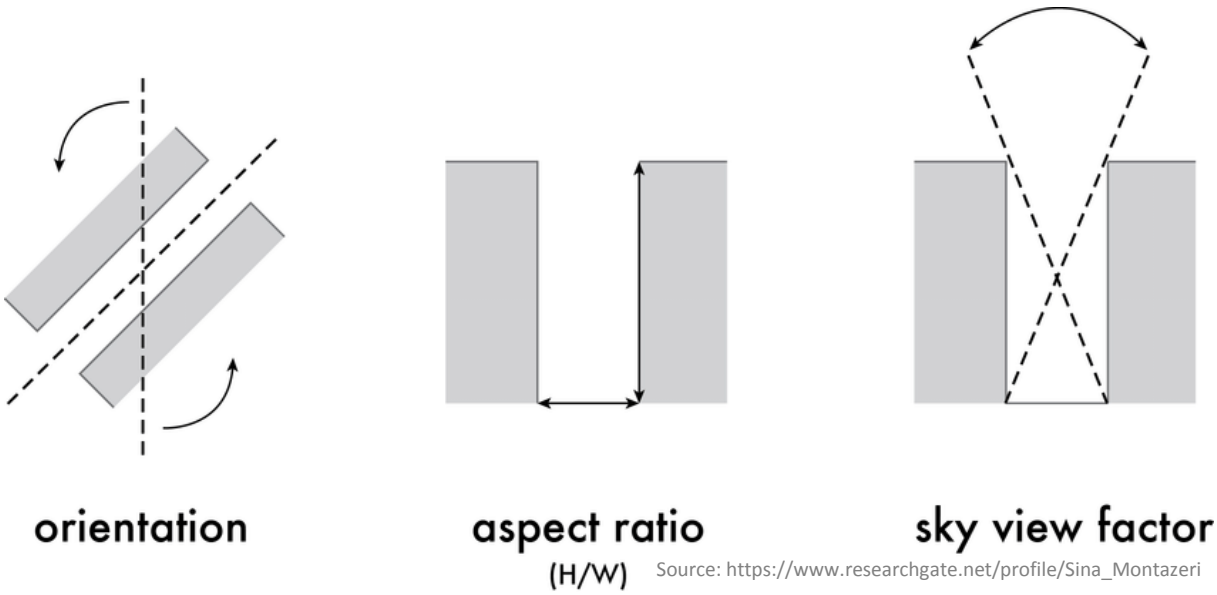


Figure 3. The Urban Form

Urban Material

The urban material includes the pavement, roof and wall are usually applied by the architecture due to various reasons like cost, durability, appearance, and etc. Certainly, each of these materials has a specific influence on the urban hydrological and the thermal balance. Furthermore, the physical modification of the urban area at microscale is dependent on the absorptivity and the thermal admittance of the surface [15].

According to the Akbari, Pomerantz, & Taha (2001), the thermal energy balance can be efficiently adjusted if the high albedo material and soft surface include the plant and the vegetation applied in the urban area [17]. From another point of view, the surface material changes are cost efficient since the new material can be easily applied to the current structure. Apart from that, with the new technology architecture is not limited to white color because the new material is modified high reflectivity and emissivity too [16].

The Urban population

As stated before head, the main source of the anthropogenic heat is human activity, the majority of this activity is located at the centre of the urban area too [12]. Therefore, population growth means increase of the number of the consumer which contributed to release the high amount of the anthropogenic heat. Apart from that, the population growth requires new towns. In this situation, if new construction irrespective of the urban form and materials developed, it can be negatively affected due to the physical modification of the urban area.

4 Conclusion

This study based on the contemporary literature tries to figure out the relation of the rapid urban development with the physical modification of the urban area. In this sense, the current study found that un-controlled urban development responsible for the physical modification of the urban area includes urban climate, air pollution, UHI and etc. Moreover, the current study believes that, majority of the study consider the physical modification of the urban area on regional and/or building scale. Therefore, a lack of microscale study is latent. On the other it is believed, that the microscale is an effective scale which contributes to the physical modification of the urban area. However, lack of appropriate methodology from one side different variables and aspect from another side made it impracticable. This study based on the energy balance equation tries to make an attempt to assess the physical modification of the urban area by considering the urban form, urban material and population.

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ARCHITECTURAL DESIGN OF BIG LECTURE HALL IN RELATION TO THERMAL COMFORT

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Abstract

The paper is focused on the architectural design of big lecture hall which considers the requirements of thermal comfort. Thermal comfort in big university lecture hall is usually provided by heating and ventilation systems. Reconciliation of architectural design with the requirements of heating and ventilation systems is inevitable for ensuring the thermal comfort of students. Detailed analysis is devoted to the process of harmonization of architectural design with thermal comfort in big university lecture hall. Ensuring the optimal parameters of the thermal comfort is immensely important for the students in the interiors of a university. Fulfilling these parameters is inevitable not only from the physiological point of view but also for achieving the desirable students' performance. Experimental measurements were carried out in the winter season in 2016 in the big lecture hall to evaluate the thermal comfort. The device Testo 480 was used for the measurements. Obtained values of air temperature and air relative humidity are presented in the charts. Architectural design and heating and ventilation systems of the big university lecture hall were evaluated based on the parameters of the thermal comfort. The conclusion of this paper presents the fundamentals of architectural design of big lecture hall in relation to designing the heating system.

Keywords

Architectural design, thermal comfort, heating and ventilation systems.

1 Introduction

Many important requirements are put on architectural design in big university lecture hall. Requirements ranging from aesthetics to comfortable seating for students with the right visual and audio contact must be fulfilled. Requirements of thermal comfort must not be forgotten. Harmonization of architectural design with requirements of thermal comfort is inevitable from the students' point of view. Ensuring the optimal parameters of the thermal comfort is immensely important for the students in big university lecture hall. Fulfilling these parameters is inevitable not only from the physiological point of view but also for achieving the desirable students' performance. Thermal comfort in the big lecture hall is defined as the state of mind that expresses satisfaction with the surrounding environment. The fundamental quantities for the evaluation of the thermal comfort are internal air temperature, operative temperature,

globe temperature, air relative humidity and air velocity [1]. Then, the thermal comfort is evaluated with index PMV (Predicted mean vote) and index PPD (Predicted percentage dissatisfied) [2], [3]. Not fulfilling the parameters of the thermal comfort in the big university lecture hall contributes to the high sickness rate of students, especially in the winter [4], [5]. Heating and ventilation systems take care of ensuring the thermal comfort in big university lecture hall. If parameters of the thermal comfort do not meet the required values, it is not possible to expect students to concentrate and perform well. Local thermal discomfort is created quite often and it (the thermal dissatisfaction) can also be caused by unwanted cooling or heating of one particular part of the body [6]. The most common cause of the local thermal discomfort is the draught, but local discomfort can also be caused by an abnormally high vertical temperature difference between head and ankles, by too warm or too cool floor, or by too high radiant temperature asymmetry. People are most sensitive to radiant asymmetry caused by a warm ceiling, a cool wall (windows, glazed facade), a cool ceiling or by a warm wall. The most common cause of not fulfilling the parameters of the thermal comfort and creation of local thermal discomfort is disharmony between architectural design, and heating and ventilation systems in big university lecture hall.

2 Analysis of Architectural Design of Big Lecture Hall in Relation to Thermal Comfort

The architecture of space of big university lecture hall is influenced by many factors. Forming of interior belongs to the most important factors in order to enable students to sit in step seating for high-quality visual and audio contact with the lecturer. Forming of ceiling construction belongs to them because of high-quality acoustics. Next, interesting high-quality seating for students belongs here as well. Finally, colourful and material design of all the walls' surfaces belong to these most important factors. Very important are also high-quality audio-visual technology, socket and internet connection for each student. Besides these factors, the most important one is to ensure the thermal comfort and to exclude the creation of local thermal discomfort. The thermal comfort in big university lecture hall in Central and Western Europe is quite often ensured by the combination of heating and mechanical ventilation systems, combination of heating and air conditioning systems or air conditioning system. Very important is to harmonize the architectural design with the requirements of technical systems ensuring thermal comfort.

Mutual interaction between architectural design and technical systems ensuring thermal comfort was analysed in detail. The combination of heating and mechanical ventilation systems was chosen from technical systems for the analysis. Since big university lecture halls have step floor, the convective heating elements are used which are placed on the flat part of the lecture hall, where the screen is located, and lecturer stands. Such example is lecture hall in the area of the Institute for the Care of Mother and Child in Prague showed in Figure 1. Placement of white panel radiator on the significantly claret wall creates a distinct contrast that brings life into the interior. Another example is big university lecture hall of Czech University of Life Sciences Prague showed in Figure 2, where large double panel radiators are located on the flat surface near both external walls. Architecturally, the lecture hall is located partially out of the building; therefore, it has two external walls allowing natural lighting from two sides. In this case, the heat losses are bigger; therefore, panel radiators were placed on both external walls and along the entire length of the flat surface. Since it is a bigger amount

of panel radiators, it is appropriate that their colour is similar to the colour of the background – walls.

Figure 1: Lecture hall in the area of the Institute for the Care of Mother and Child in Prague

Figure 2: Big university lecture hall of Czech University of Life Sciences Prague

Another alternative is the placement of convective heating elements onto the front wall under the board or under the screen. Such placement fits into big university lecture hall which is built-in into the building and thus it does not have external walls. Such example is big university lecture hall showed in Figure 3 [7], where continuously long panel radiator is placed under the screen. Since panel radiator is very large and long, the white background is suitably chosen together with the white screen to match the colour of these elements and not to be distinct. The length of panel radiator is suitably chosen to match the length of the screen which also contributes to its ability to blend with the environment. By this design, it was achieved that the dominant position of big panel radiator was softened. A similar example is university lecture hall of the University of Pardubice showed in Figure 4, where two individual heating

elements are placed under the board or screen. This university lecture hall is also built-in into the building; therefore, it does not have external walls. Although heating elements have a central location they blend with a white wall on which they are placed on.

Figure 3: Big university lecture hall with dominant position of panel radiator

Figure 4: University lecture hall of the University of Pardubice

The individual category is created by big university lecture halls in which the heating elements are placed directly under the windows in an elevated position. These are the lecture halls which are partially outside of the building with two external walls. Such example is big university lecture hall of Justus Liebig University Giessen showed in Figure 5. Placement of single panel radiators is on the wall under the windows but since it is in high height above the students' viewpoint it is not disruptive. The matching backgrounds – almost identical colour of the wall with the colour of panel radiators help to achieve this. The big advantage of this

placement is energy efficiency because panel radiators directly eliminate heat losses mainly created by big windows. A similar example is big university lecture hall of Faculty of Pharmacy of the Comenius University in Bratislava showed in Figure 6, where heating elements are placed in an alcove of an external wall under the windows. The lecture hall underwent a reconstruction during which the placement of column radiators was not changed. Heating elements are covered by strips of cladding, which is not very appropriate. This way, the major part of the heating power of column radiators is lost which causes significant residual energy losses. Todays' heating elements have such a design that it is not needed to cover them.

Figure 5: Big university lecture hall of Justus Liebig University Giessen

Figure 6: Big university lecture hall of Faculty of Pharmacy of the Comenius University in Bratislava

Another interesting and inspirational example is big university lecture hall of the Department of Informatics of Technical University of Munich showed in Figure 7, where panel radiators are placed into small alcoves inside external walls. In panel radiators, the height prevails over the depth which is identical with the depth of a stair. Such shape of panel radiator enabled their placement along the entire external wall in a stepwise height shift as showed in Figure 7. They create interesting elements in the external wall and form the modern atmosphere in university lecture hall.

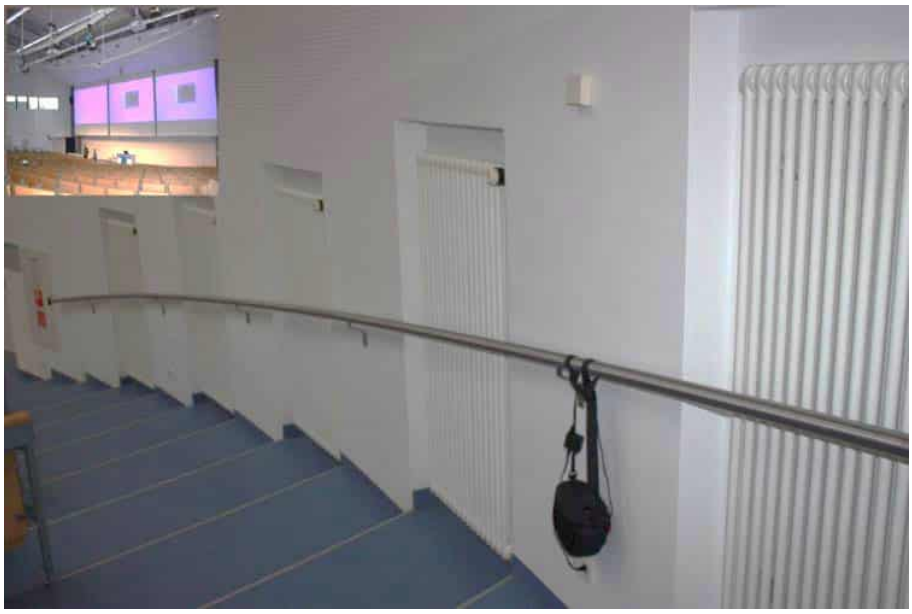

Figure 7: Big university lecture hall of the Department of Informatics of Technical University of Munich

3 Research of Thermal Comfort in Big Lecture Hall in Relation to Architectural Design

Research of thermal comfort in big university lecture hall in relation to architectural design continued with measurements. Experimental measurements were carried out in the big university lecture hall – Figures 8, 9 at the Slovak University of Technology in Bratislava, Faculty of Architecture at the beginning of March 2016.

Figure 8: Big university lecture hall of Slovak University of Technology in Bratislava

Figure 9: Big university lecture hall with the column radiator

3.1 Methodology of Research

The aim of the measurements was to record the parameters of thermal comfort: air temperature, air relative humidity, air velocity.

The measurements were carried out in the big university lecture hall with the sizes 15.7 x 14.4 m and with the height between 3.9 and 5.9 m in the centre of the room in the height of 1.1 m above the floor level. The big university lecture hall is partially placed into the ground; it is heated with two large column radiators located on both sides covered by the decorative slats in its deepest part - Figure 9; it has new quality wooden windows with interior shielding. The measurement was carried out without mechanical ventilation in its first phase and with mechanical ventilation in its second phase, Figure 10. Sixty-four students participated in the

Figure 10: The measurement in the centre of the room in the height of 1.1 m above the floor

measurement. During the measurement, students performed the activity with the metabolic rate of 1.0 met and clothing insulation was 1.0 clo. Mechanical ventilation unit of type BKL-KD was in operation during the second measurement of the second phase. Mechanical ventilation

unit does not contain humidification component. Therefore, the air treatment was not complete. The measurement was carried out from 8 to 9:45 in the morning during ordinary lectures. The parameters of the thermal comfort were recorded with the device Testo 480. Outdoor air temperature and air relative humidity were measured and recorded by the separate device. Outdoor air temperature increased from value 9.8 °C to value 11.5 °C during the measurement. Outdoor air relative humidity decreased from the value 83% to the value 74% during the measurement.

3.2 Results and Analysis of Research

Figure 11 shows the values of air temperature from the measurement during 105 minutes in the height of 1.1 m above the floor level in the centre of the room. In the beginning, the values of air temperature were low, students complained about mild coolness; later, the air temperature gradually increased. This increase was caused by additional heating of lecture hall and exhaust air from 65 students. After the mechanical ventilation was turned on, the air temperature slightly decreased and then it stabilized around the value of 23,4°C. The low value of air temperature was caused by low power of column radiator which is the consequence of decorative slats in its deepest part. During the night, the big lecture hall is only tempered, and low power of column radiator causes that air temperature is not optimal at the beginning of the lecture in the morning. The measurements showed the pointlessness of decorative slats in its deepest part; unnecessarily lowered power prevents the creation of thermal comfort. If the decorative slats were removed, the architectural design would not deteriorate, and thermal comfort would be achieved. It is a clear example of a disharmony between architectural design the requirements of thermal comfort.

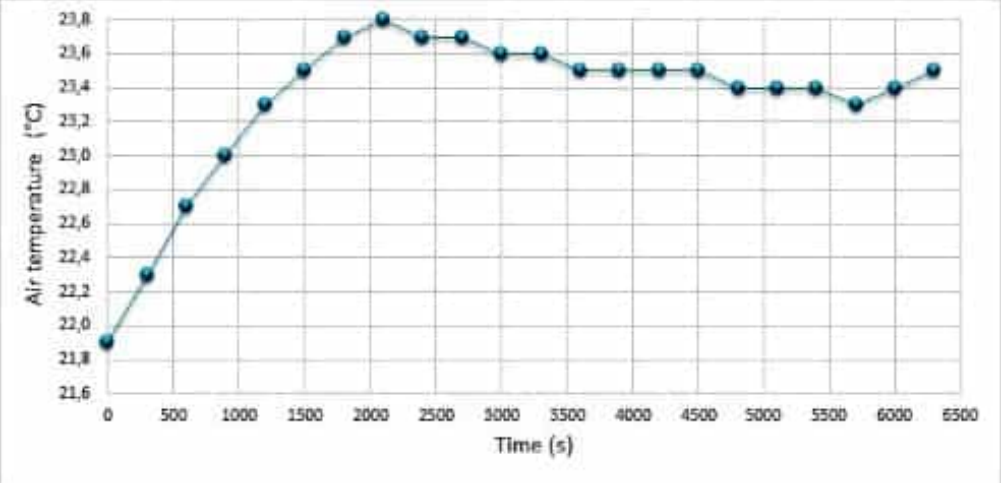

Figure 11: Values of air temperature during the measurement

Figure 12 shows the values of air relative humidity from the measurement during 105 minutes in the height of 1.1 m above the floor level in the centre of the room. In the beginning, the value of air relative humidity was lower and gradually decreasing. After the mechanical ventilation was turned on, the relative humidity was slightly increasing and stabilized around the value 40,7 %. This was achieved by the mechanical ventilation. Optimal values were not completely achieved because the unit did not have humidification component. This shows the importance of mechanical ventilation.

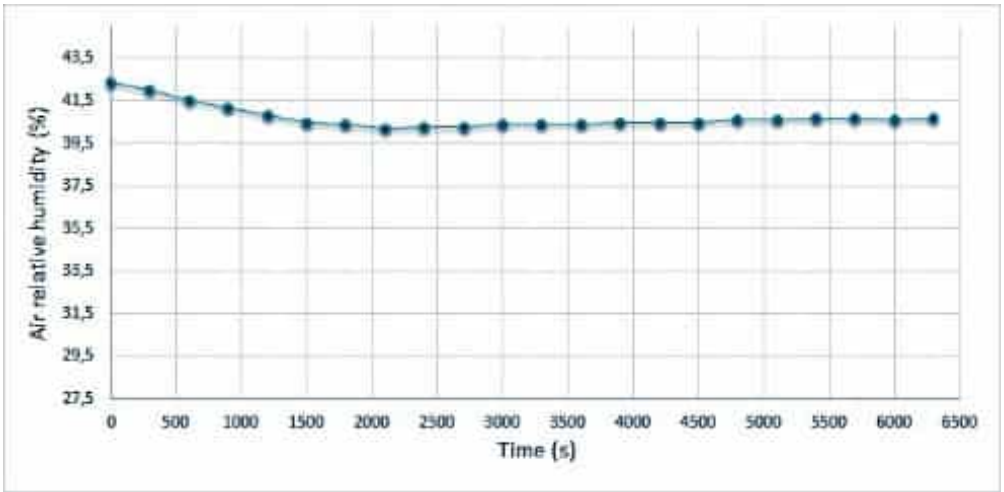

Figure 12: Values of air relative humidity during the measurement

4 Conclusions

Integration of requirements of thermal comfort in big university lecture hall into the architectural design is inevitable from the students' point of view. Analysis of the mutual interaction between architectural design and technical systems ensuring the thermal comfort showed a couple of important findings. From technical systems in big university lecture halls, the combination of heating and mechanical ventilation systems was analysed. It is a best practice to place the heating elements on a flat surface where lecturer stands, and the screen is located. If big university lecture hall is partially outside of the building, the heating elements, most often panel radiators, are needed to be placed onto both external walls. In this case, a high number of panel radiators is needed to cover the higher amount of heat losses. Usually, the background colour of panel radiators is similar to the colour of panel radiators so that this big amount of panel radiators is not an architectural obstacle in interior designing. If big university lecture hall is built-in into the building, it has no external walls and heating elements are placed under the board or screen. This way, heating elements gain a dominant central position which is softened by a white background. A separate category is created by big university lecture halls in which heating elements are placed directly under the windows in an elevated position. Often, single panel radiators are used which are in high height above the students' viewpoint and thus they do not disrupt architectural expression. In terms of energy, it is the best integration of the requirements of thermal comfort into architectural design. Architecturally, the placement of panel radiators near external walls in an atypical shape is interesting – height prevails over the depth which is identical with the depth of a stair.

The measurements showed the pointlessness of the decorative slats in its deepest part of the heating elements; unnecessarily lowered power prevents the creation of thermal comfort. If the decorative slats were removed, the architectural expression would not deteriorate. Measurements showed how important it is to harmonize the architectural design with the requirements of thermal comfort in big university lecture hall.

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INTERACTION BETWEEN ARCHITECTURAL DESIGN AND AIR CONDITIONING SYSTEM IN UNIVERSITY LECTURE HALL

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Abstract

The paper is focused on the analysis of the interaction between architectural design and air conditioning system in a university lecture hall. Correct architectural design and design of air conditioning system is immensely important for students in the interiors of a university. Fulfilling low CO_2 values is inevitable not only from the physiological point of view but also for achieving the desirable students' performance. The good architectural design must enable the application of the optimal air conditioning system and correct position of supply air and extract air, which ensures acceptable CO_2 concentration. The high CO_2 concentration is related to incorrect and insufficient ventilation in the university hall and causes students to feel distracted and tired. Experimental measurements were carried out in the winter season 2016 in the university hall to evaluate the CO_2 concentration. The device Testo 480 was used for the measurements. Obtained values of CO_2 concentration are presented in the charts. Architectural design and mechanical ventilation system of the big university lecture hall were evaluated based on the parameters of CO_2 concentration. The paper concludes with guidelines how to create a harmony between architectural design and design of air conditioning system with the correct position of supply air in the university lecture hall.

Keywords

Architectural design, CO_2 concentration, air conditioning system, correct position of supply air

1 Introduction

Looking for a right interaction between architectural design and air conditioning system with the correct position of supply air is very important in university lecture hall [1]. The good architectural design must enable the application of the optimal air conditioning system and correct position of supply air and extract air, which ensures acceptable CO_2 concentration [2]. Mechanical ventilation or air conditioning in the big lecture halls mean the exchange of the air in a room with the fresh outdoor air [3]. Insufficient supply of oxygen, a high concentration of CO_2, excessive air humidity, various types of odours, toxic pollutants, aerosol and microbial pollutants threaten students when there is insufficient ventilation or air conditioning of big university lecture hall [4]. It can cause distractibility and feeling of tiredness, various skin diseases, respiratory diseases, the emergence of allergies, the emergence of oncological

diseases and others [5]. Therefore, the correct and the sufficient ventilation of lecture hall is very important because students spend most of their time in school in the lecture hall [6]. Sufficient exchange of air influences the CO_2 concentration; therefore, this is the most important point to consider when designing the air conditioning system or mechanical ventilation system [7]. The correct position and the distance of supply air vents and extract air vents from the floor in the big lecture hall are very important to consider when designing the air conditioning system or mechanical ventilation system [8]. The position of supply air vents and extract air vents significantly influences architectural design and eventually an architectural expression in big university lecture hall. The major problem in the big university lecture hall is the draught that is caused by incorrect position, a distance of supply air and extract air from the floor, and the incorrect velocity of the air flow. Therefore, this research was focused on the interaction between architectural design and air conditioning system and the evaluation of CO_2 concentration in the university lecture hall.

2 Analysis of Interaction between Architectural Design and Air Conditioning System in University Lecture Hall

Creation of a correct interaction between architectural design and air conditioning system is very important in university lecture halls. The architectural design of university lecture hall is determined by numerous factors, including the forming of the hall and creating an interestingly designed quality seating for students. Except for these factors, a very significant aspect in university lecture hall is a quality air conditioning system with the correct position of supply air which should ensure air quality in terms of air temperature or bearable CO_2 concentration. Students have to feel pleasantly warm without the feeling of draught. The correct architectural design has to enable the application of the optimal air conditioning system and correct position of supply air and extract air. The architectural concept of university lecture hall has to consider optimal deployment of vents for supply air and vents for extract air. Architectural forming of the interior of university lecture hall has to be derived from the air distribution from the bottom towards the top. During this air distribution, air velocity in vents for supply air can be very low and thus a sitting student does not have a feeling of draught. It is not suitable to install inversely oriented air distribution from the top towards the bottom inside of modern university lecture halls. Also, the air distribution from the front to the back wall is not suitable. In both unsuitably distributed directions of air, a high air velocity is created in the place of students' seating which causes the feeling of draught, dissatisfaction and worse concentration during the lecture. Therefore, the mutual interaction between architectural design and placement of vents for supply air in university lecture hall was closely analysed. The air distribution from the bottom to the top was analysed. Most often, the vents for supply air in university lecture hall are located in the stepped floor which is built because of stepped seating. Figure 1 depicts the position of rectangular vents for supply air in the stepped floor in the lecture hall of Secondary Technical School in Prague. Interior of the hall is significantly segmented which is harmonized with the vents for supply air in the stepped floor. Here, this harmony was not destroyed during the reconstruction of the interior. Vents for supply air have a classic arrangement which does not disturb architectonic appearance of the interior. Figure 2 shows the placement of circular vents for supply air in the stepped floor in big university lecture hall [9]. Denser placement of circular vents for supply air in stepped floor enables very well-balanced airflow because air velocity can be low, and it is appreciated by students. Vents for supply air have a conspicuous shape and colored

arrangement which is in harmony with the architectural design of big university lecture hall. Thus, it does not look distracting. Vents for supply air are promoted to become a decorative interior element.

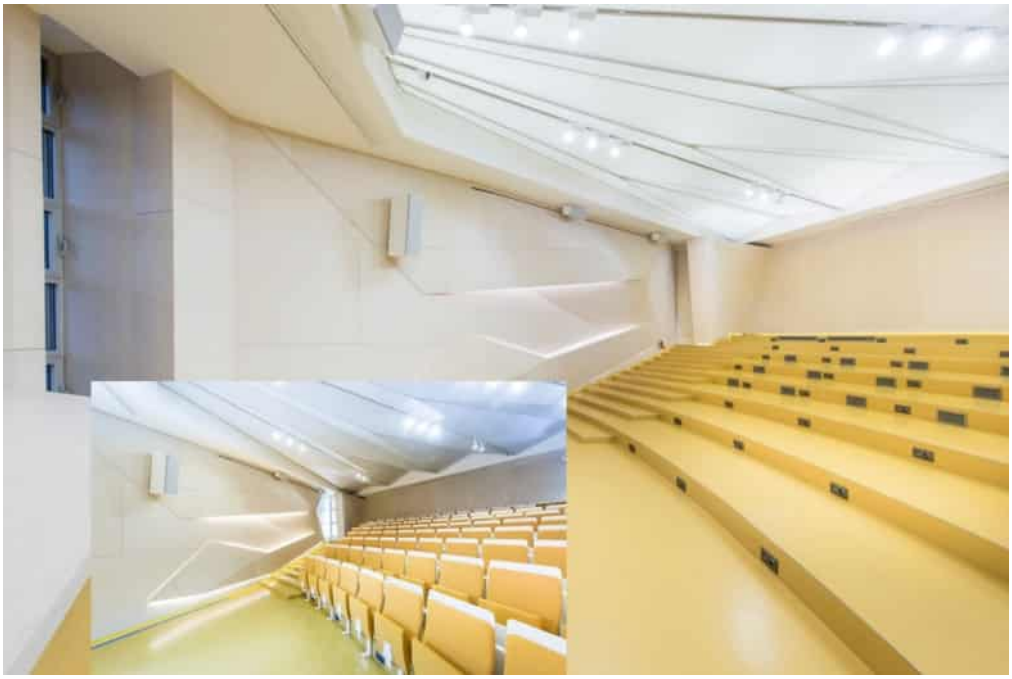

Figure 1: Lecture hall of Secondary Technical School in Prague

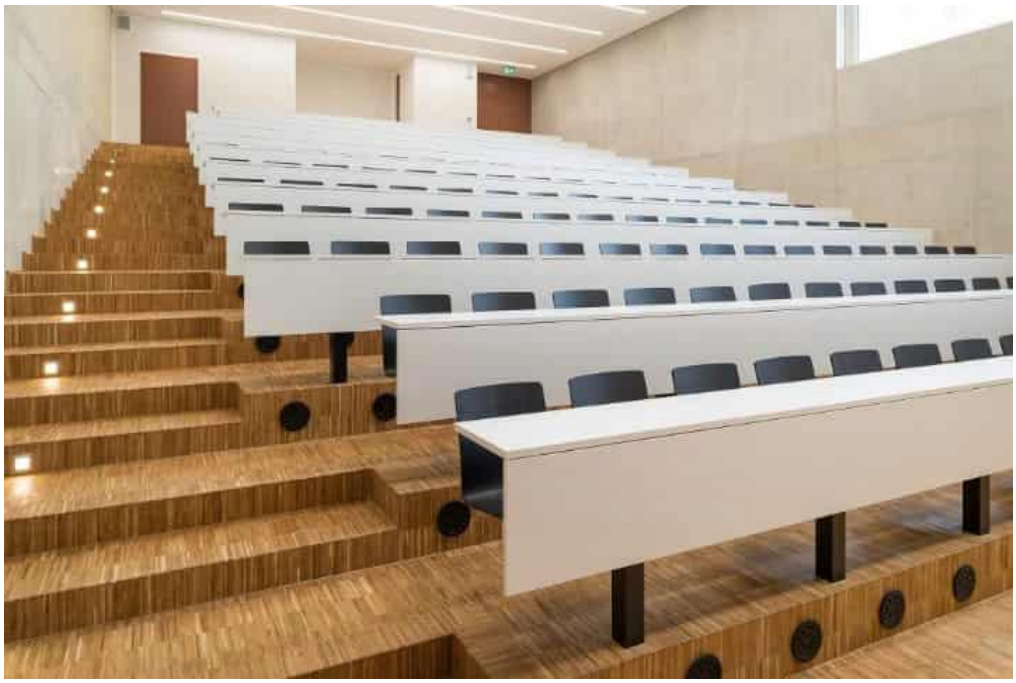

Figure 2: Big university lecture hall

The next alternative is the placement of vents for supply air to the bottom part of a seating which is connected with the elevated floor. Such example can be seen in Figure 3 in the lecture hall in Krkonošské centre for environmental education in Vrchlabí where the rectangular vents for supply air are impressively embedded into the design of the seating. The whole interior

evokes a feeling of nature because of the type of material used and the arrangement of vents for supply air. Vents for supply air do not interfere with the architectural composition of the interior but they create a harmonic unit with it. The similar example can be seen in Figure 4 in the university lecture hall of Czech University of Life Sciences Prague where continuous rectangular vents for supply air are embedded only into the first seating row, and then the vents are placed into the stepped floor. The distinctly coloured interior of the lecture hall is offset by the wooden design of seats where continuous rectangular vents for supply air look harmonious.

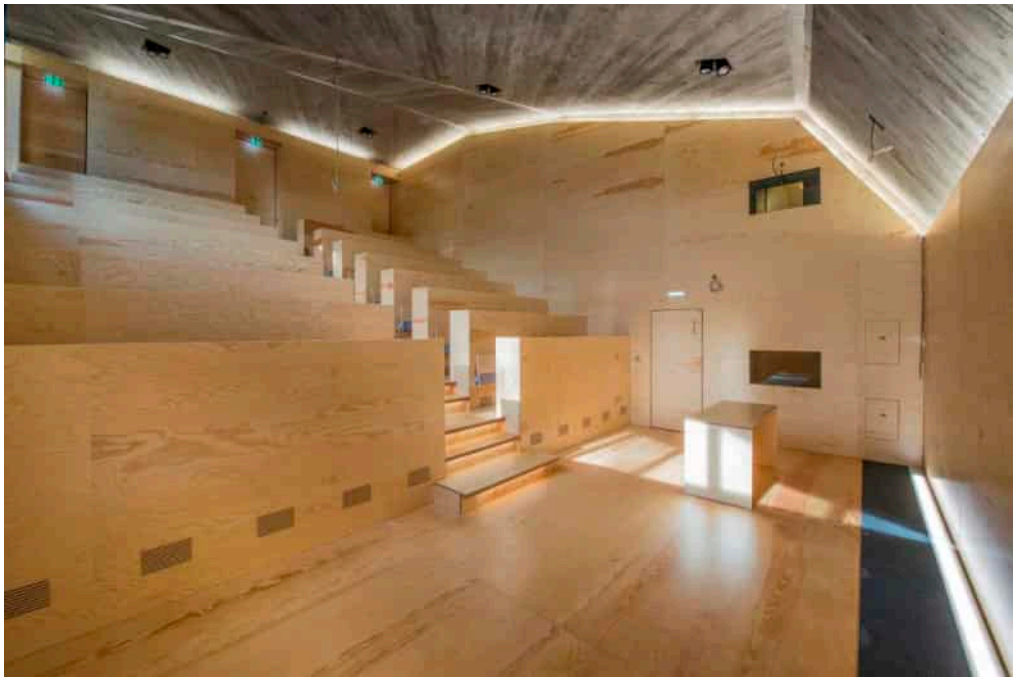

Figure 3: Lecture hall in Krkonošské centre for environmental education in Vrchlabí

Figure 4: University lecture hall of Czech University of Life Sciences Prague

A particular attention can be given to the arrangement showed in Figure 5 in the big university lecture hall in the Department of Informatics of Technical University of Munich where circular vents for supply air are embedded directly onto the floor at individual step levels. Grey vents for supply air are embedded onto the blue floor which causes their partial invisibility in the whole interior and they are almost unseen in combination with yellow seats. Thus, the undisturbed harmonic inclusion of vents for supply air into the whole architectural composition of big university lecture hall was achieved.

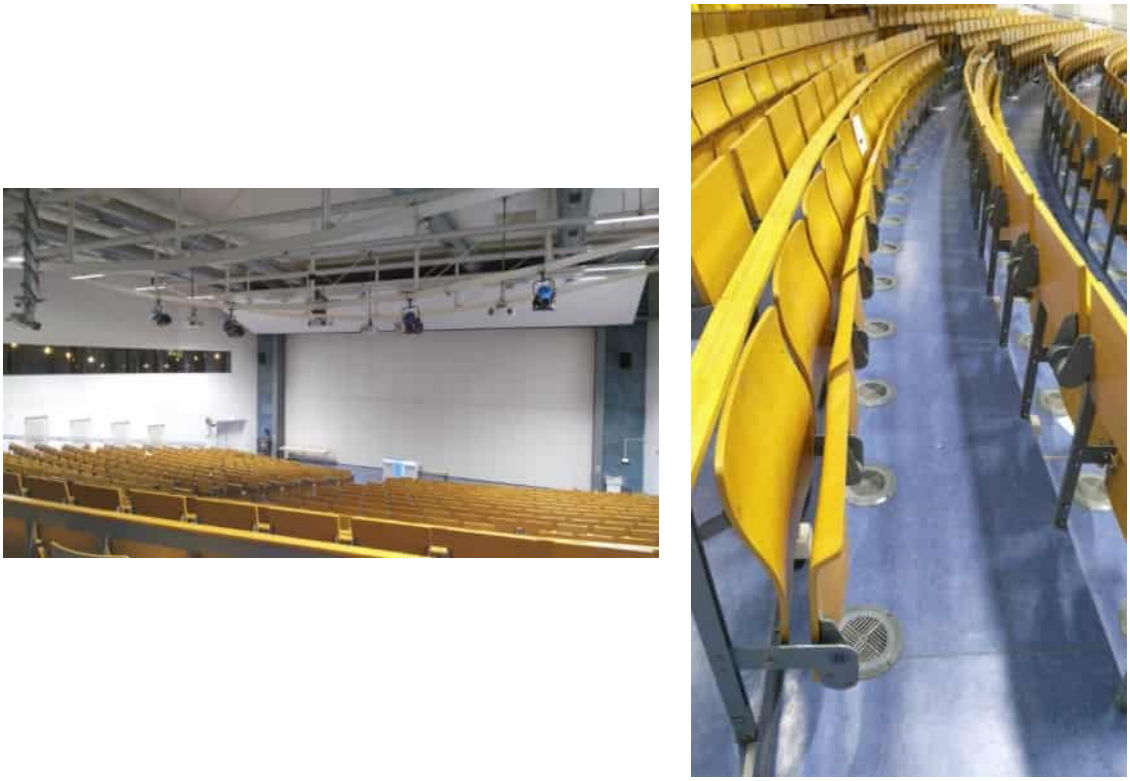

Figure 5: Big university lecture hall of Technical University of Munich

3 Research of Mechanical ventilation system in University Lecture Hall in Relation to Architectural Design

Research of mechanical ventilation system in university lecture hall in relation to architectural design continued with measurements. Experimental measurements were carried out in the big university lecture hall – Figures 6, 7 at the Slovak University of Technology in Bratislava, Faculty of Architecture at the beginning of March 2016.

3.1 Methodology of Research

The aim of the measurements was to record the CO_2 concentration and air velocity.

The measurements were carried out in the big university lecture hall in Figure 6 with the sizes 15.7 x 14.4 m and with the height between 3.9 and 5.9 m in the centre of the room in the height of 1.1 m above the floor level. The university lecture hall is partially placed into the ground. It is heated with two large column radiators. The mechanical ventilation system has vents for supply air placed into the frontal wall (Figure 6) and the vents for extract air are

Figure 6: University lecture hall with the vents for supply air

Figure 7: University lecture hall with the vents for extract air

placed into the back wall (Figure 7). It also has new quality wooden windows with interior shielding. The first measurement was carried out without mechanical ventilation with twenty-eight students, Figure 8. The second measurement was carried out without mechanical

ventilation in its first phase and with mechanical ventilation in its second phase, Figure 9. Sixty-four students participated in the second measurement. Mechanical ventilation unit of type BKL-KD in Figure 6 was in operation during the second phase of the second measurement. In the second measurement, the performance was set to 50%, thus 3675 m^3/hour, which represents the air exchange three times per hour. Mechanical ventilation unit does not contain humidification component. Therefore, the air treatment was not complete. Both measurements were carried out from 8 to 9:45 in the morning during ordinary lectures. CO_2 concentration and air velocity were recorded with the device Testo 480. Outdoor air temperature and air relative humidity were measured and recorded by the separate device. Outdoor air temperature increased from value 6.1 °C to value 8.8 °C during the first measurement and from value 9.8 °C to value 11.5 °C during the second measurement. Outdoor air relative humidity decreased from the value 83% to the value 74% during the second measurement.

Figure 8: The first measurement in the centre of the room in the height of 1.1 m above the floor level

Figure 9: The second measurement in the centre of the room in the height of 1.1 m above the floor level

3.2 Results and Analysis of Research

Figure 10 shows the values of CO_2 concentration from the first measurement during 105 minutes in the height of 1.1 m above the floor level in the centre of the room. At the beginning of the measurement, the values of CO_2 concentration were sufficient, but the values were gradually increasing and at the end of the measurement, the admissible values of CO_2 concentration were exceeded. The big lecture hall has 210 seats; the inadmissible value of CO_2 concentration was already reached with twenty-eight students after two hours. This concludes that the big lecture hall cannot be operational without mechanical ventilation or air conditioning.

Values of air velocity were measured individually in the centre of the air flow between supply air openings and extract air openings. The value of air velocity fluctuates in the range from 0,0 to 0,02 $m.s^{-1}$ which are sufficient values. It was caused by the switched-off mechanical ventilation, so there was no air flow.

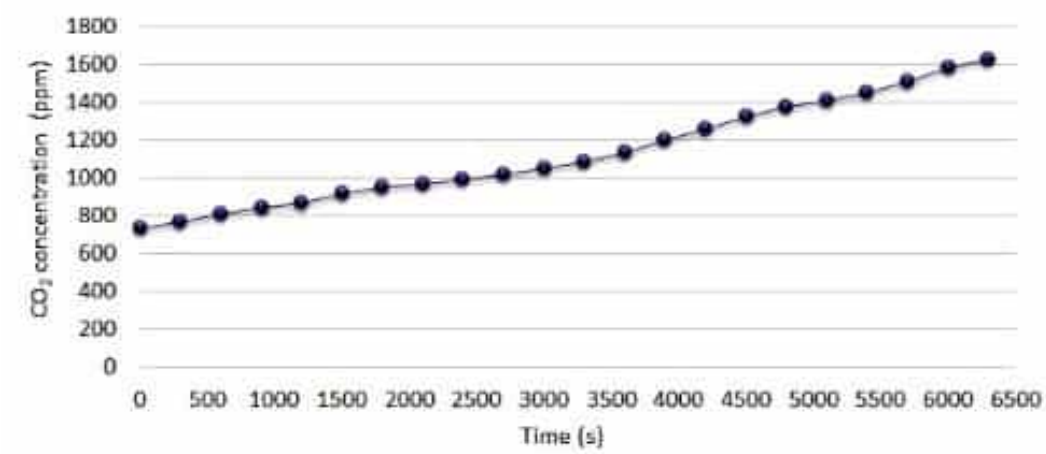

Figure 10: Values of CO_2 concentration during the first measurement

Figure 12 shows the values of CO_2 concentration from the second measurement during 105 minutes in the height of 1.1 m above the floor level in the centre of the room. At the beginning of the measurement, the values of CO_2 concentration were increased and quickly reached inadmissible values. The big lecture hall has 210 seats and the inadmissible value of CO_2 concentration was already reached with sixty-four students after thirty minutes. Then, the mechanical ventilation was turned on and the value of CO_2 concentration gradually decreased on admissible values. This measurement showed the necessity of mechanical ventilation in the big lecture hall. Only correctly designed and operated air conditioning system can bring the optimal solution for the fully occupied big lecture hall.

Values of air velocity were measured individually and intentionally in the centre of air flow between supply air and extract air vents where most of the students were seated. At the beginning of the measurement, the values of air velocity were admissible but after turning on the mechanical ventilation, the values gradually reached inadmissible high values. The students started complaining about the unbearable draft. This was caused by the incorrect design of mechanical ventilation which creates the air flow in the incorrect trajectory through

seated students. The outputs from the measurements showed that it is very important to correctly place the supply air vents and extract air vents such that the values of air velocity are admissible during the operation of mechanical ventilation or air conditioning system in the places where the students are seated.

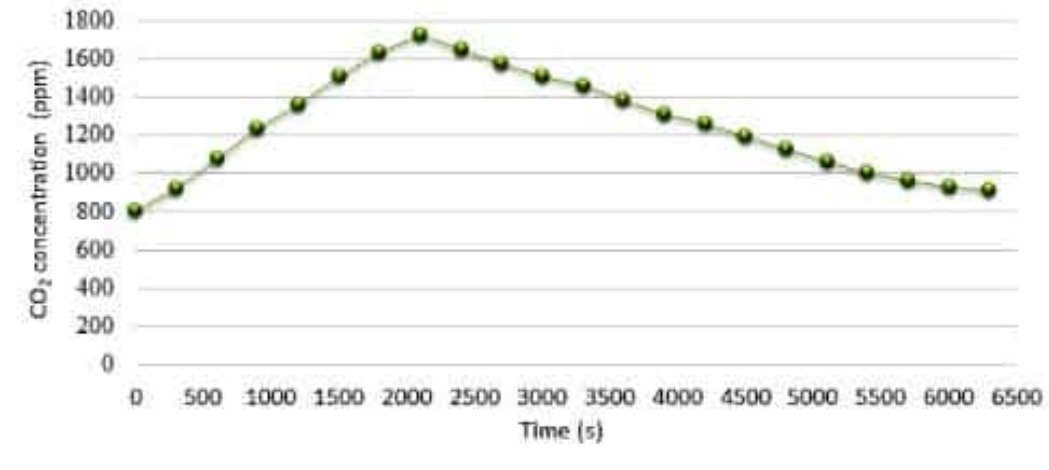

Figure 11: Values of CO_2 concentration during the second measurement

4 Conclusions

Creation of the correct interaction between architectural design and air conditioning system is very important in university lecture hall. The architectural form of the interior of university lecture hall must consider the air distribution while the best air distribution is from below upwards. In this air distribution, air velocity in vents for supply air can be very low and sitting student does not have the feeling of draught. Most often, vents for supply air in university lecture hall are placed into the stepped floor. They can have significant shape and colour form which is harmonized with the architectural design of big university lecture hall; therefore, they are not disruptive. Vents for supply air might be promoted to the decorative element of an interior. Another alternative is the placement of vents for supply air into the lower part of a settle connected with a stair. Very interesting is the solution where circular vents for supply air are incorporated directly into the floor on individual stairs.

Experimental measurements in the big lecture hall clearly showed the necessity of air conditioning system. Inadmissible values of CO_2 concentration were already reached with 13% occupancy after two hours without mechanical ventilation or air conditioning system. Conclusions of the second measurement show that air conditioning system is more suitable than just mechanical ventilation system – does not include humidification component because it can ensure the optimal value of air relative humidity. The second measurement showed that the correct operation of mechanical ventilation or air conditioning system is very important to ensure the parameters of CO_2 concentration at the beginning of a lecture in the morning and then later according to the number of students. The intensity of the air exchange could be regulated by a lecturer who would type the number of students into a control panel placed on a desk or a wall. The second measurement proved that it is very important to correctly place the vents for supply air and extract air during the design of mechanical ventilation or air conditioning system such that the values of air velocity are admissible in the area where

students are seated and the unpleasant feeling from the draft is avoided. The second measurement also proved that the air distribution system through seated students, where the vents for supply air are in the frontal wall of the big lecture hall and vents for extract air are in the rear wall, is not suitable and outdated. In older buildings, it is needed to design new air conditioning system and new air distribution system for big lecture halls. These systems must have modern controlling and regulation system.

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SMALL FRIENDLY OUT DOORS SPACES(ALMAZERA*) FOR PUBLIC USING IN THE SUDAN

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Abstract

The paper presents Sudan's regional climate in general, its types, building materials used, thermal temperature, length of day, high temperature, low humidity in the summer and the extent of it, and its reflection on the existence of some of the outer spaces that help to reduce the temperature as an auxiliary and useful for use in cooling water, Fit for use by the general as an air conditioner and drinkable Waterproof.

The paper explains the ways and means of building the MAZYARA* of pottery . and its types and forms building, which is a traditional old thing inherited but we are in the process of extinction for the emergence of electric chillers, which are located in public places ,roads, schools houses , and mosques.

The paper method its the theoretical and field research and observations and questionnaire by users and owners of these places (Almazyara*) at the individual level and at the public level in universities and schools and concluded the results of the importance of Almazyara. and the most important problems and how to develop solutions and recommendations of some of them with the development of that space friendly to the environment and helping to spread in a modern way, as well as the concepts of the sustainability scale.

Almazyara is a set of water pots arranged in a raw and located on a substrate on which the rounded bottom pots fit perfectly. The pots raw is roofed by a material that is weak heat conductor. That is because the pots are used for drinking water storage. Some modification of Almazyara took place regarding water quality, but side benefits are also gained making it a microenvironment conditioner.

Keywords: _ _ small space – Almzyara* - air conditioning - public spaces - friend of the environment, indoors, outdoors, latent heat, sustainability.

Introduction

1-1 From the traditional to the modified Almazyara

The shortcomings of the traditional water pot (Fig. 2) was reversed for production of a modified one (Fig.4). Consequently Almazyara was modified.
The traditional model (Fig. 1) of Almazyara was modified by Suad Ahmed (patent No. 3991) into the modified one (Fig.3) for improvement of drinking water and control of household contamination. Side gains were obtained; that the dripping water from the walls and the base of an upper chamber of the porous pots drip inside a lower chamber of the pot (made of aluminium or impermeable pottery) to be collected for drinking purposes via a tap. This safe the microenvironment around Almuzyara from being a suitable condition for breeding of mosquitoes as in the traditional one. Moreover it conditions the surrounding air making it more cool and humid. This takes place due to presence of water droplets on the walls of the pot which evaporate by absorbing the latent heat of evaporation from the wall leaving a cool surface. By the theory of thermal equilibrium, the water inside the pot gel cool. Water vapour invade the surrounding micro- space and again absorbs the latent heat for further evaporation from the surround ending to a relatively cool environment. Continuation of these processes results in relatively cool and humid micro-environment making Almazyara a multifunctional both outdoors and indoors. The new model has a flat bottom that facilitates its location on any
flat surface.

Figure 1. External view of the traditional Muzyara

Figure 2. External view of the unit of the traditional Muzyara

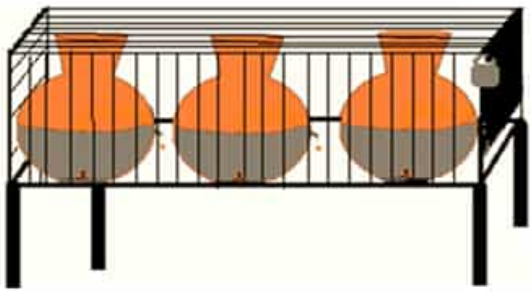

Figure 3. External view of the modified Muzyara

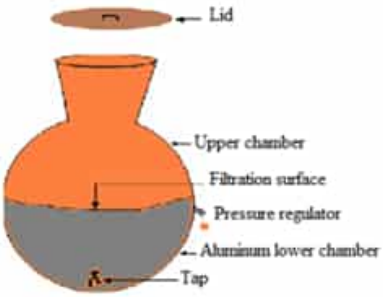

Figure 4. External view of the unit of the modified Muzyara

The Almazyara is considered to be one of the pottery vessels in which water is placed for drinking and placed in several places inside or outside the house in public places such as schools, health centers and sometimes kindergartens and private homes such as farms. And high purity for drinking water.

1-2 From which they are Almazera?

Of pottery is a form of clay soil that turns into clay and is easy to form, and then roasted in the fire and turns into a solid state similar to rock. Man has known pottery since its ancient times and was able to make most of the kitchen utensils, such as: large and small food vessels, as well as drinking utensils. This era was known as the pottery era at the time when a laboratory was discovered in the ground for the pottery industry, which was a popular industry.

1-3 How to Make Pottery

We get the necessary soil from where they are located, a kind of clay soil that is yellowish in color. Mix the soil well into soft crumbs that can be easily cleaned and dust-like soil. We bring a water pond of 2, 3 m^2, which is connected to smaller pools with small openings. Put the amount of colored soil in these ponds and pour water over it for about 3 hours. Workers descend into the ponds and mix the clay with the water well until it forms a smooth, homogeneous clay powder. The clay becomes ready for use.

1-4 Pottery and environmental issues

It is not hidden from us how to design buildings in hot, dry climates where Sudan is located in the northeastern part of Africa. Between zones 4 and 22 north of the equator and longitudes 22 and 38 The length of the maritime border on the Red Sea coast to about 670 km.

Where the Sudanese climatic regions varied from desert to tropical climate. So it is distributed as follows, hot dessert weather in the northern of Sudan. The climate is similar to the Mediterranean climate on the Red Sea coast, the semi-desert climate in northern central Sudan, poor savannah in south-central and western Sudan, the rich Savannah climate in southern Sudan and the tropical climate in southern Sudan.

2-As for the architectural aspect, we find two places

2-1 The first place – It is a public using type, where it is spaced in public places according to the actual need of people, where we find in schools in the place of eating where this place is usually in a semi-closed area near the cafeteria as well as in the university buildings and the public road and the highway street if it is major or secondary or local street and placed in front of houses ,commercial shops or under the trees.
it is being cleaned and maintained by the residents of the house and filled with water pictures picture 1 this explains the public using type.

Picture1- In the school garden

Picture 2 and 3 External wall fines for residential building –explain mazyaras location

p 

Picture 4 At university

2-3 The second place type:.

The second place is the house where the Almazyra is located near the kitchen and is found in most of the Sudanese houses and since ancient times it has been designed in some houses near to the living rooms which are designed in some

houses as an unclosed space. Also some of these dwellings are laid out outside the house for public use and they take care and cleanliness Direct her and put water in. Some of these dwellings are rented by someone to do this

2-4 The concept of sustainability and Almazyara

The philosophical and analytical framework of sustainability depends on linkages with many different disciplines and areas. In recent years, there has been a new field known as sustainability science [4]. Currently, sustainability science is not an independent field of knowledge itself and tends to be a field for solving a problem that exists and is directed towards creating an area that helps to make decisions related to solving this problem. [5].

Based on the concepts of sustainability, we find that the rich reflect and analyze the concept of multidisciplinary environmental, social and economic aspects of the environment in tempering the atmosphere and economic aspects as a low cost and works on the spread of traditional industries and socially that there is a class of society helps to help in drinking water in that hot summer All indicative of social solidarity

Picture 5 and 6

Near housing and comercial areas

near garden-public using type

Through the field research to find people on the public road there were several questions important to the existence of the Almazyra location in the way of public it is importance and take advantage of the 80% are important because they drink water, but they stressed that the pot to drink for the use of one time. They also emphasize what gives them a sense of thermal comfort when standing by their side to absorb the sun's warm rays.

As for 20% of people who drive private cars, 5% can stop and drink water while 15 do not stop. In all cases, the concept of Mazyara is a solid, popular, traditional and inherited concept, generation after generation.

As for the cleanness is direct to the citizen who put it in the general place is concerned with maintenance and cleanliness and the situation of water in it daily.

In this research, we find that the Almazyarais one of the constituents of sustainability, since it is made of simple natural materials, otherwise it is clay, and it is cheaply used by all society and is found in most urban and rural dwellings. As well as great role in tempering the atmosphere is considered a friend of the environment.

The recommendations were as follows.

- Encourage traditional industries and support them as a counterfeit industry because of their great impact on drinking water.

-Urging communities capable of building such units in public places.

- Setting specific specifications for the design of Almazyara position in the public street.

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EVANESCENCE: THE REVITALIZATION OF CHENG KANG ELEMENTARY SCHOOL IN TAIWAN

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1. Introduction

1-1 Motivation and Purpose

Among the five major airports in Taiwan, only the CKS International Airport serves large aircrafts, such as Airbus 380 and Boeing 747-800. A large number of aviation enthusiasts will therefore visit the surrounding area, but there are no suitable observing sites and facilities around the airport. The distance between Cheng Kang Elementary School (CKES) and the CKS International Airport south runway is only 400m. As a result of the declining birthrate and the relocation of military houses, the school was on the verge of being declared defunct. In order to avoid CKES being abandoned, this study tried to find opportunities for CKES's revitalization. The purpose of the study is as follows:

1) To renovate old school buildings as a basis for space activation
2) Exploring the possibilities of observation deck design through observation behavior.
3) Finding the best observation location, observation point and posture and their required assistive equipment via 3D simulation to create an advanced aircraft observation and experiencing field in Taiwan.

1-2 Methods

The main methods are literature and case analysis, experimental design study and 3D simulations.

1-3 Operating Process

The research process of this study is shown in Fig.1.

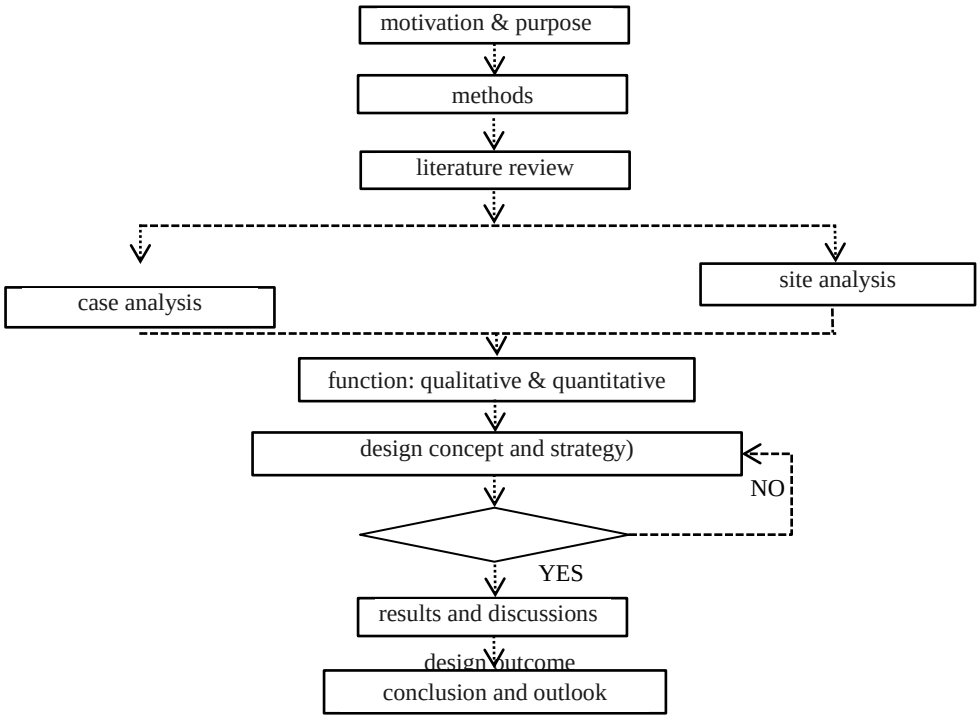


Fig.1: research flowchart

2. Literature Analysis

2-1 Evanescence and Observation

The "ephemeral nature scene" is more valuable in the landscape because of its rarity and preciousness. Although the takeoff and landing of aircrafts is not a natural scene, it is an artificial phenomenon with extremely high geographical dependence. It also attracts many people's curiosity. Therefore, this study intends to explore this phenomenon.

In the preface of the book *How to See*, Architect Wang mentioned: "*God has given people a magical eye, and in the era of modern high-tech development, it has not been possible to design alternatives to replace both eyes. However, in addition to seeing intuitive, it is the best tool to aid thinking, judgment, and analysis.*" (Nelson, 1991:1).

Therefore, this design study aims to enable visitors to experience the evanescent effects of large-scale aircraft takeoff and landing, and to observe and operate drones/UAV flights by diverse design strategies.

2-2 Campus Idle Space

Recently, as the phenomenon of "declining birthrate" has intensified, the number of primary and secondary school students in many countries has significantly decreased, leading schools to face the fate of abolition or merger. The idleness or inappropriate usage of school campuses will waste societal resources and should be avoided.

"Reuse" means to change the original function of a building for other purposes within the life cycle of the building, or to insert a process of appropriate adjustment, such as reorganizing the original building functions so that it can be used continuously (Chen, 2012). In order to encourage all counties and cities to activate the idle space of primary and secondary schools, the Taiwanese Ministry of Education promoted an overall plan for the activation of school campus for the third time in 2007. At present, idle school buildings are primarily reused as local industrial cultural development centers, community education venues, physical fitness stadiums, community care centers, service agencies, or environmental protection ecological parks. (Kao, Tsai, & Zhuang, 2011)

3. Case Analysis

3-1 Observation Tower, Republic of Latvia

Time: 2010/ Place: Jurmala/ Building type: public space/

Volume: 4.6m×4.6m×33.5m(H)/ Material: steel, wood and other sustainable materials

The Observation Tower of Ragakapa Park was relocated. Considering the difference between these two venues, adjustments in color and size are needed. The new tower is 33.5m high, taller than the original. Including the antenna, the total height of the new tower will be 38m (Fig.2). The remaining features are the same as the original plan: a lightweight and simple tower composed of parallel pipes; the metal structure is dominant, supplemented by wooden elements with suspended decks in different directions (Fig.3). There is also a comfortable and wide metal staircase that wraps around the core of the square structure and brings people to an asymmetrical top deck (Fig.4, Fig.5). The strategies that can be referenced in this study are: non-directional observation, suspended decks, sufficient height, and the reuse of the original tower.

Fig.2: night Scene; Fig.3: cantilever deck; Fig.4: observing deck 1; Fig.5: observing deck 2

3-2 Info-Box, Berlin, Germany

Time: 1995/ Place: Potsdamer Platz, Berlin/ Building type: cultural building/
Volume: 65.2m×15m×29m(H)/ Material: steel, glass and other sustainable materials

Info-Box is a simple, brightly colored red box built during the reconstruction of Berlin's Potsdamer Platz after the reunification of Germany. It attracts about 12,000 daily visitors. The Architects Schneider and Schumacher used a 40 cm diameter steel reinforced concrete column to hold the red box and let it float 7 meters high in the air. They also left the ground floor free for people and cars to cross. The simple form of Info-Box contrasted with the surrounding sites full of construction cranes. The Info-Box only had 3 months' construction time. It was designed to be easily reassembled in another location. The outdoor stairs can guide visitors to the roof deck to monitor the progress of the construction site. The box is 62.5 meters long, 15 meters wide, and has a height of 3 floors. It has a display area of 2230 m^2. Visitors can learn about the design and construction information of various buildings around the Potsdamer Platz. The significance of Info-Box is to act as an information platform to observe urban development and urban renewal (Fig.6, Fig.7). The strategies that can be referenced in this study are: an information platform with observation function near the significant construction site, free ground floor, sufficient height and reusable materials (schneider+Schumacher, 2018/03/20).

Fig.6: front view of Info-Box; Fig.7: interior exhibition of Info-Box

4. Site Analysis and Needed Functions

4-1 History of CKES

CKES sits in the middle of the CKS Airport City Area and was established in 1951. CKES, originally known as "Air Force Headquarter's Elementary School", was renamed CKES in memory of General Chen Kang in 1968. Recently, due to the relocation of the military village, the number of students has dropped drastically. At present, there are fewer than 100 teachers and students in school and the school is on the verge of becoming idle. The new Aircraft Museum will be built in the original Taoyuan Naval Base, less than 1km away from CKES, and is expected to start running by the end of 2018. This gives CKES a new opportunity

to be transformed into an aircraft and drone/UAV experience field.

4-2 The Site

The site covers an area of 1.5 hectares (Fig.8, Fig.9). In the previous study, we suggested the partial remodeling of the school buildings (Nie & Wang, 2017). Due to the loud aircraft noise, we propose a complete remodeling of the existing buildings in this study (Fig.12).

The B1 building displays CKES's history, as well as CKS International Airport's daily departure and arrival record. The B2 building was used for drone/UAV sale and coffee catering. An observation tower was added to the commanding deck to transform the old playground into a drone/UAV flight test and performance field. There are interactive sound fountains in the transition area between the school buildings and the playground to transition the "static" display area to the "dynamic" observation area. The B1 and B2 buildings are single-story, brick walled with sloped roofs (Fig.12).

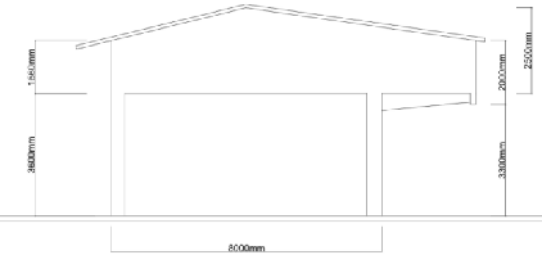


Fig.8: site photo (source: google map:2017/03/12); Fig.9: schematic view of the elevation of Building B

4-3 Detailed Floor Functions

Detailed floor functions are as table 1.

Table 1: spatial qualitative and quantitative information

space type	function	features	quantity	size (m)	area (m^2)
indoor display（building B1）	preface hall	reception, guided tours for visitors	1	5×8	**240**
	aviation display 1	history of CKS Airport: past, present and future	1	22×1.5	
	aviation display 2	demonstrate relations between aviation knowledge and Chen Kang in various periods	1	22×1.5	
	experience zone	interactive multimedia, images and VRs to strengthen interactive experience	1	18×5	
	restroom	toilets and lavatories	1	4×5	
	drone/UAV display	knowledge and videos of drone/UAV development	1	1×24	
service area	service pace	staff office	1	6×8	48
toilet 1	male toilet	4 squat toilets, 4 urinals	1	/	**48**
	female toilet	8 squat toilets	1	/	
	barrier-free toilets	1 squat toilet、1 urinal	1	3×2	
transitional area	aisle	connecting the exhibition area with the experencing area	1	56×5	**632**
	green	visual beautification	1	/	

	sound fountain	visual interactive display of aircraft takeoff and landing control to further experience the spirit of the place	1	22×16	
interactive platform and observation tower	rostrum	renovation of the rostrum and preservation of the collective memory of CKES	1	/	**136**
	lower deck	evanescent experience	1	/	**24**
	middle deck	evanescent experience	1	/	**26**
	higher deck	evanescent experience	1	/	**16**
	elevator	vertical traffic tube	1	2.2×2.2	/
	stairs	emergency evacuation	1	/	/
coffee bar and drone/UAV sales（building B2）	coffee bar	leisure and communication	1	24×5	**120**
	drone/UAV sale	selling drones/UAVs and after-sales services	1	15×5	75
toilet 2	male toilet	4 squat toilets, 4 urinals	1	/	48
	female toilet	8 squat toilets	1	/	
	barrier-free toilet	1 squat toilet, 1 urinal	1	3×2	
drone/UAV flight test area	entrance	tickets selling and checking	1	/	/
	test flight field	executing drone/UAV test flight and performance	1	100×50 H=15	5000
	observing area	observing drone/UAV test flight and performance	1	120×10	1200

4-4 Design Concepts

We propose the following two concepts for the 150mx10m site:

1）static vs. dynamic: the observation tower plays the “dynamic” role, while the indoor exhibition areas in the B series buildings serve as the “static”. The transitional area connects the “static” and the “dynamic”, Fig.10, Fig.11, table 1.

2）introducing effective observation strategies: "general observation", "observing the evanescent moment" and "new experience" , table 2

Fig.10: takeoff at night 1; Fig.11: takeoff at night 2

Table 2: different observing strategies

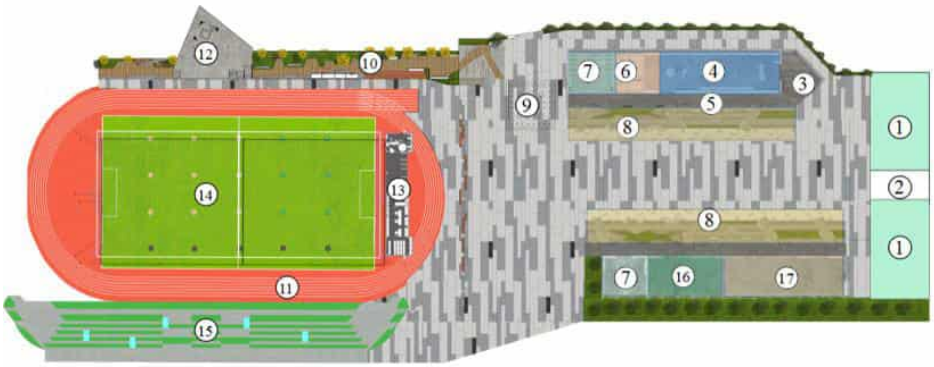
How	observing strategies	fixed / not fixed	varieties of observing	discriptions

To See	S1	general observing	non-fixed	large aircraft takeoff and landing	solving problem of obstacles for observing aircrafts via building the observing tower
				significant aircraft's body painting	
				observing the silhouette of the aircraft under the backlight	
	S2	fleeting view	fixed point	takeoff and landing of specific flights	creating unique experiences for evanescent moments
				touchdown of the aircraft's landing	
				curve and moment of aircraft's takeoff	
	S3	new experienc e	fixed point	observing drone/UAV development show	combining the spirit of the unique site with drones/UAVs
				observing the applied possibilities of drones/UAVs	
			non-fixed	test flights of various types of drones/UAVs	

5. Findings

5-1 Site Plan

According to site analysis, we divided the site into 4 parts: indoor display area, interacting platform & observation tower, coffee dining area and transitional area. These are linearly connected for visitors. The exhibition area is dominated by the planned guided story lines, while the rest are more flexible. The observation tower is only 400m away from the south runway of CKS International Airport and is the perfect location for observing aircrafts (Fig.12, Fig.13).



1.building A 2. school main entrane 3.indoor exhibition entrance 4.exhibition hall 5.drone/UAV display 6.office 7.WCs 8.outdoor green 9.interactive sound fountain 10.transitional area 11.existing sport track 12.observation tower 13.entrance of drone/UAV field 14.drone/UAV field 15.audiance area 16. Drone/UAV sales 17.coffee/dining

Fig.12: site plan

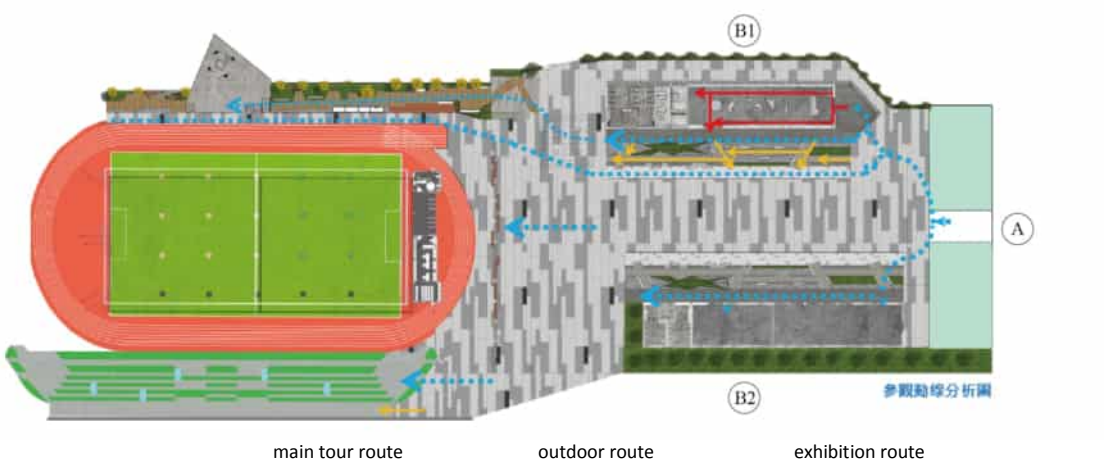


Fig.13 tour route map

5-2 Entrance and Exhibition Halls

1) in-between entrance

Fig.14

The 45 degree rotation and addition of a steel frame to the existing B1 building creates a sharp contrast to the original building, guiding the visitors into the exhibition hall (Fig.14).

2) details information about the exhibition hall

The B1 exhibition hall mainly displays the history of aircrafts that once landed at CKS International Airport and is presented on a timeline. Aircraft information is presented through chronological 2D printouts, interactive multimedia/VR and airplane models. An innovative experience zone is set up in the aisle window area of the outer wall to show current and advanced visions of drones/UAVs (Fig.15, Fig.16).

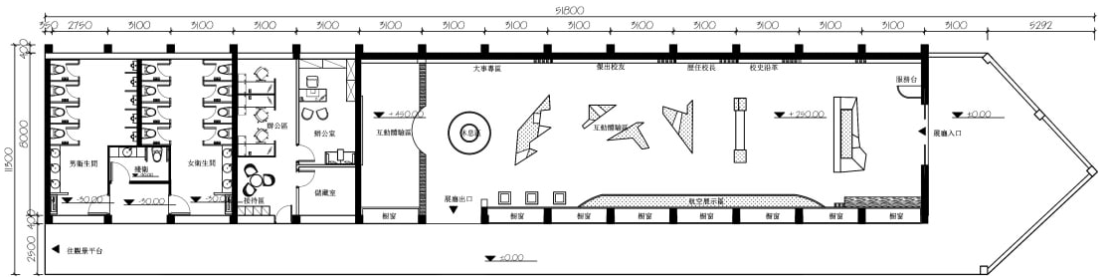


Fig.15: exhibition plan after renovation of Building B1

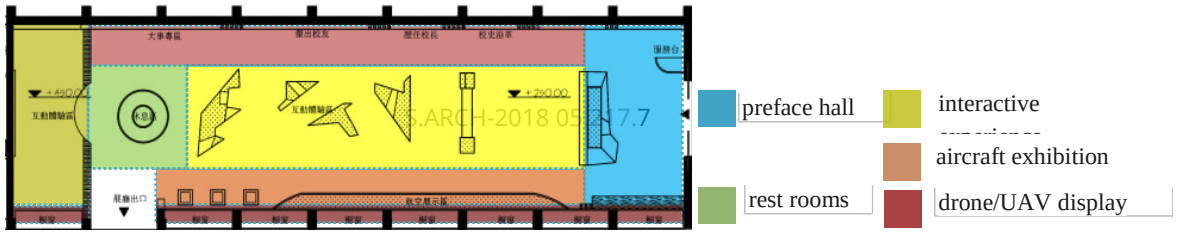


Fig.16: display plan of exhibition hal

The inspiration for the aviation exhibition area is the triangular image formed by the plane and the ground when it takes off and lands (Fig.10, Fig.11). It is used as a formative basis for display furniture and makes the display space more compatible with the image of the aircraft. Information on aircraft and airlines to take off and land at CKS International Airport, as well as real-time flight departures and arrivals, will be used to elaborate upon the follow-up observation towers. The interactive experience area offers visitors unique multimedia and VR experiences (Fig.17 to Fig.19).

Fig.17/ Fig.18/ Fig.19: simulation of indoor exhibition 1/2/3

5-3 Transitional Area

The transitional area is located between the display area and the interactive platform & observation tower area, and includes the sound fountain and passageway. Fountain area eases the surrounding aircraft noise through the activation of fountains via interactive sound devices (Fig.20). The fountain spray takes the shape of the CKES school logo, which aids in creating a transition. Passageway uses gradually raised concrete steps to create a change in the visual depth of the site. Anti-corrosion iron wood is used to enhance visitors' comfort (Fig.21).

Fig.20: simulation of interactive fountain at night Fig.21: simulation of transitional area

5-4 Observation Tower and Platform

The observation tower is divided into three parts, which are the highlights of this design study: commanding platform, lower/middle/higher observation decks, and vertical staircase. The observation tower meets the specific needs of different user groups and provides various observation opportunities and experiences with different postures. In the lower deck, the observation mode is provided by combining mechanical devices with the naked eye. At the same time, different equipment assisting sitting, standing, leaning, and squatting postures is provided on the deck. The middle deck faces the CKES school gate and the future Aviation Museum. On this deck, you have a panoramic view of CKES. Based on the platform's 3D simulation, the height of the design perspective was revised to provide an immersive observation of the transient scene (Fig.22 to Fig.28).

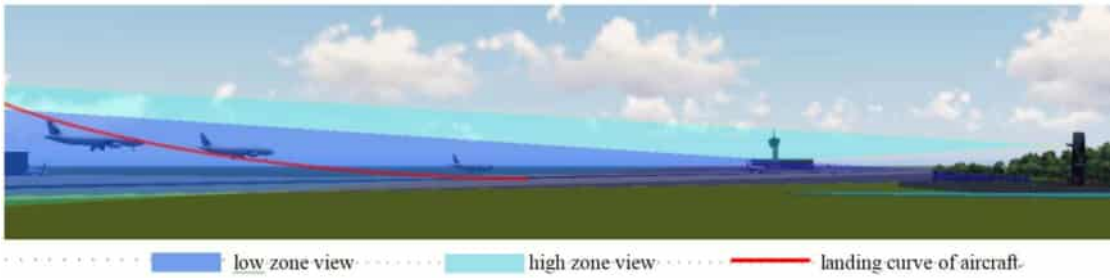


Fig.22: 3D simulation of airplane landing at CKS International Airport
Fig.23: simulated of airplane takeoff curve from view point A/ higher deck
Fig.24: simulated of the instance moment of an airplane takeoff from view point B/ lower deck

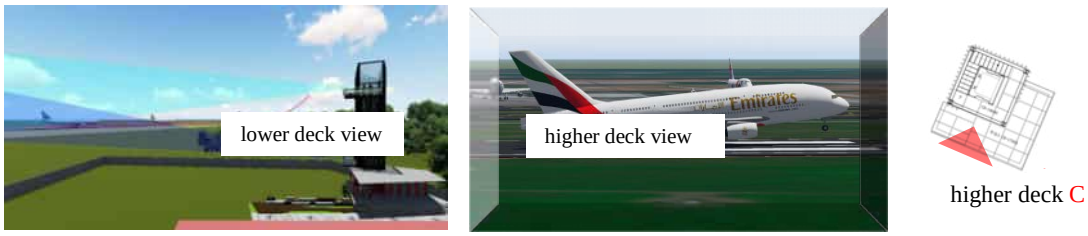


Fig.25: takeoff simulation of an Airbus 380 at CKS International Airport
Fig.26: simulation from view point C/ higher deck

The 4m high commanding platform is for visitors to visit and use in community activities. At the same time, in order to further improve the perspectives of the aircraft's takeoff and landing, the angle of the commanding platform roof echoes the angle of the CKS International Airport south runway (05L-23R) and reaches a state parallel to the runway for easy observation. The suspended metal roof is supported by a 10 cm diameter steel column and cantilevers 5m outwards (Fig.27 to Fig.30). The observation tower is a steel structure. Peripheral materials such as glass curtain wall and wood preservative grille are used as facade materials. The total height of the main body is 22.5m, the height of the lower deck is 4.5m, the middle deck is 13.5m, and the higher deck is 18.9m (Fig.31).

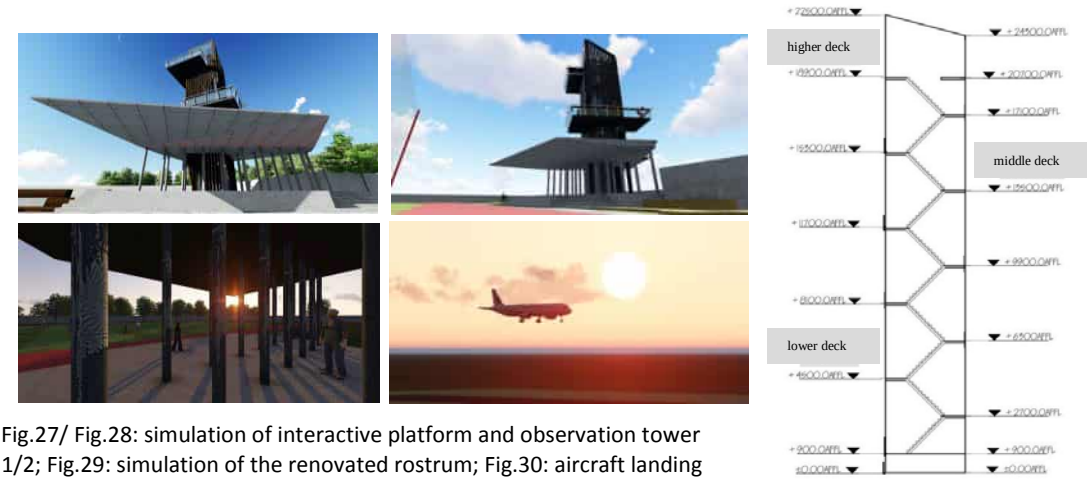


Fig.27/ Fig.28: simulation of interactive platform and observation tower 1/2; Fig.29: simulation of the renovated rostrum; Fig.30: aircraft landing silhouette; Fig.31: schematic section of the staircase

5-5 Variety of Observation

The observation tower achieves the diversity of observation through 3 different design strategies. Strategy 1: open-air observation of different aircraft types' takeoff and landing at

different times, and the CKS International Airport operation scenarios; Strategy 2: offering auxiliary designed equipment on the observation tower to capture aircraft's specific scenarios, such as the instances of touchdown and takeoff. The five stages of the aircraft landing process: slipping, leveling, keeping level, falling and rolling. When the aircraft is ready to land, the landing gear is lowered and the timing of the landing gear is related to the approach procedures, speed, flap positions and altitude. Generally 5.6km away from the runway, the flaps are placed in the final gear.

Fig.32: simulation of auxiliary device 1; Fig.33: observing the aircraft landing via auxiliary device 1 from view point D/ higer deck

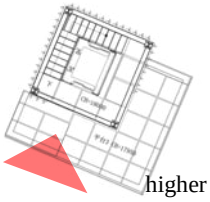


Fig.34: simulation of auxiliary device 2; Fig.35: observing airplane landing via auxiliary device 2 from view point E/ higher deck

After extending the landing gear, the aircraft begins to slide at a steady speed along a nearly oblique line. When it slides down to about 6-12m from the ground, the aircraft pulls back the steering column and the elevation angle increases to enter the leveling stage. The track of the aircraft gradually becomes horizontal and gradually slows down before entering the "level flight phase." In the "level flight phase", in order to maintain horizontal flight in the event of a deceleration, the aircraft's elevation angle continues to increase, resulting in a further decrease in the speed of flight. When the elevation angle can no longer increase, the aircraft gradually sinks under the influence of gravity and begins to enter the "falling phase." Once the main wheels of the landing gear hits the ground, the aircraft begins to slide on the ground and the pilot operates the brakes and deceleration devices until the aircraft completely stops. Through device 1 (Fig.32, Fig.33), visitors can further observe the landing gear extension and landing process. At the same time, device 2 (Fig.34) captures the instant moment that the wheels touch the ground during the landing process, enhancing the visitors' dynamic experience (Fig.35).

Fig.36: simulation of auxiliary device 3; Fig.37: observing aircraft takeoff via auxiliary device 3 from view point F/ higher deck

The general jet aircraft takeoff process includes three phases: ground run, lift-off, and accelerated climb. When the aircraft receives its takeoff order, the pilot increases the throttle of the aircraft and starts to roll. When the running speed reaches a certain value (the ground speed), the pilot pulls back the steering column to increase the aircraft's elevation angle. In this way, the lift of the aircraft increases with the increase of the speed and the elevation angle. When lift increases to more than the aircraft's gravity, the airplane begins to leave the ground. After that, the aircraft continues to accelerate the climb. When the aircraft climbs to 10-15 m above the ground, the pilot starts retracting the landing gear

to reduce the flight resistance. When the aircraft climbs to a safe altitude, the "takeoff phase" ends. Device 3 (Fig.36) allows the observer to further observe the instant the aircraft leaves the ground and the retraction process of the landing gear (Fig.37). The different altitudes of the observing decks also meet the needs of the strategy 3/ new experience: watching drones/UAVs fly and perform at different altitudes, providing more immersive choices (Fig.38, Fig.39).

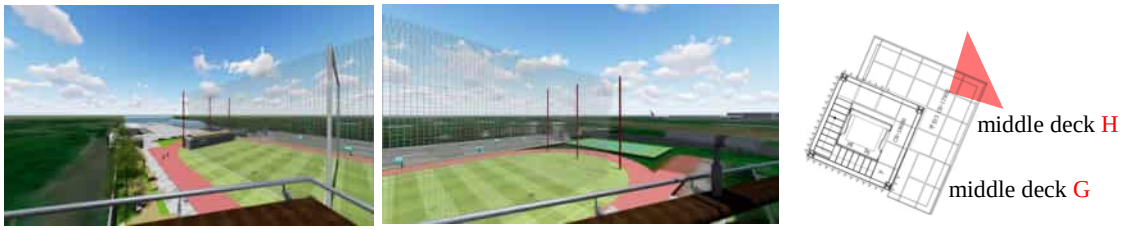


Fig.38: simulation of drone/UAV field from view point H/ middle deck; Fig.39: simulation of drone/UAV field from view point G/ middle deck

5-6 Observation Furniture

The following three designs (Fig. 40 to Fig. 42) assist visitors in capturing the evanescent moments.

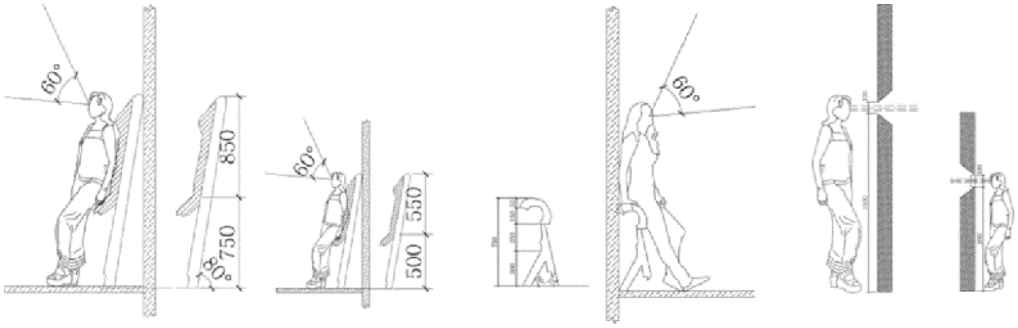


Fig.40: simulation of auxiliary furniture 1-leaning; Fig.41: simulation of auxiliary furniture 2-sitting; Fig.42: simulation of auxiliary furniture 3- observation holes

5-7 Drone/UAV Test and Performance Field

The drone/UAV test flight field adopts a design with a specific field and a specific height to place the drone/UAV test flight within the zone. The field length is 100m long, 50m wide and 15m high (Fig.43). The drone/UAV test flight entrance area includes service spaces such as ticketing, ticket checking, toilets, and rest areas (Fig.44, Fig.45).

Fig.43: drone/UAV test flight field; Fig.44: drone/UAV test flight field entrance; Fig.45: drone/UAV test flight field ay night

In the field, there are spaces for visitors of different experience levels to play different games, such as flying alone (Fig.46), formation of drill holes (Fig.47), and aerial performance controlled through programming (Fig.48).

Fig.46: flying alone; Fig.47: flying formation drilling hole; Fig.48: flying program-controlled performance

5-8 Drone/UAV Auditorium Area

Next to the test flight field, a multi-layer auditorium area is set up to connect with the drone/UAV sales areas and coffee shops (Fig.49, Fig.50). There is a variety of outdoor furniture for sitting and leaning on the steps to provide more options for watching drone/

UAV performances (Fig.51).

Fig.49: drone/UAV auditorium at night; Fig.50: drone/UAV test flight field from auditorium; Fig.51: auxiliary furniture of auditorium

6. Conclusion and Outlook

6-1 Conclusions

This design study reached the following 5 conclusions:

1) 3D simulations verified that in the elevated observation tower, the path of the aircrafts' takeoff and landing can be observed by the naked eye: observing the large aircraft taking-off and landing, observing the special fuselage painting and the silhouette of the aircraft under the backlight, etc. (Fig.22 to Fig.26, Fig.30, Fig.35).
2) Through 3D simulation, it is verified that on the basis of the foregoing design process, the purpose of capturing aircraft touchdown and observing the takeoff and landing paths of special aircraft types, such as the Airbus 380, can be achieved by providing special instruments, auxiliary tools and fixed-point openings (Fig.32 to Fig.37).
3) Providing drone/UAV test and performance fields for aircraft aficionados (Fig.38, Fig.39, Fig.43 to Fig.51).
4) Creating the opportunity to revitalize CKES.
5) Creating 5 different types of auxiliary equipment and furniture (Fig.40 to Fig.42).

6-2 Outlook

Due to time limitations, this study only discusses the effects of the visitors taking and experiencing the instances of takeoff and touchdown in different postures, such as sitting, standing and leaning. In the future, it will be possible to find more special locations in the vicinity of the airport, or even within the airport, to enhance the dynamic experience.

6-3 Acknowledgments

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TOWARDS A POST-TRAUMATIC ARCHITECTURE THAT HEALS CITIES' INHABITANTS SUFFERING FROM PTSD

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Abstract

Cities are generally in a state of constant modification. Some experience this modification at a more rapid pace due to the technology available in the city; others experience this modification due to the city's time of life, which requires many civilizations to imprint their architectural style and project their social image and identity. In certain cases, these modifications are due to natural disasters, such as earthquakes or tsunamis, or man-made wars, or even both.

In either case, the main purpose is for the city's inhabitants to adapt to these changes. Unfortunately, forms of post-traumatic stress disorder (PTSD) among inhabitants have been observed and, as a result, the nexus between the built environment's modifications after disasters and PTSD is to be investigated in-depth.

This article expounds upon the case of Beirut: it is a city that for centuries has experienced earthquakes, wars, invasions, social exchange between countries, and different architectural styles. To explain the numerous rises and falls of this city and to find its built environment changes and impact on the PTSD range in its inhabitants, questionnaires were distributed and in-depth interviews supported by photos were conducted with 40 people who come from Beirut and who live there to measure their various perceptions of their city and its effect on their healing. Participants were selected from Beirut's different areas, which led to a diversity of lifestyles, religious beliefs, educational backgrounds, ages, roles during the "civil war" of 1975–1990, and perceptions of Beirut before and after this war.

The relationship found between the ability of "Beirutis" (how Beirut's original inhabitants call themselves) to perceive their identity through the built environment and PTSD, added to past literature, will help urban planners and architects find the procedures based on observation and scientific facts to build with the opportunity to heal disaster-torn cities' inhabitants from PTSD.

Keywords

phenomenography, urban planning, PTSD, built environment, neuro-architecture

Introduction

"With a better understanding of the contributing factors to posttraumatic stress, we can increase our capacity to design in a way that is both sympathetic to this altered state and conducive to healing" [1]

Humans have always tried to imprint their interventions through the visible structure in an attempt to defy natural and man-made disasters. To "control" hurricanes, earthquakes, or floods, people have *built* the solution. People have even *rebuilt* their controlling solutions after being defeated or having defeated and occupied others' lands or countries, reflecting through it the state's power and identity by means of a city [2]. Therefore, throughout the centuries, people have found themselves spending their lives inside the man-made environment and even surrounded by it [3].

In attempts to correct the natural or man-made urban problems, the growing built environment shaped the adapting inhabitants' interaction in the urban milieu, through the creation of visible (architectural) and invisible (social and psychological) bulwarks [3]. Moreover, throughout these evolving architectural processes, there were professionals from the social, philosophical, medical, and architectural fields who proved the interdependent relationship between the human and the environment, on the one hand, and the natural and built environment, on the other. At the present time, recent findings are leading professionals to support the environmental conservation or upkeep that leads to sustainable solutions healthily balancing the built environment and the inhabitants' well-being [3]. Looking in-depth for the reasons of cities' urban development, observations and scientific results show that people have a cycle of creating needs for themselves and working hard to find suitable solutions [3]. As a result, there are series of emotions that become specific of the inhabitants of a specific city [4].

To examine the relationship between architecture and the mental state of people, the referral to findings related to neuroscience and mental illnesses is incontestable. In effect, according to the Lebanese psychiatrist Dr. Elie Karam, much research was conducted to map out the brain and its specific activities during specific events, and genes and stressors were examined in-depth. Dr. Karam added that "therapy is no longer an art but a solid science, subjected to the scrutiny of an army of researchers" [5].

Consequently, the focus of this study will be the scientific findings of mental state and architecture related to man-made disasters, specifically wars. The answers of a community regarding their perception of their city's prewar and postwar built environment in this context help to show the mental process of archiving memories and interpreting events through individual and collective memories of war. In effect, war can be described as a public event that can intrude private aspects of life and where all the inhabitants of a city are concerned and touched in one way or another. In other words, war can compose a barrier forbidding people to go to the place of the work they would prefer or to see people close to them. It can destroy memories and build other memories or force the building of certain memories through several ways. Furthermore, another consequence of a city's destruction is the overattachment to or complete detachment from the space.

The process for the study, first, will be defining post-traumatic stress disorder (PTSD) and its effect on memory. Subsequently, its symptoms will be linked to the traumas of war. The specific case of Beirut in its architecture, urban development, and traumatic events throughout history will be developed. Then the concept of therapy through architecture supported by neuroscience findings will be expounded. A random sample from Beirutis (how Beirut's original inhabitants call themselves) will be analyzed; the results will be supported by past literature in the field of psychiatry and architecture, and as a final point will be expanded the ways of healing cities' inhabitants suffering from PTSD through architecture and urban planning.

Thereby, many questions can cover the study in its multiple facets. The judgment of the city's inhabitants as to whether they find their city disfigured or well renovated in its public spaces and private spaces is to be taken into consideration in this case.

1 Post-Traumatic Stress Disorder (PTSD) and Memory

According to the National Institute of Mental Health, PTSD occurs when people do not overcome the fear they have felt during an event they were not prepared to live through [6] or that is life threatening [7]. These events can be the experience of physical harm or emotional harm caused by nature (e.g., seism) or another person (e.g., war) for one time or on a repetitive basis that cumulates and causes complex trauma [8, 9]. Therefore, people could suffer from remembering the experience, which affects their quality of life and at times the life of their partners and families too. Some people recover, while PTSD can become chronic for others if they are more vulnerable according to their character or their life defying conditions [6]. Generally, a longer period of exposure to the traumatic event and its frequency affects the severity of the PTSD [10]. Therefore, in war zones, all categories of people who have to stay and watch the attacks or be attacked, or people who have to leave all their belongings and escape, are subject to PTSD if adequate resources are not available to help them heal, such as mental therapy and a suitable urban plan to restore all the destruction.

In the matters of the visual, the shapes that do not refer to configurations easy to discern by the brain, such as half-destroyed houses, require visual efforts, which can lead to a degree of disturbance [11] that affects the memories that people's brains process. In fact, memory can be healthy or traumatized. The healthy memory adapts according to circumstances and contexts [12] and builds short-term and long-term evolutive memory [1, 12]. On the other hand, the traumatic memory is a "torn" memory recounting a trauma (an event not expected and not prepared to experience) [12]. When any object or event reminds the traumatized person of the memory that has occurred, the process of the present situation adaptability leads to a "fight or flight" response or to immobility, whereby the traumatized people observe without reacting because the brain is convincing these people of their vulnerability for survival purposes [1, 13]. Thus, this process becomes a dissociated memory in their brains that is used as an implicit memory, linking the present situation to the physical and emotional memories of the traumatic situation [1].

2 The Case of Beirut

2.1 Architecture and the Community's Identity

Beirut has always been a looked-for city by people around the world. Beirut has especially witnessed its turning point when it became a capital during the Ottoman's occupation, when its commune features changed to become urban as it was the case for some European cities' development during the 1880s [14]. Unfortunately, it was scarred from a massive "civil war" from 1975 to 1990.

No matter the true political story behind this war, the first thing that strikes when discovering the city is that urban discontinuity based on sectarianism and religious enclaves is found today in Beirut. However, the disparities nowadays no longer rise in religious differences that were the "superficial" excuse to fire; rather, on one side, they lie in the preservation of architectural heritage and the possibility of its projection in the new buildings, and, on the other side, in the demolition of old buildings under the presumption of their danger of falling and in the construction of high-rise buildings that reflect economic consumption and do not relate in any architectural element to the history of architecture in Beirut. In fact, what happened regarding the rise of Beirut is a mixture of construction (of the new), reconstruction (which is more a renovation to some traditional Beiruti houses), and, as the Lebanese architect Serge Yazigi, who is a Beiruti living in Beirut, mentioned in a private interview, "deconstruction" because some architectural icons were destroyed after the war and some elements were built in Beirut without having a fluid interconnection within its urban tissue [15]. Furthermore, during the period of stagnated urban development, the souk of Beirut was fragmented and business owners moved their stores to the housing area of the city. This is one of the aspects of the adaptive urbanism that was adopted in Beirut, which is also referred to as "Morphogenesis" [16]. Many researchers have defined this concept as a series of small steps in architectural changes in a city based on individual present-day needs and without a solid urban plan linking all parts of the city, which leads in the long term to a major urban transformation where people will find their city unrecognizable in terms of architecture, economy, and social life [16]. What happened in reality is that the armed groups during war marked the battle lines that became the real ones still dividing Beirut's area [17, 18] (Figure 1).

Figure 1. The green line is the separation line that is still virtually dividing Beirut's areas in people's memory. It is green since plants grew when the inhabitants fled due to the severe battles that occurred there. This line passed by the downtown (picture from Habib, Haagenrud, Ludvigsen, Møystad, & Saad [19], annotation from Maria A. El Helou)

Following a survival mode to revive the once vibrant Beirut, the rapid expansion of Beirut after the 1990s was in fact occurring at the same time as other countries worldwide; hence, in normal cases, there would have been nothing to worry about. The only problem in Beirut's case lays in the fact that Beirut was just coming out of a war, and there was a need to reconstruct what was demolished. Many of the inhabitants expected to have the old Beirut rebuilt as it was, but the rapid expansion of the so called "contemporary city" worldwide made it impossible.

Beirutis tried to adapt and are still using this approach to forget the past. Yet, in reality, the contemporary city is not mitigating this task since it has become the place of this one goal: investment attraction using business redevelopment with a part being from foreign background [17], which leads to multiple disparities of the city's image between the historical and the profit-oriented. In fact, according to Beiruti architect Mona Hallak, the decision from the concerned parties was to destroy 800 houses and buildings considered iconic of Beirut's symbolism, leaving only 220 of them [18]. These houses and buildings ranged between renovated and taken care of and abandoned with scars of destruction. As a result, the inhabitants of Beirut are not in control of what surrounds them because the decision-makers in the city are the ones who are deciding how the city must look like, and they are not looking in-depth into other aspects that might affect negatively the inhabitants of the constant lively city [20]. For example, some Beirutis consider that in postwar Beirut was placed only an emphasis for economic profits [17] leading to a neglect of the visual aspects of heritage. On the other hand, the private sector owns more plots in the present time than the municipality, which is increasing individual interventions and an aleatory horizontal and vertical urban expansion without an overall long-term urban planning distributing the functions needed and its amounts in each area.

All of these components affect the one identity of the city that creates a secured sense of a purposeful urban tissue and that leads to a genuine positive attachment linking the physical space with its true emotional and affective fulfillments, and not only a nostalgic attachment [21, 22]. As a consequence, Beirutis become vulnerable and try to find healthy resilience [23]. Hence, security and motivation are the dynamic agents that should be acting together to preserve a defined and clear identity of trust based on the city's structure [17, 24].

2.2 PTSD Applied to the Case of Beirut

Even though PTSD affects a limited number of people witnessing a traumatic event [25], children and adolescents exposed to war for only three weeks in their natal country can develop PTSD and/or "major depressive disorder (MDD), separation anxiety disorder (SAD), [or] overanxious disorder (OAD)" [26]. In the case of Lebanon, 15 years of war and exposure to life-threatening attacks were enough for Lebanon to become the third country in the world with the number of people suffering from PTSD [5] with an annual average of 11.2% in anxiety disorders (of which PTSD is part) [5]. In some severe cases, psychiatric comorbidity can occur, [25] and traumatized people start predicting dangerous future events based on their past memories [10] instead of relying on the reality as it is.

Being hypervigilant during war is good to avoid injury or death. However, the problem is that this state of hypervigilance and destructive memory does not go away for years,

especially for predisposed people [23, 27]. As a result, people with PTSD are extremely cautious and focus on any detail, any sound, and any action [12], including the architectural details around them. In general, people worldwide , including Beirutis, were even taught that PTSD fades away after an average of six months [27] and consequently, people convince themselves they are perfectly healthy and mask their state, considering it shameful if it persists. However, these people have the underlying feeling of danger around the built environment, especially the one that resembles the scenes of danger they witnessed [1]. This feeling of danger includes seeing certain roofs, building entrances, and windows. Traumatized people can even be cautious of the floor and the sky or an opening through which bullets can pass [1]. People who were directly involved in war (who participated in battles) are the ones to develop guilt and PTSD more than others and the tendency to commit suicide [28, 29] and MDD [30]. Thus, man-made disasters can lead to a spectrum of disorders and problems—but not necessarily illnesses—in "thought, speech, emotion, and behavior" [31]. Therefore, cases in Beirut are not limited to illnesses, but are as well linked to problems.

3 Neuro-architecture as a Solution for Therapy Through Architecture

3.1 Definition and Role

'Neuro-architecture' is the discipline that came as a solution to study human brain processing of the built environment and human behavior and to analyze urban and architectural designs that improve people's well-being and productivity through brain neuroplasticity [32, 33]. Nowadays, reducing mental problems and illnesses is being a part of the urban planning goals [34], through observing people's reactions and analyzing their brain imaging in different built environments or using images of real environment landscapes to examine how the human brain processes buildings and spaces. Several technologies are used for that purpose such as neurophysiology, neuroanatomy, and functional brain imaging, and mainly the functional magnetic resonance imaging (fMRI) and the electroencephalography (EEG) [11, 32, 35]. Such technologies help to get objective results rather than relying solely on subjective interviews [36]. These techniques help architects see how urban and architectural shapes affect people psychologically because people perceive configurations and not random shapes [37]. The brain is highly organized, and through the brain areas that are involved in the built environment information process, measuring natural and built environment is possible [11]. Consequently, a built environment stimulates specific emotions that define people's conscious or unconscious behaviors [36] when they identify themselves in a particular place according to the "biocultural memories" or the maps that their brain nerves form [38, 39] to help judge the beauty and security of a place [40] and give it a meaning to get individual and collective memories [41, 42]. This human–place interaction is similar to human–human interaction, which leads to a particular attachment of the person to the place. The person therefore gives this place an identity through the relational and territorial dimensions of the community leading to the sense of fulfillment and social acceptance [43].

3.2 The Case of Healing PTSD Through Architecture

The purpose of architecture in this case study is to heal from PTSD symptoms to return to a state of safety and security. Therefore, studies are conducted on the human brain and

reaction to external stimuli to design the architecture that prevents further mental problem and illness severity by measuring the degrees of arousal triggered in defined parts of the brain, although it is considered as complex as the complexity of modern architecture [36]. In fact, modern architecture and urban expansion concern all cities of the world, but the severity of the cases is where lies the difference. For example, Beirut must deal with traffic, pollution (as well as the "moral pollution" [2] that the civil war has left in Beirut), and (un)planned expansion; but most importantly, it deals with the preservation of its architectural past that is becoming increasingly complicated [44]. Added to that is the complexity of the war that occurred in Beirut between 1975 and 1990 that was no longer limited to the usual weapons, but instead focused on destroying its interconnected urban fabric. By that, destroying a city is an "urbicide" that resembles a genocide [2] where people could be living dead without being killed and act through unhealthy protective reactions [13]; where people become a figure of "inverse phantoms" whose bodies are still alive but whose souls are just surviving [18]. They are somehow forced to forget their past and be invaded by new technologies that destroy the urban tissue rich with heritage [2]. The spectrum of symptoms and comportments are analogous [1]. Moreover, the more the inhabitants of a city are satisfied in their lives, the more they develop social trust and develop the abilities to overcome illnesses and stressful events, which increases productivity and economic profits of a city [45]. **Thus, the same patterns adopted for an architectural and urban planning design could serve as a common therapy for most PTSD sufferers** [1] and collaborative work would serve as a scientific solid base for architects to create the spaces that adapt to the simplest ways the brain processes them and labels the healthy ones [11].

The space that architects should create must reflect both familiarity (for security) and discovery (for motivation) through people's fluid adaptability of movement and communication, or, as art historian Gombrich said, "easy adjustment and easy arousal" [37]. In fact, according to the environmental psychologists Pornin and Peeters, the fine line between motivational spaces and spaces of anxiety depend on: the intensity of stimulation of the human senses (e.g., visual), the clarity to "read" the whole architectural frame of a street or a city, the functionality of a space, and the easiness for people to understand why this space has been built [46]. This frame offers for people the sense of control over the spaces so that they can feel that the spaces follow their freedom of action and their independence and that these are restorative spaces that will calm people and decrease their fatigue and stress [46]. The interesting part of this work process is that the areas that are highlighted during brain imaging confirm the mental problem or illness to be worked on even though the concerned people are not conscious of the mental problem they have (Figure 2).

In the case of PTSD, people categorize urban and architectural elements and spaces as safe or dangerous. For example, they consider the doorway and narrow passageways as highly stress stimulating because they link it to what they call "the fatal funnel" that is usually a place where sudden attacks can occur [1].

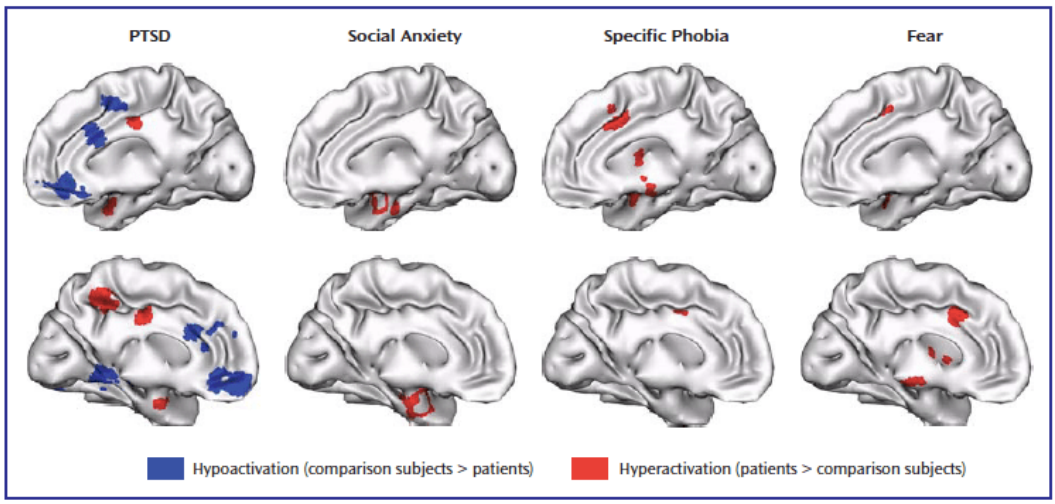

Figure 2. Brain imaging results of hypoactivation and hyperactivation due to PTSD and other mental problems and illnesses [47]. These are the brain areas to heal in people, conscious and not conscious of the mental problem they have, through architecture with the collaboration of neuroscientists.

4 Research Methods

The following methods were used in this study to find the correlation between the war in Beirut and the urban factors of Beirut as it is today and the relation with the severity of PTSD among its inhabitants. The participants are a stratified random sampling of 40 Beirutis still living in Beirut: 10 were adults during war (ages 21 and up), 10 were adolescents then adults (ages 12 and up), 10 were children then adolescents (ages 3 and up) and 10 were born after 1990. The ages are categorized in this way because the war lasted for 15 years and people experienced different life stages (age-wise) during war.

4.1 PTSD in Beirut: Past Study Results

For this study, past results of research are important to take into consideration to link after that PTSD, war, and the built environment based on the work of experts in the psychiatry field. The importance of these results lies in the fact they are based on studies that a team of Lebanese psychiatrists has conducted on around 3,000 adults who lived in Lebanon during the war [48]. In fact, after their investigation based on a "World Health Organization (WHO) interview tool to diagnose mental health disorders" [48], these psychiatrists collected results based on the interviews in which they asked each participant to recount their traumatic events that occurred during war [48]. Among the many results they unfolded, the most important results that support the current study are the following:

a. At least 25% of the participants who had different life conditions during the war (38% refugees, 55% civilians in war zones, and 18% witnesses of death or injuries) carried a mental disorder at a certain point in their lives, mainly due to war [48]. The percentage of people suffering from mental disorders can be higher; however, due to the taboos

or the lack of consciousness of having such illnesses, the participants could have answered that they are perfectly healthy [48].

b. Half of the participants who had anxiety disorders (PTSD included) received professional treatment; moreover, they were treated after a delay reaching 28 years [48].

c. Psychiatric healthcare in Lebanon is developed and, therefore, the awareness is to be highlighted to decrease taboos and untreated cases of mental illnesses [48].

4.2 Questionnaires

A questionnaire in formal Arabic consisting of the following five questions was distributed to the 40 participants to have a current data sample of PTSD symptoms:

1. Have you experienced or do you still experience nightmares and flashbacks of dangerous scenes? Are you still experiencing them now?
2. Are you feeling disconnected from others? Do you feel that others might harm you at any time?
3. Did you lose your interest in daily activities or things you liked to do? Do you see yourself isolated?
4. Do you feel yourself reacting often with anger? And/or hypervigilance?
5. Do you think that these symptoms are related to the urban change of Beirut?

4.3 In-depth interviews

Along with the questionnaires highlighting symptoms of PTSD among Beirutis, in-depth interviews in Lebanese Arabic language were conducted with this sampling. The purpose of the interview is to examine the effects of war on people with different living circumstances and to examine in which conditions PTSD is developed the most. During the interviews, users answered the following five questions:

1. How do you portray Beirut before the Lebanese civil war for a friend who has never visited it during that period and Beirut as it is today?
2. Are you attached to Beirut of the past or Beirut as it is today? Why?
3. Do you feel guilty for an event that happened during war?
4. Do you feel danger around you in a certain built environment? If yes, in which one?
5. What do you feel is missing to have an agreeable Beirut to stroll in?

4.4 Visual Study

During the interview, the participants were shown the same five photos of different past and present architectural elements specific to Beirut that usually Beirutis find significant according to the daily conversations with Beirutis and their comments on social medias (Figures 3, 4, 5, 6)

Figure 3. An aerial view of Beirut showing Martyrs' Square (in the middle) surrounded by the urban tissue known as the Beirut downtown in 1958 (photo of a postcard from Nidal Chouman's collection available at Beirut Heritage group, archived in 2017)

Figure 4. Photo of an abandoned traditional two-storey building in Ras el Nabeh region, Beirut (photo available at Beirut Heritage group, archived in 2017)

Figure 5. Photo of a traditional house in Saifi region, Beirut (photo by Ousama Sandid available at Beirut Heritage group, archived in 2017)

Figure 6. Photo in 2017 from the region of Ayn el Mreisseh, Beirut, to the Zeytuna Bay (Photo by Youssef Rached Doughan available at Beirut Heritage group, archived in 2017)

5. Results

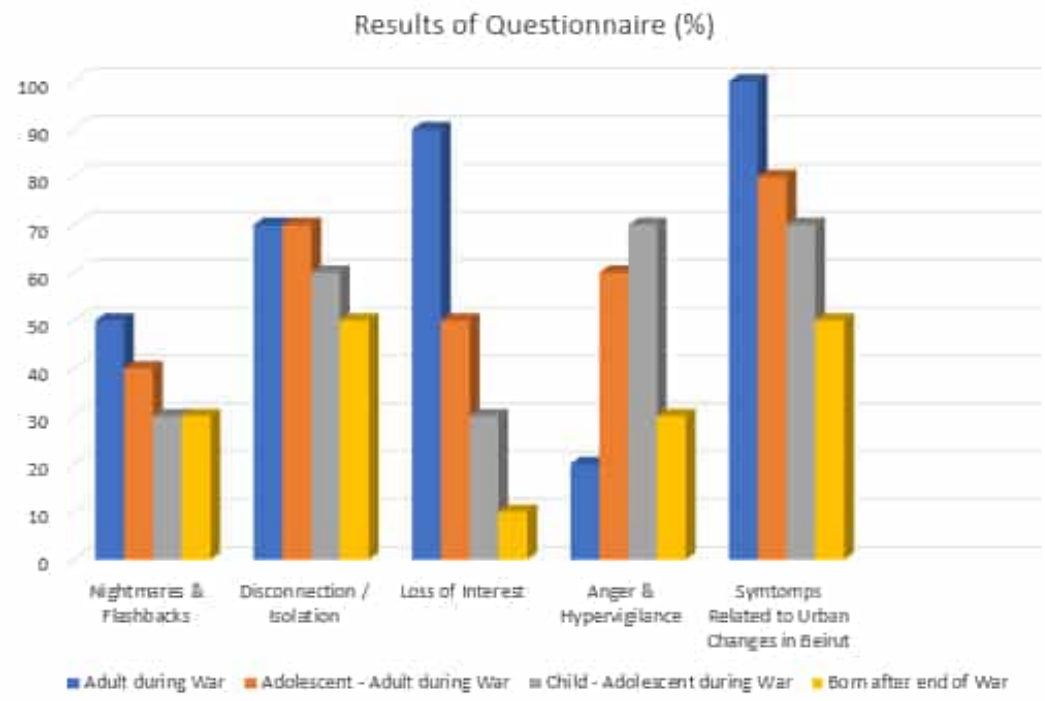

Figure 7. Results of the questionnaire showing degrees of PTSD symptoms among the participants according to their ages

Afterwards, the in-depth interviews conducted with the 40 Beirutis helped to support the analysis of the past literature and questionnaire's answers. Among the Beirutis interviews were ten warriors of war, five people who studied abroad in Europe and the United States of America during the war (for two to five years) and came back during the last five years of war (between 1985 and 1990) or after the war, three people who lost their businesses, five people who were kidnapped for several hours, three people who lost a family member due to random killing, four people who lived in denial of the war, and 10 university students who were born after 1990 and did not experience the war. The unexpected result is that no matter these people's positions and roles during the war, many answers were similar, which shows a solid collective memory in Beirut. With the questions and the pictures, the answers were as follows:

Portraying Beirut: All of the participants agreed that Beirut was more beautiful before 1975. They all also agreed that Beirut today lacks public spaces. Even 20% of the participants answered that "Beirut is a beauty queen that was forced to undergo unsuccessful plastic surgeries" and 10% answered that they "do not recognize the Beirut they have known anymore." They related this beauty to Beirut's houses or buildings with gardens and fountains. They also talked about the souks that had gathered people from all social and economic backgrounds: 75% of the participants said that "before war, Beirut was for everyone, especially the downtown souk" and 25% referred to the present souk as a "ghost town" available only for rich people and for tourists, mentioning the downtown that witnessed severe battles and is now missing the prewar crowd. Lastly, 80% admitted that they still call the areas of Beirut east and west; these names were given during the war and represented geographic and religion divisions.

Attachment to Beirut: From the responses, 60% of the participants said that "Beirut is Beirut" and that they are attached to it no matter how it is because they "love Beirut", while 20% said

they are attached to Beirut of the past. Eight out of ten participants who were warriors during all the period of the war (from 1975 to 1990) or for several years answered that they are “not attached to anything” and that “life moves on.”

Guilt: Unexpectedly, all of the participants feel guilty, except for the three businessmen who were bankrupted during war and said that the present circumstances are not helping them regain their business success. The ten warriors feel guilty for the innocent people who were killed during the war by them or by their fighting groups. The five participants who left during the war to study or work feel guilty for having left their parents and friends because when they returned they had a family member or a friend who died or got severely injured and had to go through recovery without their support. The 10 university students feel guilty because they could not do anything to preserve for their parents and grandparents the old Beirut they talk about with nostalgia. One of these university students said that he feels guilty because “traditional houses pictures remind me of a story that I will never live. These houses even know the stories of my parents more than I do”. The five participants who were kidnapped feel guilty for having caused their families “the trauma of having been kidnapped” and for not being cautious enough at the time. The three people who lost a family member said that they feel guilty for not protecting enough the people they loved the most and constantly ask themselves “what if these innocent martyrs were not on the street at that particular time?”. Even the four participants who were in denial during war “feel guilty for not trying to help anyone during [the] war and not even sympathizing with anyone.”

Danger Feelings: Of the responses, 80% feel that they belong to certain neighborhoods but feel that they are strangers in different ones, categorizing these spaces between east and west Beirut; 25% of the participants even agreed that they still exhibit anxiety signs such as sweating or shaking when they go to the “other region,” especially two of participants who were kidnapped, even after 28 years of peace. Lastly, 20% of the participants say that they do not feel anything negative because Beirut is for everyone.

Missing elements in Beirut: All 40 participants agreed on three elements: public squares, sidewalks, and green spaces for rest or free activities. Of the responses, 80% mentioned the possibility to reach the beach for free because in Beirut, “the private beach resorts are considering the seashore adjacent to their plot limits as their private property”. In addition, 50% of the participants mentioned that the old abandoned houses that were affected during the war should be renovated through the support of the state because “these houses are a constant reminder of the frightening scenes of war”.

Other answers: Of the responses, 35% of the participants considered that “this is not a civil war because many other countries were involved” as they explained during the interview that they had many friends from a different religion and they were helping each other during “these difficult times”. Furthermore, 30% of the participants said they still live in their memories and “cannot see well the future in Beirut.” Regarding the postwar downtown Beirut, 30% supported it whereas 70% were against this new place that “took the memory of our balad.” (the Lebanese term for downtown is the term “balad” which means also “country” because the Lebanese considered that everything was found in the Beirut downtown as if the country’s power and image relied on it). In fact, these people are in a state of “shock,” as they said, “why do the investors not see that the architecture of Beirut in its uniqueness can attract tourists and raise our economy?”. Lastly, 15% of the participants added that ”international medias force us to believe that the situation is unstable, even if it is.”

6. Solutions

Based on the results, Beirutis are defining themselves (identity, psychological state) the way they see their urban environment. Several urban solutions could be applied to the case of Beirut to enhance security and motivation:

1. **Create an inclusive restorative built environment:** Besides spreading awareness and having effective trauma therapy techniques, the creation of dynamic spaces helps the constructive activity of the hippocampus, which is especially beneficial for adults who were children during war to form new memories. When urban design facilitates mobility and positive functioning for people with visible and invisible disabilities, people achieve a certain interior balance to get motivated and explore the outside world. These dynamic spaces are mentally restorative following people's constant dynamic change.

2. **Create a long-term healing built environment that defines the meaning of freedom:** Understanding the rights and limitations of freedom in Beirut in important to reflect moderate degrees of security measures in order to avoid dangerous incidents without feeling too surrounded with the safety procedures that could remind the traumatized people of war. One of the urban solutions would be to build an urban strategy where people participate in improving Beirut without falling into the individual initiatives and promote more for the public collaboration to gain collective trust.

3. **Building on a human scale and promoting green mobility:** Designing a pedestrian-friendly city [11, 49] with sidewalks and gardens and human-human and human-nature live contacts helps people become more positive, generous, and friendlier, especially when exposed to green spaces [40, 45] in a world where towers could lead. In fact, pedestrianism in places where small shops can open the door to the sidewalk enhances visual contacts between the indoors and outdoors in public places [11]. This is where, according to Danish architect and urban design consultant Jan Gehl, people buffering against loneliness and alienation become more positive, walk slower, and initiate social contacts [45, 49]. Buildings should have windows oriented to a green landscape and allowing a view of the sea and mountain that is still somehow available in the case of Beirut in small plots. This urban approach is very important for PTSD cases because the pedestrian-friendly city involves the emotions and aesthetics interaction and encourages exploration [32], a healthy activity that improves the hippocampus healthy functioning and memory work (space processing and communication) through brain plasticity [32]. **These spaces could be any elements of any scale** and their placement in urban spaces motivates people to walk for unexpected and spontaneous interactions such as passive communication (just seeing that there is a form of life around them), active conversations, and events [11]. Whether in urban, architectural, or interior designs, capacious spaces with repetitive patterns are the best to apply in this case because they provide rest [37].

4. **Create (or recreate) the urban design that increases the sense of attachment and control:** The more people are more attached to a place, the more the identity of that place is better defined [21]. Enhancing familiarity and respecting the meaning of attachment and satisfaction of a community through architecture will make people see it as secure [3]. The most important for people suffering from PTSD is to create for them spaces where they can

enhance the feeling of dominance of space because it was the way they acted to feel secure during war [1]. In the language of urban planning, these concepts can be translated to defined public spaces for mutual protection and trust (for communication and teamwork since feeling alone is highly threatening [1]) and low-rise buildings (for the feeling of dominance of space).

7. Conclusion

Beirut is a challenged city in term of urban health. In one century, Beirut rose to be one of the most desirable Levantine cities to visit and then fell in a war that imprinted a facet of sectarianism, only to rise again in a different aspect. Nowadays, the city must face the problem of the high-rise building that has nothing to do with its past architecture. Beirutis are in a constant cycle of nostalgia and aim to move on, pulling up by that their sense of judgment on the day-by day changes that are occurring in their built environment to find suddenly that the changes are enormous to digest. This state of confusion only increases their loss during their search of emotional stability. The sectarian urban planning still exists and people are still living a cold war. Therefore, PTSD caused by war is still haunting Beirut as people are not be able to forget war since they experience the emotions of war on a daily basis. Moreover, guideline plans mixed the urban heritage with the contemporary architectural style, narrowing the opportunities to get a solid root and defined single identity for the whole urban tissue of Beirut. Therefore, if people do not find themselves in the place they thought they knew, but now changed due to war, they will remember the fear of its loss and the thought of losing the places where they have constructed beautiful and meaningful memories, especially with close people who died or are permanently disabled due to war. It is about endeavoring to get a whole interconnected system between architectural and emotional infrastructure, which means, the roads, the forms and functions of the neighboring buildings, the shared public spaces, the facilitation of reaching places Beirutis find primary for their daily life, and many other key factors.

Hence, urban planners have a major role in alleviating mental illnesses through the elements and shapes they propose during the planning of a postwar rising city, enhancing the harmonious relationship between the livable environment and the brain processes. The resulting urban spaces are exciting enough for motivation and quiet enough for rest. By that, Beirut will be able to help its inhabitants get over guilt and mourning through the grief visual therapy they need without having to relocate.

Limitations

As a final point, more research should be done on participants during a walk study (sensewalking) to collect more accurate results about the people's emotions who would be living the space with its visual, auditory, haptic, and emotional environment as they walk in the city.

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THE INFLUENCE OF MIGRANT CULTURE ON PUBLIC URBAN SPACE IN BERLIN, GERMANY

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Abstract

Since decades immigrants from Middle Eastern countries have come to Germany and they have changed the appearance, culture and urban experience in cities and neighbourhoods in a significant way. There are certain neighbourhoods like Kreuzberg, Wedding and Neukölln in Berlin that have gained a new identity through the mix and interchange of people with different backgrounds intermixed with the local population - visible in the context of urban space.

There are three main topics that are analysed within this context: Small family businesses and their influence on their surrounding space; form and use of public space; and significant architecture types like mosques and their role for urban space.

Keywords:

public space, culture, heritage, multicultural experience, migrant society

1 Introduction

Islamic culture is present in everyday life in Germany, especially in its capital, Berlin. The everyday culture and how it shapes and changes urban space and public life in Berlin is the focal point of this paper. It is based on empiric data collection and critical observation in three distinct neighbourhoods, that have a big Islamic population: Kreuzberg, Neukölln and Wedding. Everyday culture ("Alltagskultur") presents a contemporary and highly respected viewpoint in nowadays German research. Our lives, chances, aspirations, our culture are at least as much influenced by our everyday lives as by our historic sites if not more.

This paper investigates the three main streets of three distinct neighbourhoods, shows how the Islamic culture shapes the street life, the small businesses, a new type of architecture in Germany, the mosque and its presence on the street. An additional focus is the life in the public parks and public spaces in the warmer seasons.

Therefore this topic of Islamic life and heritage in Berlin can show a very important contemporary aspect. This bottom-up method also presents a contemporary approach to the research of everyday culture and public space.

2. Architectural appearance of Berlin and its three ”migrant“ neighbourhoods

Berlin is the capital of Germany and at the same time one of the sixteen German states. Geographically it is embedded in the European glacier plains and influenced by a temperate seasonal climate. Generally speaking the city is recognised for its contemporary art, diverse architecture, scientific research and for a high quality of living due to a multicultural atmosphere and to moderate cost of living.

With a population of 3.4 million people, Berlin also is Germany’s largest city located in the centre of the Berlin-Brandenburg metropolitan area, which is comprised of 5 million people. 13,9 % come from over 190 nations. The largest group of foreign nationals are from Turkey (more than 100,000). Large numbers of Turks, but also Greeks and Italians originally came as “guest workers” in the 1960s. Today many citizens with foreign roots are second or third generation “migrants”, a large number of them have adopted the German nationality or have double citizenship.

Most ethnic groups in Berlin live in the three neighbourhoods called Kreuzberg, Neukölln and Wedding, located in the former western part of Berlin. All three neighbourhoods basically have the same urban history. They date back to the Industrial Revolution, which transformed Berlin during the 19th century. The city's economy and population expanded dramatically during that time, and it became the economic centre of Germany. Additional suburbs soon developed and increased the area and population of Berlin. In 1861, outlying suburbs were incorporated into Berlin. In 1871, Berlin became the capital of the newly founded German Empire. Most of the three neighbourhoods investigated here were built during the industrial revolution. This period dates from the end of the German-French war in 1871 to the beginning of the second world war in 1914. During that time, numerous industrial plants and manufacturing businesses were founded in German cities. Berlin grew extensively during this time. Hundreds of thousands of factory workers came from all over the country and from neighbouring European countries to find work. They all had to find housing. New neighbourhoods relatively close to the centre were developed in a grid system during the second half of the 19th century based on an urban planning design from 1862 by James Hobrecht, the so-called Hobrecht Plan for Berlin.

Figure 1. Typical Street (Oranienstraße in Kreuzberg)

With regard to urban planning, the districts form a relatively uniform picture. They are predominantly characterized by five-story, multiple dwelling units in closed blocks, the majority of which date from the turn of the century (1889 to 1905). Due to the long property lots, the blocks are very large and have backyards. Today, they form a nearly homogeneous historic building area [1]. Envisioned as working-class districts, building blocks were composed of tenement houses (“Mietskasernen“) with front houses containing larger apartments, and one or more rear buildings with small apartments or industrial lofts in the backyards. The streets were 22 metres wide, the height of the buildings was 22 metres. These measurements were designed this way due to fire regulations. If a facade collapsed because of fire it would not destroy the building across the street.

The old buildings still give an impression of the days when the boroughs were part of so-called Steinernes Berlin (Rocky Berlin) [2].

2.1 Kreuzberg

Kreuzberg has emerged from its history as one of the poorest quarters in Berlin, located south of the centre of Berlin. The borough is known for its very large percentage of migrants and second-generation migrants, many of whom are of Turkish ancestry. While Kreuzberg thrives on its diverse culture and is still an attractive area for migrants and students, the district is also characterized by high levels of unemployment and some of the lowest average incomes in Berlin.

Far into the 20th century, Kreuzberg was the most populous of Berlin's boroughs even in absolute numbers, with more than 400,000 people, although it was and still is geographically the smallest. As a result, with more than 60,000 people per square kilometre, Kreuzberg had the highest population density in Berlin. In addition to housing, Kreuzberg was also one centre of Berlin's industry. The so-called export quarter along Ritter Street consisted of many small businesses, and the "press quarter" along Kochstraße was the home of most of Germany's large newspapers.

After World War II, Kreuzberg's housing rents were regulated by law which made investments unattractive. As a result, housing was of low quality, but cheap. Starting in the late 1960s, increasing numbers of students and artists also began moving to Kreuzberg. In the eighties, the International Building Exhibition (IBA) was located in Kreuzberg, called “gentle urban renewal“ (“Behutsame Stadterneuerung“). Many buildings were renovated and subsidized by the government, so that the rents remained affordable.

Since the fall of the Berlin Wall in 1989, Kreuzberg suddenly found itself in the middle of the city again. The initially cheap rents and many 19th century houses made some parts of the neighbourhood more attractive as residential area for a richer variety of people. This lead to gentrification in parts of the neighbourhood. But migrants, many students and freelancers working in the creatve sector are still living there. Today, Kreuzberg has one of the youngest populations of all European city boroughs.

2.1.1. Kreuzberg, Oranienstraße

Oranienstraße is the main street of the neighbourhood Kreuzberg. Its one-kilometre-stretch from Moritzplatz to Wiener Straße forms a mixed neighbourhood centre with many family businesses, clubs, restaurants and bars. Festivals and also demonstrations take place here on a regular basis.

2.2. Neukölln

Neukölln is an inner-city neighbourhood at the southern border of Kreuzberg. The district is densely settled with a population of 150,756 inhabitants (2008). It is characterized by a high percentage of immigrants, especially of Turkish and Arab descent. In the past few years, northern Neukölln, frequently known as Kreuzkölln (Kreuzberg + Neukölln), has undergone a transformation and has seen a huge influx of students and artists as the area becomes increasingly popular. Gentrification has not taken place here to a large extend (yet), rents are still partly affordable.

2.2.1. Neukölln, Sonnenallee

Sonnenallee is a long street starting at Hermannplatz, at the border of Kreuzberg and continuing into the eastern part of the city, into the neighbourhood of Treptow. The most central part at a length of one kilometre from Hermannplatz to Elbestraße is a busy street with many Turkish and Arabian businesses like restaurants, bakeries, driving schools, shisha lounges. In recent years an originally African population found their new home here as well and opened a variety of shops.

2.3. Wedding

Wedding is located north-west of the inner city. In a way it is the northern counterpart to Kreuzberg and Neukölln. The constant migration of country-dwellers into the city at the end of the 19th century converted Wedding into a working-class district. The labourers lived in similar cramped tenement blocks as described above. Today, Wedding is one of the poorest areas of Berlin, with a high unemployment rate (almost 26%). Almost 17% of the population live on social welfare; 27% live below the poverty line. Foreigners make up almost 30% of the population. Wedding has so far not experienced the boom and gentrification of the 1990s that then happened in many parts in Berlin. Unlike many other 19th century working class districts like Kreuzberg and the northern part of Neukölln, the original character of Wedding and its population has been preserved, but there are currently artists and students moving there. Rents still partly remain affordable.

2.3.1. Wedding, Badstraße

Badstraße is one main shopping street of the district of Wedding. It starts at the transportation hub “Gesundbrunnen” where there also is a big shopping mall. On the one kilometre to Koloniestraße this street has numerous textile and fashion shops, mostly run by people of Turkish origin.

3. Small family businesses

Ethnic economies - and especially the Turkish economy - already have become and are predicted to become even more important for the German national economy in the near future. These family businesses have developed a successful structure in a foreign country that is highly accepted and used not only by their compatriots but also partly by German people. This implies that the entrepreneurs, who live and work in a culturally mixed context, have the necessary skills and cultural competencies to handle this complexity [3]. The multicultural atmosphere is often visible in bilingual shop signs (predominantly German and Turkish or German and Arabic).

3.1. Shops

Shops for bridal wear, evening dresses, shoes, gift articles or furniture are geared towards the migrant population. The fashion, culture and taste are too different to have customers from both populations.

Figure 2. Gift shops

Another important branch of the family businesses are the food shops, that sell fresh fruits, vegetables, bread, pastry, meat and other original food items. Like newsstands they are frequented by large numbers of all kinds of population [4].


Figure 3. Food shops: bakery, pastry, fruit

3.2. Services

The services cater to the migrant population as well. They are mainly comprised of telephone and internet shops, copy shops, photo studios, barbers, taxi and driving schools, religious schools and travel agencies [5].

Figure 4. Barbers

Figure 5. Wedding shop and services: bridal wear, wedding car, photo studio

Figure 6. Internet café, travel agency, copy shop

3.3. Food

Berlin is a Doner/Falafel/Shawarma capital. It is not known who opened the first Doner Kebab snack bar in Germany. Legend says that it took place at the beginning of the 1970s in Berlin-Kreuzberg. First in Berlin, then all over Germany, Doner became a popular lunch or evening snack or meal [6]. There are more than 15,000 Doner/Sharwarma snack bars in Germany. 200 to 300 tons are being produced daily. The yearly turnover is around 1,5 Billion Euro. The Doner Kebab served in Germany is different from the one in the Arabic countries. It adds salad, tomatoes, cucumbers, cabbage and sauces. These snack bars are popular by Germans and migrants. They are mostly integrated in the ground floor of the buildings. The German building code allows this mixed use in apartment buildings. There are some detached kiosk style snack bars as well, predominantly at street corners to attract more customers.

Figure 7. Snack bars: at street corner or in the ground floor of apartment building

Figure 8. Snack bar advertisement in two languages

3.4. Culture

There are many oriental culture associations [7]. Dance, wellness and music are among the creative industries that sprung up during the last twenty years [8]. Kreuzberg-based Turkish/German rapper Killa Hakan mentions Kreuzberg in most of his songs, most notably in his 2007 single "Kreuzberg City". There is a very vibrant rap, hip hop and saz scene in Berlin [9].

Figure 9. Music and DVD shops

A Turkish film festival has been established in Berlin and took place five years in a row. Turkish-German filmmaker Neco Celik who portrays the American influence over the youth culture in Kreuzberg in his first film “Alltag” (Daily Life) notes, "Kreuzberg is a kind of biotope where different nationalities live, but the environment determines their lives, not their nationalities."

4. Form and use of public space

While urban space is the most commonly experienced feature of the city, it possesses different meanings and serves various purposes for the individuals engaging with it. The urban landscape is thus a space changing all the time according to the habits of its inhabitants. As a dynamic space, it carries the narratives and symbolic meanings of the past, present, and future. The economic, social, and cultural uses of space showcase the everyday culture.

4.1. Streets

Shop owners display their goods in front of their shops. This changes the appearance of the sidewalk in a very animated and colourful way during the day and in warm summer nights [10]. You can observe a similar effect in front of the snack bars and restaurants. Chairs and tables are put out in front, guests are invited to stay, and this animates the street life. The sidewalks in Berlin are wide enough to accommodate this additional use.

Figure 10. Use of sidewalk

Many migrants are also active business people on several markets, that take place once or twice a week in the neighbourhoods. In Neukölln at the border to Kreuzberg a so-called ”Türkenmarkt“ (Turkish market) has been established and successfully organized for decades. It is very popular by all kinds of shoppers and visitors, even by tourists, it is written up in several guide books. Streets and plazas are in some areas also being used for informal trade.

Figure 11. Market on Hermannplatz (border between Kreuzberg and Neukölln)

4.2. Parks

In the summer the central park of Berlin, the ”Tiergarten,“ is known for being used for barbecues. Large Turkish and Arabian families gather here on weekends, they bring food like salad and meat to be barbecued, tea, chairs, tables, blankets and children’s games and spend the day. The Berlin city council changed the regulation, since several years it is only allowed to put up a barbecue in certain areas of the park to prevent bush fires but also because some people complained about the fume all over the park.

Figure 12. Use of park

Figure 13. Activities in park

Also the small neighbourhood parks (Görlitzer Park in Kreuzberg, Hasenheide in Neukölln and Humboldthain in Wedding) are being used for family picnics the minute the weather permits it.

5. Significant architecture types like mosques and their role for urban space

Mosques as centres of the religious, cultural and social life have first been accommodated in backyards or cellars of the quarters with a high number of Muslim inhabitants [11]. There are currently about 2,600 Islamic centres of worship in Germany along with 200 structures that can be classified as mosques [12]. According to current plans, this last figure is now expected to double [13; 14].

In recent years several mosques have been constructed in Berlin [15]. This also represents the evolution of Islamic heritage from the private to the public sphere. It has become part of the cityscape [16]. German building code allows the building of mosques and minarets, the buildings have to comply with the German regulations (e.g. height of buildings, fire regulations). Some resistance by the German population could be observed, conservative citizens did not want the presence on the street, and they were afraid that the mosques would attract too much street traffic.

Figure 14. Religious centres in backyards in Kreuzberg

Whereas some mosques are typically neighbourhood mosques where members live close by, other mosques attract Muslims from all over Berlin. Many mosques are combined with cultural centres. Mosques and businesses serve the particular needs of the Muslim community. They are examples of spaces in which minority groups feel accepted while not necessarily segregating themselves from the rest of the city. In this sense members can move between minority (city) and majority (mosque) communities.

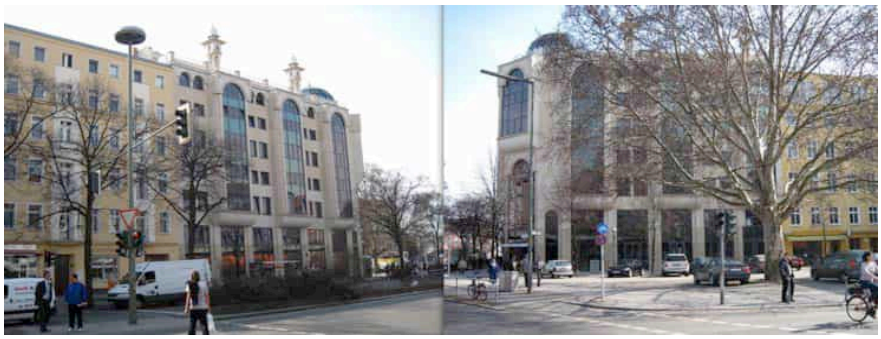

Figure 15. Umar Ibn Al-Khattab Mosque in Kreuzberg

There are eighty mosques in Berlin, 56 of them Turkish. In Kreuzberg the big Umar Ibn Al-Khattab mosque has been completed in 2008, it can house 700 people. Located at a street corner, it forms part of the typical Berlin block of 22 m height, a necessity to get a building permit in this urban location. The mosque has four minarets. The Sehitlik mosque was constructed in 1983 in Neukölln, it was expanded in 2005. It is located on a former Turkish cemetery, next to a Christian cemetery, it is a singular building, not part of an urban block structure. It has its own bus stop and traffic light regulated pedestrian crossing in front.

Figure 16. Sehitlik Mosque in Neukölln

The visualisation of a religious minority through mosques is a cultural diversification of urban space.

6. Conclusion: The influence ot migrant culture on public urban space

The built environment provides perhaps the most immediate visual impression of a city. However, not only the physical structures, monuments, residential areas and public spaces shape a city, but also the everyday life of the city residents. They imprint their own mark on urban spaces through everyday interaction.

Migration is changing the cityscape. Migrants bring with them own cultures, experiences, religions and histories through which they shape the environment in which they settle. New urban patterns are emerging, and they are also influenced or created by the Islamic way of life.

Figure 17. Imprint on urban fabric

In Berlin, these urban patterns and experiences are mostly visible in the three migrant neighbourhoods of Kreuzberg, Neukölln and Wedding. The inhabitants and their heritage shape the streets and sidewalks concerning form, use and appearance, and they

also influence the sensual experiences of a space in terms of view, smell, and sound. For the most part, the spaces are influenced and/or changed through culture, business and religion or the mixture of those. There is a rich culture of small family businesses and services in the migrant societies. First of all the snack bars (Doner, Shawarma, nuts, pastry) form a successful business model. Small or medium sized food shops are second in number, selling fresh fruits, vegetables, bread, pastry, meat and other original food items. Also newsstands are among the businesses often run by migrant families. All of them are frequented by migrants and Germans alike. Other shops like bridal wear, evening dresses, shoes, gift articles, furniture, or services like barbers, travel agencies, driving and taxi schools, copy shops, photo studios, internet services are rather geared towards the migrant population. Many migrants are also active business people on several markets. The public space also serves as a place for small and informal trade. In the warmer season, migrant families use the parks of Berlin for barbecues and picnics on weekends.

Parts of the migrant population are also emerging into the creative industries. Businesses in the areas of music, dance or wellness are growing. Musicians (mostly men) tend to combine their Islamic heritage with their everyday experience of living in Berlin in their music. Dance and wellness businesses are mostly run by women, catering to women of all backgrounds.

The architectural type of the mosque currently develops a significant role for urban space. Centres of the religious, cultural and social life were first accommodated almost invisibly in backyards or cellars, but in recent years a number of mosques were built along the streets or are currently in planning. Prominently located on major streets or on public plazas, they gain more visibility, and they shape the city scape. Having a significant impact on the neighbourhoods, they often serve as a point of identification. Many of them welcome different or mixed religious groups and make efforts to relate to all neighbours, e.g. through certain events or open days.

Migrants have changed the face and the cultural characteristics of places in the living environment in Berlin. Islamic heritage is present in everyday life every day. It is important to respect and appreciate these trends. Everyone has to make an effort on tolerance, making Berlin and other cities a more multicultural and diverse place to live.

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UNDERSTANDING CHANGE OF URBANISM PATTERNS IN JEDDAH BETWEEN 1938-2017

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1 ABSTRACT

Jeddah is one of the most urbanised cities in the western region of Saudi Arabia due to its economic status as a commercial hub during the Saudi regime era and earlier times. The urban sprawl of the city has rapidly increased since the oil boom in 1938 and this continuous expansion has resulted in changing the physical environment, lifestyles of Saudis and the Islamic identity. However, other factors that have contributed to changing the urban fabric of the city include the introduction of the automobile, new construction techniques, and building materials. In this setting, the urban pattern of the traditional city has witnessed a series of significant changes. The traditional city was distinguished by a homogenised urban environment where the local architecture complemented the compact urban fabric of the city based on Islamic planning and designing principles. However, Jeddah has transformed into a heterogeneous city where many of the housing typologies have not considered the socio-cultural values of residents. Using the criteria of scale, functionality, interface, diversity, and geometry, it is argued that the urban pattern of the city has lost its unique features, which traditionally contributed to resolving environmental, and socio-cultural matters and reflected Islamic principles. In this paper, changes in the urban pattern of Jeddah have been reviewed to shed light on the key drivers of change, urban policies, and building regulations that led to new urban patterns in Jeddah. Finally, some modifications to the existing urban pattern in Jeddah that reflect more balanced local socio-cultural values and Islamic principles are suggested. The outcomes of this paper will assist in avoiding existing urban issues and socio-cultural conflicts, including expressing Islamic identity when planning new cities, such as the King Abdullah Economic City (KAEC).

Keywords

traditional, transitional, contemporary, patterns, Key-drivers

2 INTRODUCTION

Jeddah is one of the most urbanised cities in the western region of Saudi Arabia due to its historic and economic status as a commercial hub during the regime of the Saudi rulers and prior [1]. The urban sprawl of the city has rapidly increased since the oil boom in 1938 until today, with up to 90% of Jeddah's urban planning being implemented during the late 1940s [1, 2]. This continuous expansion has resulted in changing local forms, structures, patterns of city planning as well as building, residents lifestyles, and the Islamic identity of the city, thus up to 90% of the city has been planned in late forties [1, 3]. However, other factors have significantly contributed to changing the urban fabric of the city, including the introduction of the automobile, construction techniques, and building materials. Therefore, the spatial context of the housing units has also changed resulting in new architectural features and diminishing local identity. The structure of the traditional city was distinguished by homogenised urban forms where the local architecture complements the compact urban fabric of the city. Since the 1940s, it has transformed into a heterogeneous city where most of the neighbourhoods and housing patterns do not reflect local socio-cultural values [4, 5]. Moreover, Jeddah's urban pattern has lost its unique features, which functionally contribute to solving environmental and socio-cultural matters. For example, wide roads, intersections, and highways traditional have replaced historic narrow alleyways, while most public spaces have been transformed into parking areas, and local grocery shops to supermarkets. Due to this rapid urban transformation, the city has witnessed dramatic changes in its physical environment, which led to a gradual change in the indigenous socio-cultural values of the residents. Subsequently, the society itself has lost its traditional Islamic pattern and has become "a semi-cosmopolitan environment of the twentieth century" [6] (see Figure 1).

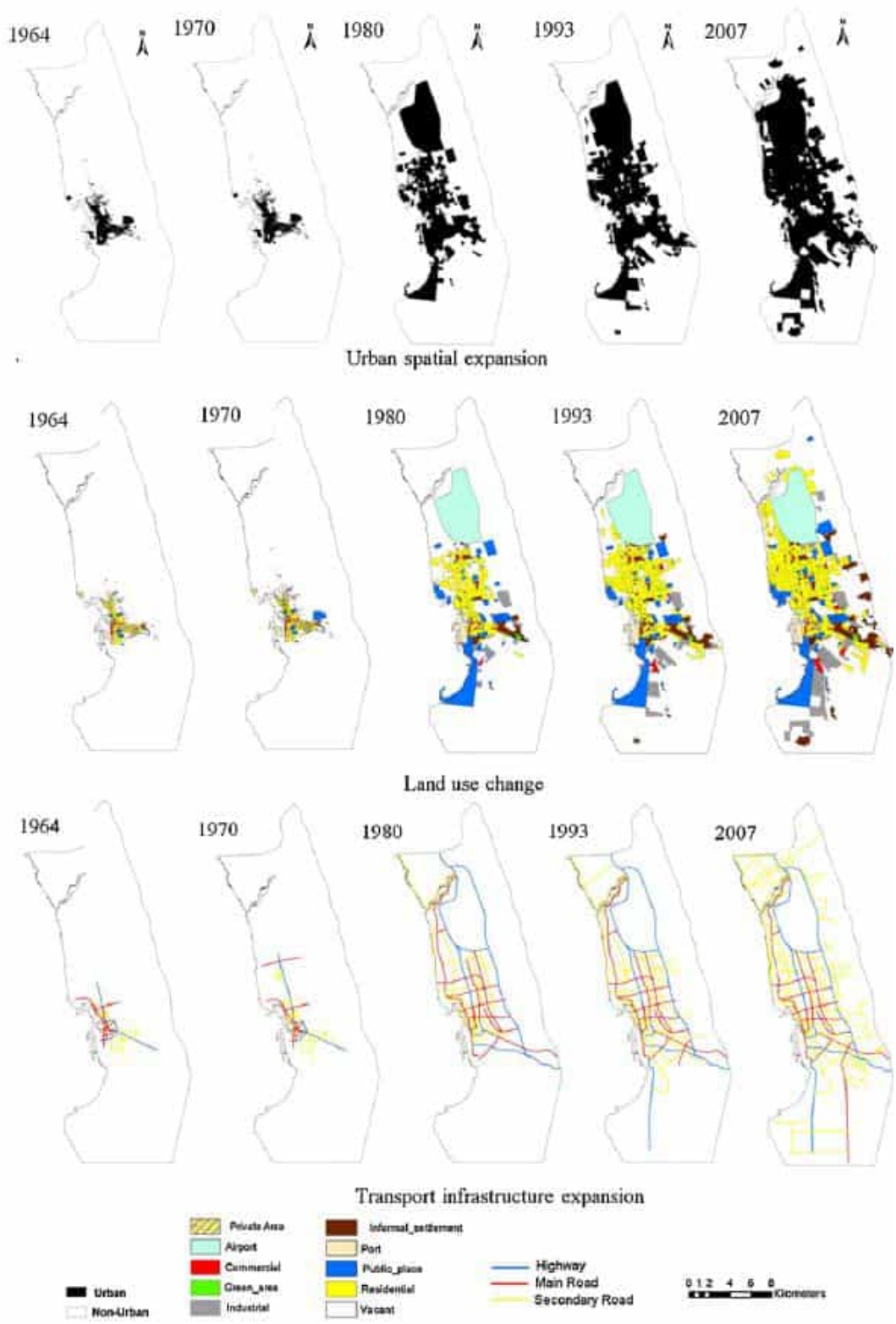


Figure 1.: Land use changes in Jeddah from 1964-2007. Source: [7]

3 OVERVIEW OF JEDDAH

The west of Saudi Arabia includes several major cities in the Hijazi Tehama region. Jeddah is one of these cities, located on the western shore of the country and is the second largest city in Saudi Arabia [8]. Hijazji Tehama includes cities made significant due to either their religious roles such as Makkah and Al-Madinah, or their commercial roles, such as Jeddah and Taif [9]. Jeddah has the oldest seaport in the country which has been used over time for commercial activities as well as receiving pilgrims from around the world (see Figure 2&3). The total number of the population in the late 1940s was 30,000;this number has increased to 3,400,000 in 2010 [1, 10]. The total area of the city has increased from 2.5km² to 1400km² in the same time frame [10, 11]. Jeddah's climate is mostly semi-tropical coastal, and experiences extremely high temperatures during summer. During the summer the temperature could be more than 43°C and dropping to around 30°C at night [1].

Figure 2: The port of Jeddah during the early 1930s. Source:[12]

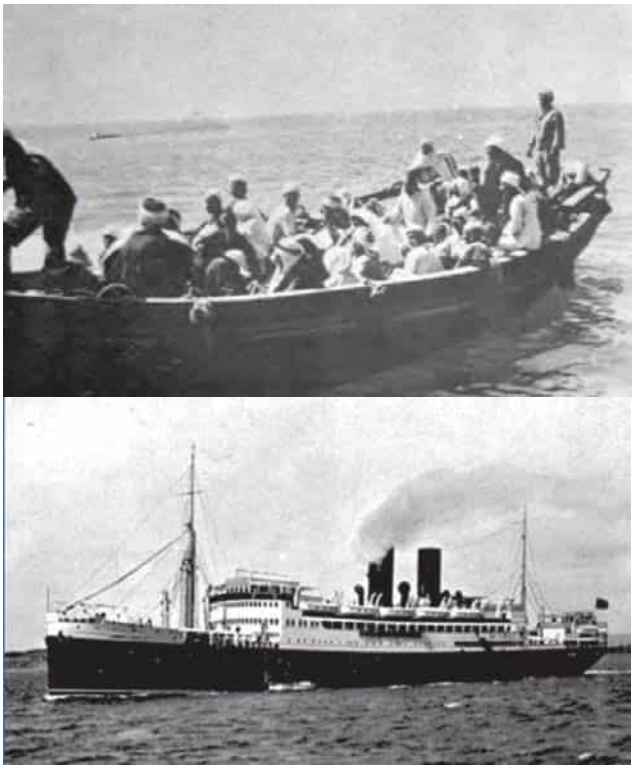


Figure 3: Pilgrims arriving at Jeddah in different time periods at early twentieth century using basic and modern forms of transportation. Source:[12]

In terms of demographic changes, some of the pilgrims preferred to remain in either Makkah or Jeddah for the rest of their live and became a significant part of Saudi society, especially in the Western region [13]. These pilgrims built small houses to accommodate their existing needs and as a result, some of the architectural elements of housing were imported from other countries and modified to fulfill surrounding principles of local society. Most housing was designed to accommodate a nuclear family but remained flexible for future possible expansions to accommodate new generations and extended family, or to run commercial activities and so on. The diversity has increased over time, affecting the city's architecture and urban pattern to reflect their backgrounds. However, after the urban sprawl which started in the fifties, most of the traditional houses in Jeddah were occupied by non-Saudi workers who predominantly came from Africa and parts of East and South-East Asia. Until early forties, the urban fabric, as well as the architecture, was able adopt the different socio-cultural backgrounds of its inhabitants by adopting common Islamic principles as the basis for city planning and housing design [3, 14].

There is currently no official census that exists which confirms the exact number of the population of Jeddah during the 1930s – 1960s. The "King Abdulaziz Project for Regeneration & Development of Historic Jeddah" was conducted in 2002 and focused on developing the historic part of Jeddah with pay attention to keep the traditional buildings and reuse the traditional architectural elements at the new buildings. However, the information from this study included other parts of the city that were located outside of the boundaries of old Jeddah's wall, compromising the usefulness of the data According to population statistics in 1970, the population in old Jeddah was 58,000 people; this number steadily declined to 46,000 people in 2002 until it later reached 35,000 people [1, 5, 12]. Some statistics from the

"King Abdulaziz Project for Regeneration & Development of Historic Jeddah" showed that the total number of legal residents in the old city was only 13,000 people, most of whom were under 45 years of age. In relation to the same matter, the *Umdah* [the official governmental representative for the historic city] has reported in 2011 that the number of the population of the old city is 35,000-40,000 people. This data was not announced in official censuses but it was based on estimated data completed by some of the stakeholders that include economic, real estate developers, academic staffs, planners and architects [5].

4 FORM AND STRUCTURE OF JEDDAH

4.1 The Traditional Districts

The urban fabric of the traditional district has offered a unique example of the homogenisation of architecture, urban fabric, socio-cultural values, and Islamic principles. The high-density houses were connected by shaded, narrow alleyways. These alleyways started growing from semi-public spaces [*cul-de-sac*] until reaching the main public space close to the main mosque. There are four main quarters in the traditional district: [*Sham, Mazloum, Bahar, Yemen*] (see Figure 4).

Figure 4.: The four main quarters in the traditional district in 1200 which still existing until today. Source: [12]

On one hand, the urban spaces of Jeddah accommodated commercial activities and religious practices similar to most Islamic cities, which demonstrated the dialectic relationship between the main mosque and the *Souk* [marketplace] . However, the urban fabric of housing units also contained some architectural styles which were unique to the Red Sea coastal region which differed from the architecture styles present in other Islamic cities. The architectural style in Jeddah has been described as an introverted style (see Figure 5).

Figure 5.: The architectural style in the traditional district. Source:[12]

The urban fabric of the Red Sea coastal cities was extremely compact. Housing blocks were typically surrounded by streets from each side (see Figure 6&7) and established a direct visual relationship with the semi-public and public spaces by using an architectural element at the front of the house around the main entrance called a *Roshan* [window] (see Figure 8)[15]. The [*Roshan*] ensured a safe visual connection with surrounding semi-public and public spaces by alleviating any concerns related to the privacy of the women dwelling inside the house [16, 17].

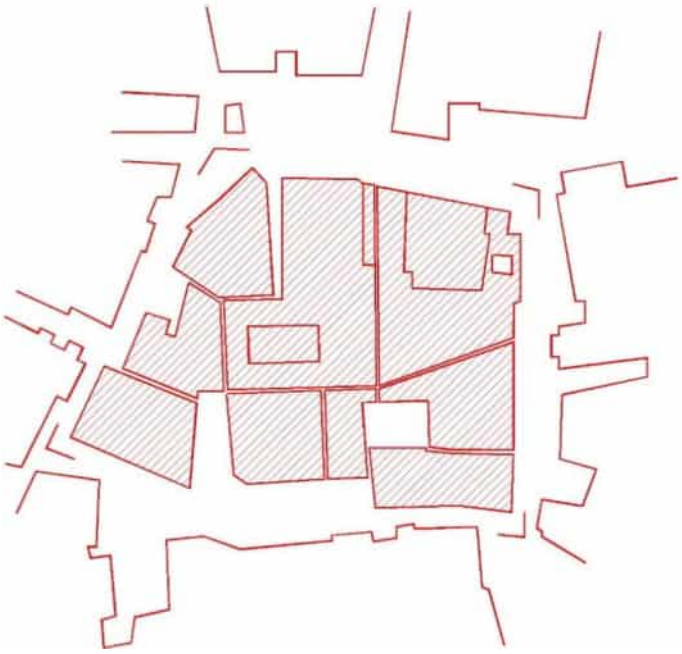


Figure 6: The compact pattern at the traditional district, derived from Y. Faden. Source: [18]

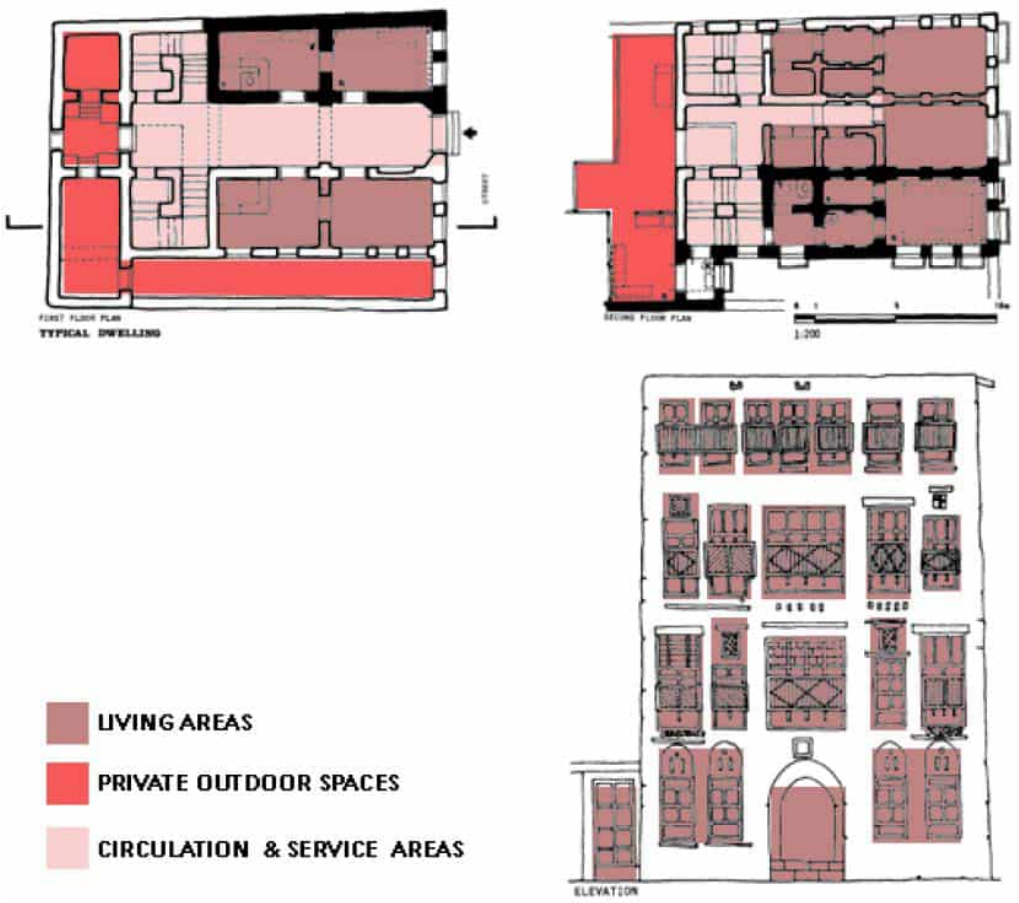


Figure 7: The housing unit in the traditional district, derived from Y. Faden. Source: [18]

Figure 8: Different styles of *Roshan* as they appeared on the houses' facades in the traditional district. Source: [8, 12, 17]

As the result of adopting a distinct morphology, the urban spaces of the traditional district acquired a specific character which distinguished them from other urban spaces in other Islamic cities. For example, the courtyard usually located in the middle of the house was replaced by open spaces in the upper levels, while the main open space was located on the roof of the house (see Figure 9). However, the urban public spaces of Jeddah did not witness any major changes as they were derived from surrounding Islamic principles, environmental circumstances, and the local socio-cultural values of the residents.

Figure 9: Open spaces appeared in the upper levels of the traditional district with different forms based on the required degree of residents' privacy. For example, number [3] is a private outdoor space for the family, so it was surrounded by walls to ensure privacy for household and neighbours as well. Source: [12]

There were other low-density houses that were slightly isolated from the rest of the residential blocks. These were built to host international Consulates and Delegations. The central part of the traditional city was located between the two main *Souks*: [*Al-`Alawi*] and the [*Bedawi*], also known as the [*Juma`a*] *souk* (see Figure 10). This section of the city contained a large number of the historic houses. The main Mosque, known as [*ash-Shafe`i*], was also located in this part of the city. The two main *Souks* mentioned above crossed the traditional areas from the East to the West to connect the trading port of Jeddah with the main Gate of Makkah. This commercial axis was considered a vital artery for the traditional city because it contained a wide variety of land use including both public and religious bodies, Mosques, housing, and shops. However, under the recent urban development, some parts of the *souks* have since been demolished; specifically, from the seacoast to Dahab Street.

Figure 10: *(Left) Al-`Alawi Souk* in 1918. *(Right) Al-`Alawi Souk* in 2006. Source: [12]

Jeddah has since witnessed wide-scale urban development following the oil boom of 1938, leading to the development of a new commercial axis that crossed the old Jeddah from the north to the south via [*Al-Madinah Road*]. The southern part of the old city has grown around the new commercial axis, especially at the [*Harat Yemen*] or [*Yemen's*] Quarter (see Figure 11 &12). During the last 40 years, most of the ground floors of the residential buildings in this area are used for commercial activities. This area of the city contains with mostly traditional housing, consisting of two or three floors populated by low-income households.

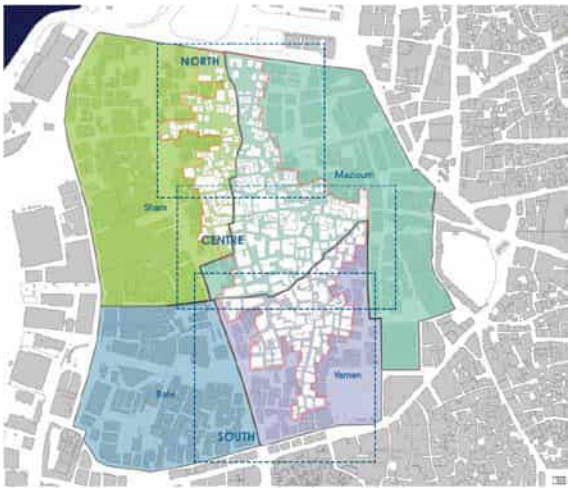


Figure 11: The overlap between the different quarters in the traditional district. The blue squares indicate the location of the commercial axis. Source: [12]

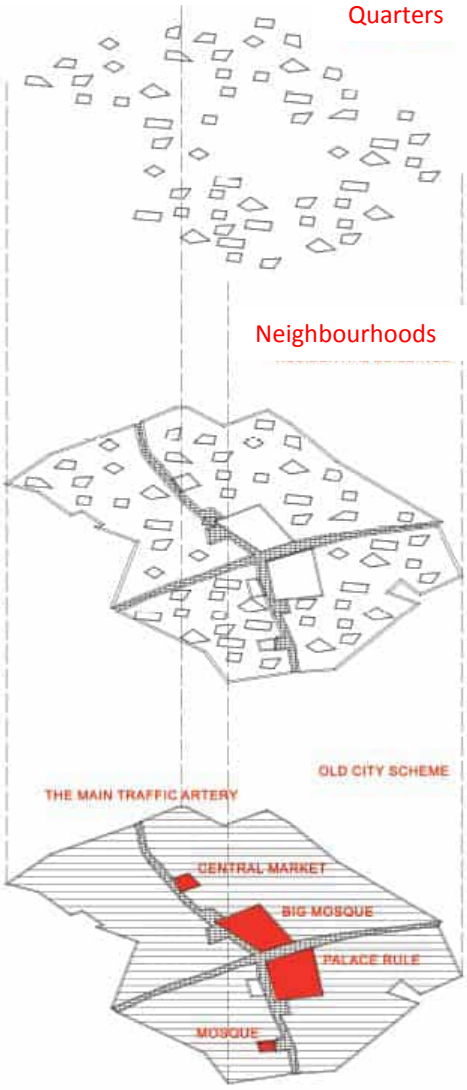


Figure 12: The profile of the main commercial axis at the traditional district. Source: [Authors]

The traditional district of Jeddah was surrounded by a protective wall which was re-built during the 16th century, with a height of approximately 3-4 meters. This protective wall was demolished in 1948 to expand the city in response the economic boom after the discovery of the oil in the Eastern province [1]. The wall had several gates which were opened during the day until dusk and aided in the protection of the city from attacks by enemies or thieves (see Figure 13). During the 1930s, the traditional district had expanded to around 1km², with a total population of 35,000 inhabitants in 1947 [12].

Figure 13: *Al-Madinah* & *Makkah* Gates in early 1920s. Source:[12]

Nowadays, the traditional district is small compared to the modern district of Jeddah. In terms of the architecture and the urban development of the traditional district, the shortage of having scientific archaeological studies during that time has resulted in missing important information about the traditional built environment. However, some known factors exist that contributed to shaping the architecture of the traditional district in Jeddah. In particular, the socio-cultural values, described in some early literature as reflecting "Social Conservatism" [12, 19], meant using the available local materials and construction methods for constructing forms and structures that complied with Islamic principles and local socio-cultural values of the residents.

Most of the buildings built during the early Islamic era in 1200A.D. are not habitable. The one building that remains habitable in the old city is located in [*Qabel Street*], the warehouse [*Ash-Shoona*]. As I common in other Islamic cities, the souk in the traditional district is not only used for commercial activities but also as a public space to commence socio-cultural practices where people meet to celebrate religious events and discuss public matters. The location of shops in the souk was designated based on types of craft or services. For example, shops which specialised in specific crafts were grouped together in specific zones of the souk. Commercial activities gradually reduced in proximity to residential areas, giving way to the narrow, shaded alleyways that lead to houses [16].

Alleyways also played a role in other types of socio-cultural activities of residents who lived in the *Hara* [residential neighbourhood] which directly connected to the [cul-de-sacs]. The *Zawiya* [local mosque] and the surrounding shops were connected with the residential blocks through alleyways; the local religious, social, and commercial activities taking place at the *Baraha* [which represented the open public space surrounding residential blocks] [12]. Within

the *Baraha* is another place for social practices, such as talking with friends while drinking tea or smoking *Shesha*, which is known as *Gahwa* [a traditional cafe with smoking area].

The local shops were usually owned by people who were living at the same neighbourhood and the landlord holds social responsibility towards monitoring the *Baraha* to report any risks or unusual activities to the *Umda* [the government representative at Hara] (see Figure 14). In the traditional district of Jeddah, each *Hara* had a government representative. The *Umda* maintained socio-cultural authority and held a legal responsibility towards the residents who lived in their allocated residential neighbourhood.

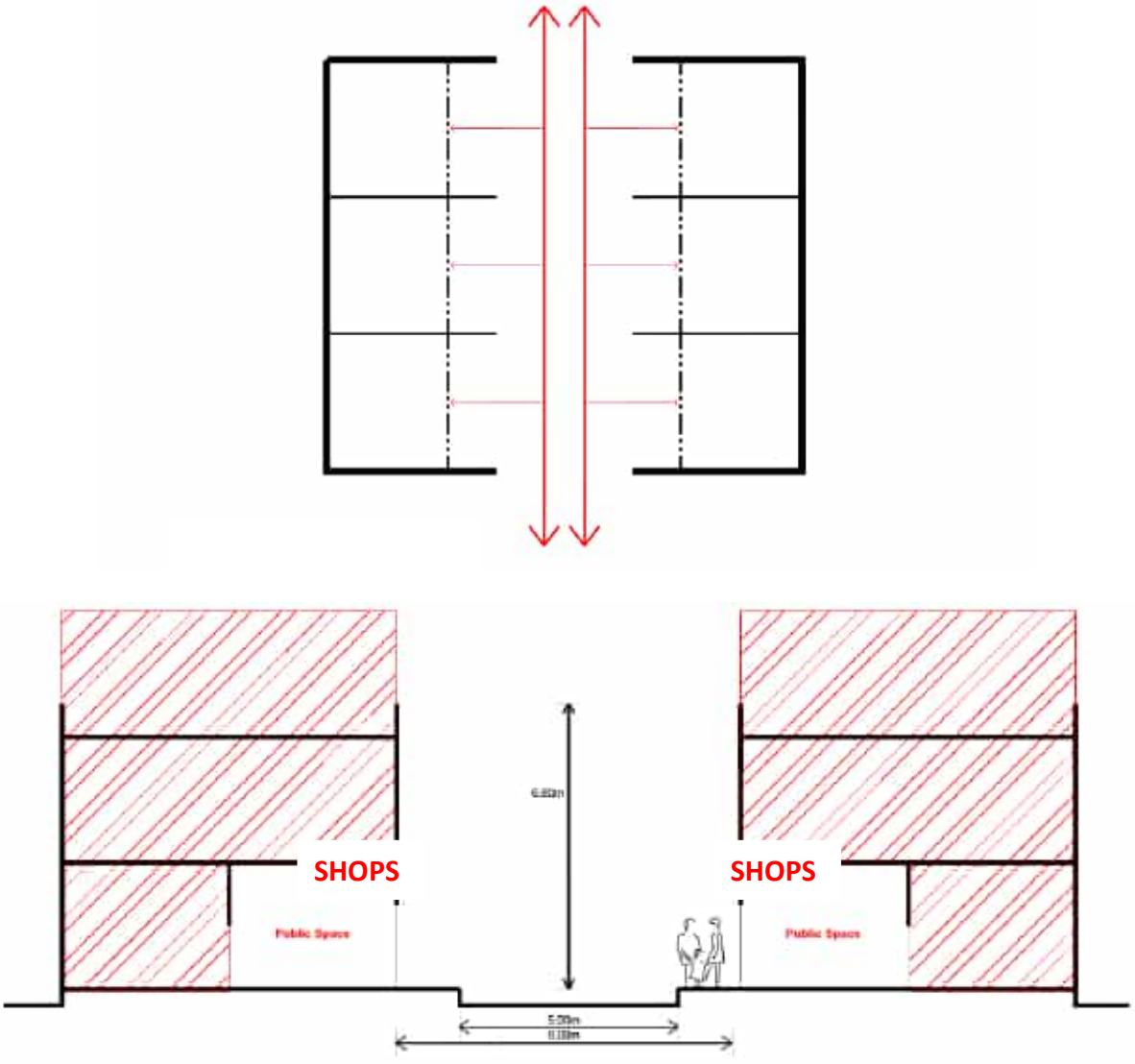


Figure 14: Owners of local shops would often monitor the streets of their businesses, as they were also residents of the same neighbourhood. Source: [Author]

Thus, the *Umda* was responsible for maintaining the public security by solving disputes between the residents. However, in 1980 the government decided to divide the traditional district of Jeddah into two main parts: the [*Yemen*] and [*Bahar*] neighbourhoods, and the [*Al-*

Sham] and [*Mazloum*] neighbourhoods. As a result, each part was subject to the authority of one *Umda*, instead of having a designated *Umda* for each neighbourhood.

4.2 The Transitional Districts

The transitional district appeared between 1950-1960 as a result of several factors. First was the economic revival of Saudi Arabia after discovering oil in the early 1940s. The government during this period allocated a portion of the resulting national income to modernise major cities, in part to accommodate the increasing shift towards a modern lifestyle by locals in the Eastern province. The introduction of cars and shortage of adequate public transportation systems also led to replacing the narrow alleyways with wide streets. Despite these efforts, these roads were still not wide enough. One of these was the limited number of car owners in the area. Furthermore, the forms and structures of the traditional district remained embedded in the local psyche, resulting in the newly developed streets being used to continue the same socio-cultural activities even after the introduction of cars. For example, neighbours maintained gatherings at the *Mastabah* [outdoor sitting area], which was usually located at the front of the traditional houses to accommodate socio-cultural activities and discussing public matters (see Figure 15).

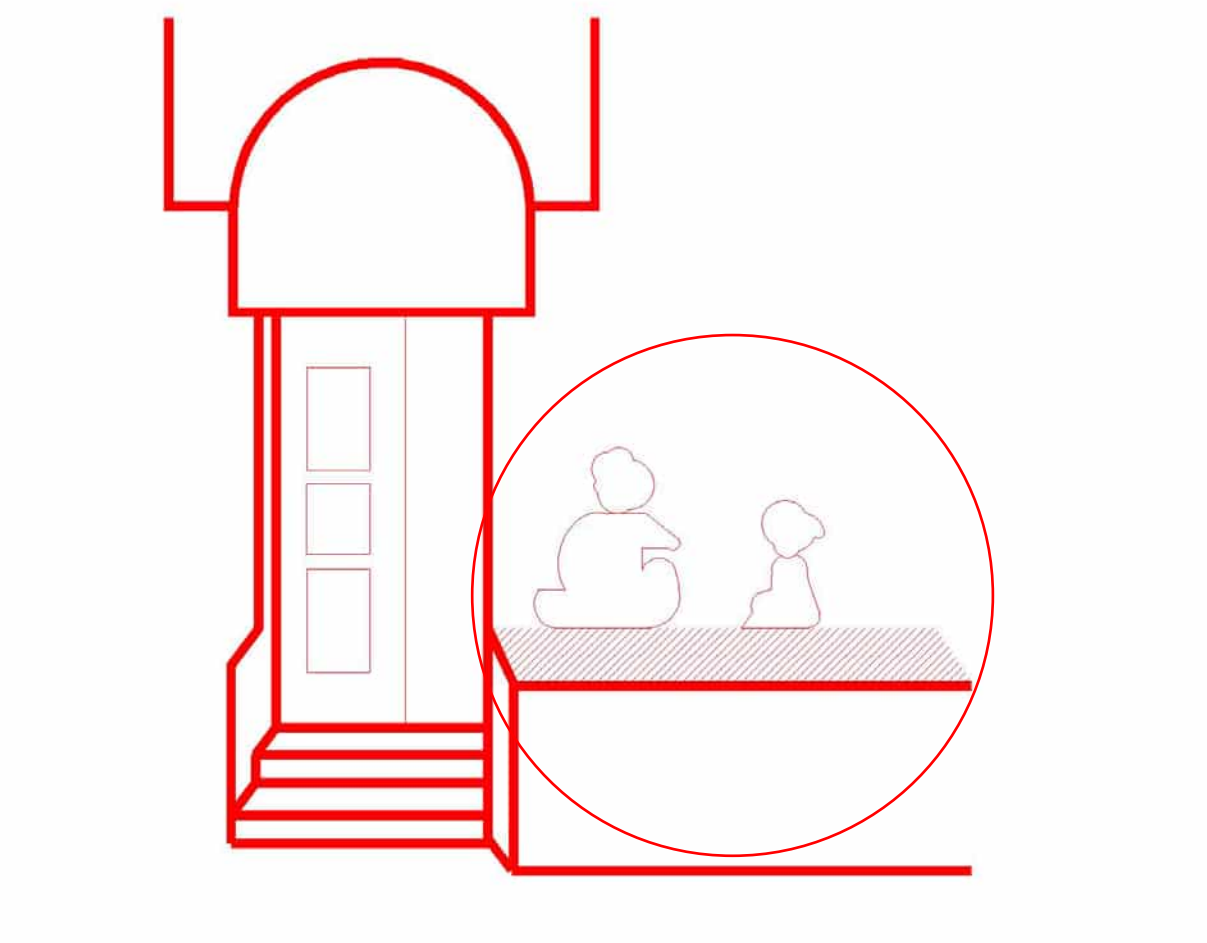


Figure 15: The Mastabah as it appeared at the traditional district derived from S.Akbar. Source: [20]

The [*Mastabah*] disappeared in transitional housing and was replaced by placing furniture at the front of the house or in public spaces to sustain socio-cultural activities. However, there were also some similarities between traditional and transitional neighbourhoods. For example, local shops remained within walking distance for residents to easily access daily necessities such as dairy products, butcheries, and fresh produce. The overall forms and structures of the neighbourhoods did not significantly differ from the traditional district beyond the above-mentioned exceptions (see Figure 16&17).

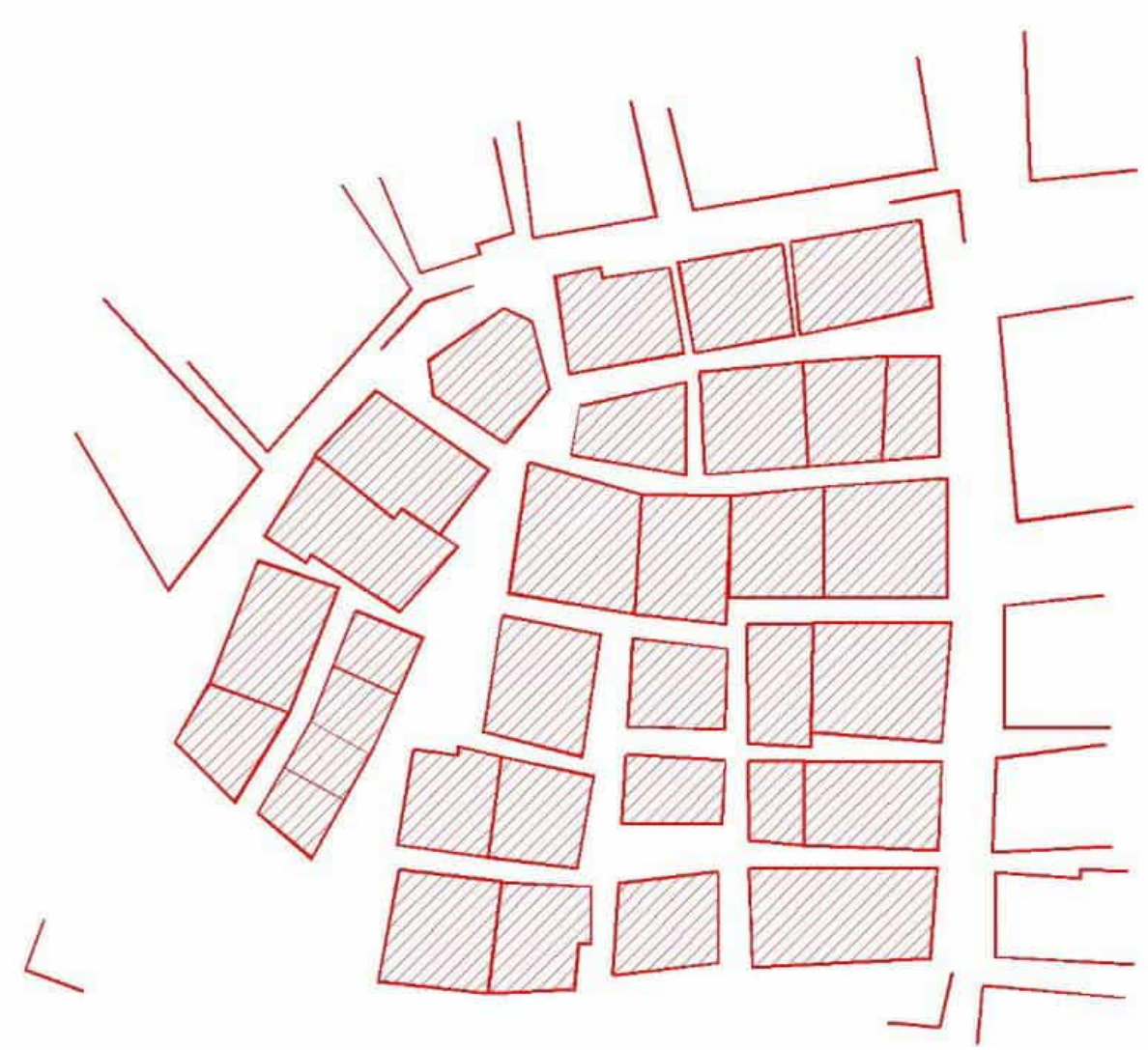


Figure 16: The urban pattern at the transitional district, derived from Y. Faden. Source: [18]

Figure 17: The housing unit in the transitional district, derived from Y. Faden. Source: [18]

There was an overlap between the traditional and transitional patterns in some areas which produced patterns of mixed-use areas. The mixed used areas have the features of both traditional and transitional districts, which could be an indicator of socio-cultural resistance and conflict between inhabitants' views. While some of the residents had accepted socio-cultural changes due to economic transition, others adhered to the traditional socio-cultural values that shaped their neighbourhoods.

4.3 The Contemporary Districts

The contemporary district appeared in the early 1970s following the approval of new planning policies and building regulations by the government as well as adopting new building technologies and materials [3, 21]. These policies and regulations widely changed the urban morphology of Saudi Arabia. In this period, the streets were divided into several levels such as highways, major, and service roads. The gridiron pattern dominated the planning of Jeddah and other major cities (see Figure 18). New building regulations left residents with no option but to accept the villa as the only housing type which met these regulations (see Figure 19) [2, 22].

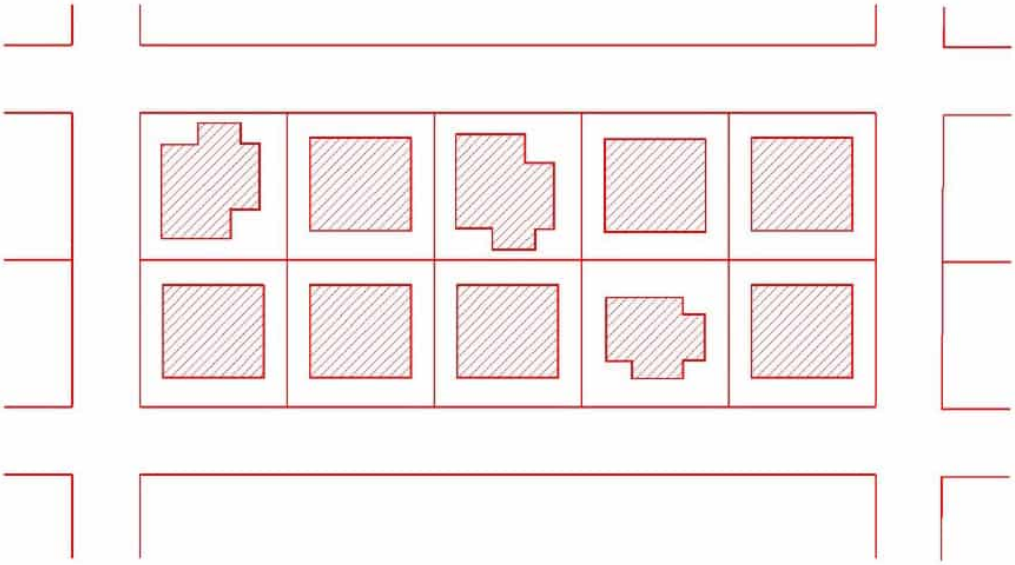


Figure 18: The urban pattern at the contemporary district, derived from Y. Faden.
Source: [18]

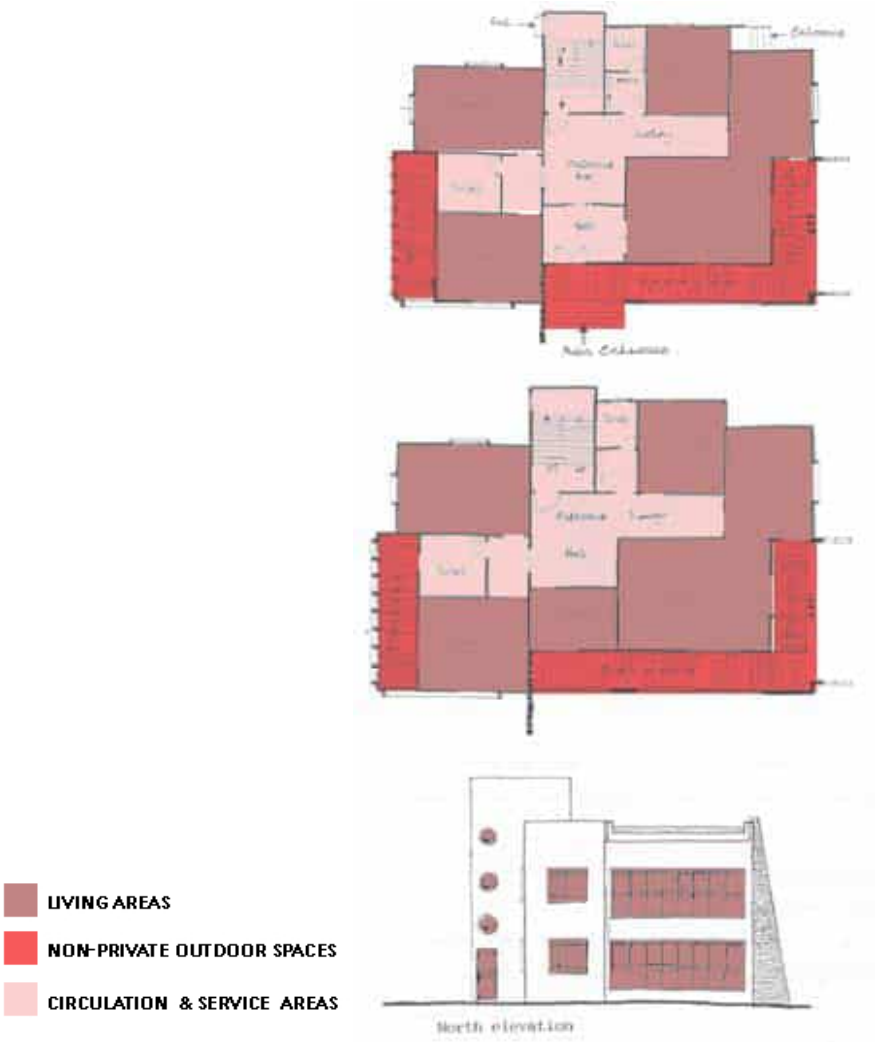


Figure 19: The housing unit in the contemporary district, derived from Y. Faden.
Source: [18]

In the early 1980s, due to the economic boom and an influx of migrants from inside and outside the country towards Jeddah, multi-storey buildings were constructed to accommodate the sudden increase in the population [5]. At first, locals preferred not to move into these apartments and the main occupants of these buildings were immigrants. However, due to increasing land prices and the cost of housing construction materials, this type of accommodation gradually became widely accepted by Saudis as well. The majority of the residential neighbourhoods in Jeddah now consist of multi-storey buildings as a result of skyrocketing land prices since the collapse of the stock market in 2006 and the shortage of public services and infrastructure in the southern and eastern parts of the city.

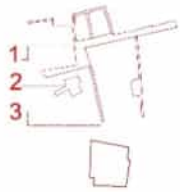
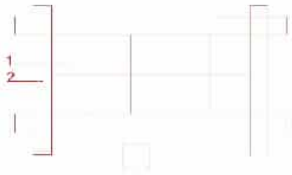
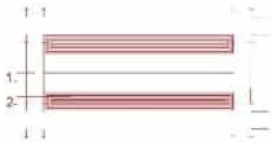
5 DISCUSSION

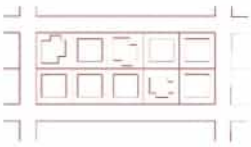
Using the criteria of scale, functionality, interface, diversity, and geometry, the three districts mentioned above have been compared. First, the scale of the traditional district has greatly considered the human scale as one of the significant factors in planning and designing the residential neighbourhoods. The urban spaces in the dense quarters were appropriate to the human scale and household needs. The scale of the residential quarters did not exceed forty

houses, and the dimensions of streets are quite narrow to consider socio-cultural values and environmental aspects. The transitional district was similar to the traditional, however, the introduction of cars has changed street patterns as well as dimension. While the contemporary district is different because it has been divided into super blocks, the neighbourhood has also become larger and is no longer appropriate in terms of scale and function. Secondly, with respect to functionality, the compact forms of the traditional district followed the function of the space. The form of the housing units differed based on the changing needs of inhabitants. The narrow alleyways played significant roles in treating socio-cultural, environmental, and urban aspects. Different types of public space were introduced: (i) public, (ii) semi-public, (iii) semi-private, and (iv) private inside the housing units. The transitional district has similar features as mentioned above to the traditional district, however, the semi-private space started to disappear. In the contemporary district, form has become homogenised through the application of building and planning regulations [5]. Thus, the area of the lots has become the same for the majority of the residential blocks. Also, the building regulations were quite restrictive in terms of the total area of each floor as well as the setback dimensions from each direction. As a result, the floor plan of the housing units is very similar and the housing form no longer reflected the function of the space but was limited to meet building regulations only. The interaction between public and private realms in the traditional environment was unique. The interaction happened naturally, where people transferred from their private spaces inside the house, to public space during the day for trading and commercial matters. This kind of interface between public and private realms made travel between alleyways more interesting, livable, and safe. This was not the case in the transitional district because the introduction of cars has resulted in conflict between use of drivers and pedestrians. Commercial use started to appear in the majority of the ground floors due to the economic growth following the oil boom. Most residents started to build their own commercial businesses and western products started to appear in local grocery shops. This situation increased in the contemporary district, where the interface between public and private evolved into a strict, organized formula. Thus, planners were designing streets for cars instead of inhabitants, and introducing new interfaces scales and functions that could be seen as disjointed. The diversity of the form and structure of the traditional district was a result of several factors. Islamic factors, such as neighbour rights and gender segregation, played a significant role. Socio-cultural factors shaped traditional housing in adherence to the concept of privacy such as in public, semi-public, and private space, as did the extended family, which required the housing units designs to be flexible to accommodate the growth of family members. In the transitional district, the new buildings became more regimented in terms of the outline of the houses due to importing new architectural designs from other countries. In the contemporary district, as mentioned above, forms and designs of housing units are almost the same, however, the buildings facades slightly differ from house to another. Housing units in some neighbourhood can be extended up to six floors, while in other neighbourhoods the maximum height is only two floors. Thus, the urban pattern and housing units have been unified to meet the building and planning regulations and eliminated the creativity and diversity. The criteria of geometries and diversity are similar in terms of the factors the led to having specific urban forms and structures in each type of districts. For example, in the traditional district, the irregular geometries of the housing units were a result of considering some socio-cultural values and Islamic principles when designing the housing units such as accommodating extended families and ensuring the privacy of the residents as

well as the neighbours. The table below summarises the five criteria which have been used to discuss the three types of the residential districts in Jeddah.

Table 1: Applying several criteria to track the changes in the form and structure of the residential districts in Jeddah.

Criteria	Type of District		
	Traditional	Transitional	Contemporary
Scale: Human scale and dense lots expressed in traditional district; medium in transitional; and very low at the contemporary ones.			
Functionality: Forms follow the function in the traditional district, thus three kinds of spaces found: (i) public, (ii) semi-public, (iii) semi-private			
Interface: Natural interaction between public and private realms of the houses			
Diversity: Variety of forms and structures due to several factors such as flexibility, extended family in both traditional and transitional districts.			

Geometry: Geometries are very similar to the diversity in terms of how it has been expressed in the traditional and transitional districts, and what factors that have led to have different geometries for the housing units. While in the contemporary district the housing units mostly have the same design.			

6 CONCLUSION

Jeddah has witnessed a great urban transformation since discovering oil in early 1940s until today. This urban transformation has changed the form and structure of the city over that time. Now Jeddah can be divided into three main parts: (i) Traditional district, (ii) Transitional district, and (iii) Contemporary district. Local forms, structures, and patterns applied to the traditional district have been developed based on a deep understanding of several factors to express Islamic principles, socio-cultural values, and environmental aspects. There was a gradual change in the local forms, structures, and patterns of the city since the oil boom. This gradual change has resulted in shaping the transitional district in Jeddah. The urban morphology of the traditional district was similar to the traditional district in terms of the residential blocks and public spaces. However, it differs in respect to the street patterns due to the introduction of the car. Later, in early 1970s, due to several reasons such as the approval of planning and building regulations, using new building technologies and materials, the sudden increase of the number of migrants from suburban areas towards the major cities due to economic issues, the contemporary district has appeared. Forms, structures, and patterns of the contemporary districts completely differ from the other districts. Thus, the contemporary district has ignored Islamic principles, local socio-cultural values, and environmental aspects. As a result, inhabitants started to change urban and architectural structures to reflect local socio-cultural values which are derived from Islamic principles. All this contributed to diverse the pattern of the urbanisation seen in the varying designs in Saudi Arabia cities. So, stakeholders should consider the local socio-cultural values, Islamic principles, and other surrounding circumstances prior to suggesting urban changes to existing cities or launching new cities. To avoid several issues on the longtime such as economic waste, environmental issues, and socio-cultural conflicts [23].

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RE-NATURING ECONOMY: FROM POLLUTANTS TO PRODUCTIVE LANDSCAPES

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Abstract

In the light of climate change, ecosystem derangement and debasement of local economies in the name of globalisation and free trade, capitalism has almost exhausted its own source of subsistence: Nature. However, going beyond the widespread –and very popular- myth that humans act as destructive agents of the pure and delicate nature, instrumentalising the landscape to support various production models has always been the way to build human economies and societies. Today, our rupture with nature is still manifested in the antithesis between Economy and Ecology, as two opposing notions. In fact, the concept of placing humanity within natural processes [or, in the other way around, defining humans as custodians of nature's ecological heritage] has strong supporters in theory and strict critics in practice. On the basis of this heated debate, this paper discusses in which way anthropogenic activities could intertwine harmoniously with ecosystems [a re-established human-nature equilibrium] and investigates a new pollution theorem: a projective ecology that overturns negative outputs of our current economic model (pollutants, waste flows) into inputs for new productive landscapes of the Anthropocene. The operative framework of such a shift, as examined and illustrated in the case of the Dutch-Flemish Delta, could eventually lay a solid foundation for re-instrumentalising deltaic landscapes and enhancing the adaptive capacity of local economies, ecosystems and socio-spatial constructs towards resource depletion, climate change and sea-level rise.

Keywords

pollutants as resources, productive landscapes, new ecologies of the Anthropocene, adaptive local economies, re- instrumentalising deltaic landscapes

1 In lieu of introduction: Planetary transformations

Unfolding crises in economic models always call into question the conditions that caused them to happen. The conditions triggering our contemporary neoliberal capitalism crisis display patterns of globalised urbanisation, a dense mesh of transport infrastructures and the constant devaluation of local economies for the sake of world trade proliferation. And this rise of global, market-based economies, dictated by the capitalistic dogma of maximum profits and gain, is always implemented at the expense of its own source of subsistence: Nature.

Obviously, this is an already established diagnosis which portrays a rather bleak perspective for humanity. Félix Guattari, prominent theorist of political economy and ecology notions, mentions in *The Three Ecologies* that "If no remedy is found, the ecological disequilibrium this [period of intense techno-scientific transformations] has generated will ultimately threaten the continuation of life on the planet's surface" (2000, p. 27). Undoubtedly, the effects of anthropogenic activities on the terrestrial biosphere have induced precipitate environmental changes on a global scale. However, these changes have also nurtured the misconception that anthropogenic activities create only disturbances to our delicate and pristine ecosystems. This rather mainstream view portrays human populations solely as agents of destruction. Still, it is salutary to remember that economy has always instrumentalised nature and shaped landscape in order to support various systems of economy and production. As a matter of fact, environmental scientist Erle C. Ellis (2014) in his extensive research on humankind's impact on the planet found that: "By as early as 3,000 years ago, nearly half of the terrestrial biosphere, including about 60% of all of Earth's Tropical and Temperate Woodlands, were most likely in use by shifting cultivators who may have cleared almost all of this area, one small patch at a time, at some point in history or prehistory'' (as cited in Reed & Lister, 2014, pp. 168-182).

It is becoming evident that human/environment interplays throughout centuries have been complex and dynamic, ranging from relatively stable states to moments of vast transformations. Historically speaking, urban areas and the economies they entailed were constantly determined by a social and ecological interdependence with their geographical context. This last is greatly illustrated in Jason Moore's statement: "[..] nature is not "just there." It is *historical*" (2015, p.12). What appears to be unprecedented for humanity today is that, for the first time, the majority of human population lives in urban areas, a proportion that is expected to reach 66% of the world's population by 2050 (UN, 2014). And as urban agglomerations keep increasing, cities seem to be better linked to the planetary system of production and trade than to their surrounding context. This abrupt socio-metabolic upscaling towards global supply chains reduces nature to an extensive operational landscape and poses the primary question of this paper: could capitalism unfold *within* nature instead of invariably exhausting it?

2 The demise of dualisms

Tracing the roots of today's rupture between Ecology and Economy, one inevitably goes back to modernity and the illusory, blind faith in the capability of technology to generate a much more perfect world. The modern paradigm, originating largely from the techno-scientific developments of the late sixteenth century and onwards (Enlightenment, Cartesian thinking), was built upon binary oppositions, separating the ecosystems from anthropogenic activities. Corner (1997) mentions that "..the rise of capitalist market economies inspired many Enlightenment intellectuals to assume that people could master nature" (p.263). From that moment on, Nature was diminished to an external entity, subject to rationalisation or quantification, and has been brutally exploited by the mechanistic and materialistic tactics of the capitalistic dogma.

Climate change, global warming and the subtle shift of global economic centres from the West to the booming economies of the East (China, Japan) are some of today's processes that shake the foundations of capitalism's [illusory] imposition on Nature and social

relations. Nonetheless, critical political economy seems to be forever caught in the dualistic characteristics of modernity. An example of this tendency is that every natural catastrophe is considered nature's revenge and too rarely a *ricochet* of capitalistic practices. Having said that, I follow Hight (2014) on his argument that "the recent anxiety about ecology in design [in our case, landscape and urbanism] results exactly from the recognition that the way the disciplines have been constructed in modernity can no longer effectively deal with our world of hybridity" (as cited in Reed & Lister, 2014, pp. 84-105).

While this notion of polar opposites (capitalism-nature) may be a useful tool in framing discussions of the sustainability paradigm - as indicated by Larsen (2009) - the real prioritisation of the needs of one over the other constitutes a fundamental societal stumbling block and the significance of one over the other remains a heated point of contention. As Larsen (2009) suggests, notions of sustainability could be seen as a "yet-to-be-formulated mediating structure" between apparently opposite anthropocentric and biocentric viewpoints. Still, even this statement fails to establish a common ground for fruitful discussion as it does not underline the fundamental unity between Nature and the Anthropocene on which I emphasize.

The key problem today is that environmental consequences (and certain societal stresses) are still seen as ontologically secondary or subsequent to capitalism's quest for resources. Nonetheless, Nature is not simply a variable to be added to the equation. Echoing Moore again, if ''capitalism is a way of organising nature" (2015, p.2), it should be a way of historically co-evolving with resource flows, landscape processes and time. If we really have to insist on dualism to frame a discussion, I would prefer a two Janus-faced framework, where Economy and Ecology are two sides of the same coin rather than opposing notions; a concept of defining humans as custodians of nature's ecological and cultural heritage. Simply put, a double human-nature re-coupling.

3 Towards the sustainability paradigm

3.1 Opposing viewpoints: environmental economics versus the myth of green capitalism

The provisional notion of human-nature re-coupling, as I have previously employed it, aims at reversing the dogma suggesting that our current way of life and the ideal of a sustainable society might be mutually exclusive. Pearce and Barbier (1989) explain that the majority of today's environmental problems are a direct outcome of our economic system's inability to maximise advantage within, and extract value from our natural environments (as cited in Wheeler and Beatley, 2000). At the core of environmental economics lies the assumption that "the way we manage economy impacts on the environment and [..] environmental quality impacts on the performance of the economy." (Pearce & Markandya, 1989, p.4). The key issue stressed here is that no proper values are attributed on the resources and services provided by Nature, which means that they are not subject to the acts of buying and sell; capitalism seizes the cheap goods of nature free of charge. And a primary law of supply and demand says that the cheaper a good is, the more it will be demanded. Unfortunately, the covetous nature of capitalism towards the free goods of natural environments has imperilled the ability of ecosystems to recover or adapt to extended pollution or biodiversity losses and has resulted in boomerang effects (climate change, sea-level rise) towards its own socio-

economic backbone. By the same token, environmental degradation puts at stake the conditions of production and thus, generates unexpected costs that are subtracted from potential profits. In this regard, environmental regulations and quotas on pollution –translated into tradable emission permits- are some of the key elements proposed by theorists and practitioners in this field, under the overall umbrella of preserving the natural capital.

On the other hand, Wright and Nyberg (2015) argue that "the global economic system of corporate capitalism appears incapable of achieving the levels of decarbonisation necessary to avoid dangerous climate change." And it may be true that corporate environmentalism and business sustainability, although often portrayed as key means of responding to environmental destruction, are incapable or unwilling to trigger a change in practices and lower profits in view of environmental degradation. Not to mention that there is no renewable energy market –yet. In addition, many environmentalists themselves have long nurtured the fear of a future where inevitable resource depletion, overpopulation, global warming and earth-system breakdown will cause the end of civilisation as we know it.

While not an exhaustive survey or review of theoretical perspectives, these competing viewpoints already display a specific pattern of disagreement and a huge diversity of starting positions that ask for a less volatile relation between economic models and nature. Bellamy Foster (2002) adds up to this argument by stating that: 'We should not underestimate capitalism's capacity to accumulate in the midst of the most blatant ecological destruction, to profit from environmental degradation[…] and to continue to destroy the earth to the point of no return—both for human society and for most of the world's living species."

3.2 The role of metabolism and the pollution theorem

Looking at the role of urban metabolism in the actual conditions of economy, Bellamy Foster (2000) acknowledges Marx's concept of the metabolic rift as a way to "capture the material estrangement of human beings within capitalist society from the natural conditions that formed the basis for their existence."(p.163). Based on this statement, Moore (2014) shifts from the metabolic rift to the *metabolic shift* where "metabolism, liberated from dualisms, acts as a solvent'' (as cited in Ibañez & Katsikis, 2014, p. 15). Consequently, in his *world-ecology* paradigm, the author moves towards a singular metabolism and envisions a material ecology where productivity and waste flows are revitalised through ''agro-ecology, permaculture, and other non-capitalist agronomies'' (p.286-287). Pierre Bélanger's writings (2014) also frame urbanisation as a metabolic field of flows where design is considered the key agent of their re-organisation. As he claims: "The task of urbanists –twenty-first-century waste handlers- will therefore be to ensure the design of these material flows, pathways and routes [..]"(as cited in Ibañez & Katsikis, p. 186).

All of this brings me to the main purpose of this essay. Based on Moore's initial statement, I would boldly add that *pollution now becomes historical*. Instead of being trapped in the false perception of Nature's primacy towards Anthropocene errors, it is high time we considered pollution as a resource. But not as a simple input: as part of our history, of humanity's cultural evolution. This makes urbanists something more than modern waste-handlers, as it highlights their ability to become custodians of nature's ecological and cultural values and address urbanisation as a field of cascading flows, logistics and landscape[s] (see Fig. 1).

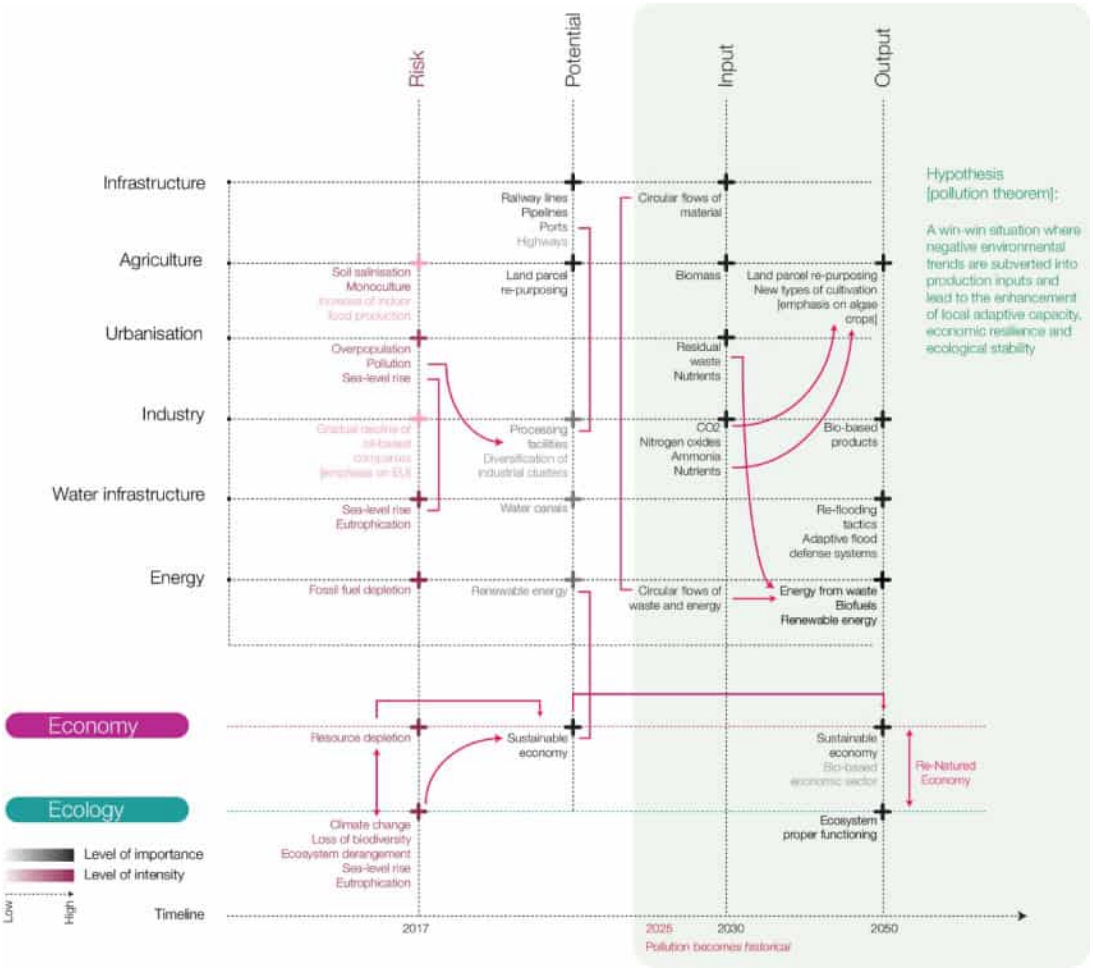

Figure 1. Matrix illustrating the assessment of risk and potential of key factors in contemporary growth-oriented economy and expected inputs and outputs with regard to the proposed hypothesis [pollution theorem]. According to the risk and the potential of each factor, connections and interdependencies for metabolic processes, flows and logistic patterns are highlighted within the matrix. Diagram by author.

I do not wish to resort to an eschatology of environmental calamity or reduce life-forms and natural processes to numbers and utility factors. What I aim to stress here is how well defined conditions of contemporary socio-spatial constructs –and not simply of contemporary scholarship–may provide opportunities for the sustainable paradigm I desire. In fact, the *raison d'être* of this paper is to go beyond theory and, following my pollution theorem, to discuss the operative framework of such a shift.

4 In search of an operative framework

4.1 Learning from the Dutch-Flemish Delta

In the process of defining an operative framework, it is fair to observe that "metabolisms are always geographical" (Moore, 2014 -as cited in Ibañez & Katsikis, p. 15). Such a perspective immediately draws the attention towards geographical space: a territory that displays spatial relations often characterised by distinguishable patterns or production modes -agriculture, services, industry and so on. As a matter of fact, the extreme separation of city and hinterland [or countryside] that took place under capitalism's dogma resulted in the division

of the world into developed and underdeveloped areas, with the latter being occupied mostly by agriculture. I emphasise on this because this same division has nurtured the binary Economy versus Ecology and the rupture between urban populations and nature; therefore, its re-examination may be the key to investigate the spatial dimensions of working with new metabolic flows and to frame the transition between our growth oriented economy and the sustainable economy we envisage for the future.

I wish to illustrate this transition with a simple example from my own thesis: in the last decades, industrial and agricultural discharges in the Dutch-Flemish Delta contain increased nitrogen and phosphorus loads which alter the nutrient composition of the local rivers and cause an excessive growth of plankton algae (see Fig. 2); this algae, when blooming, de-oxygenates the water and causes local fish and shellfish to die or migrate.

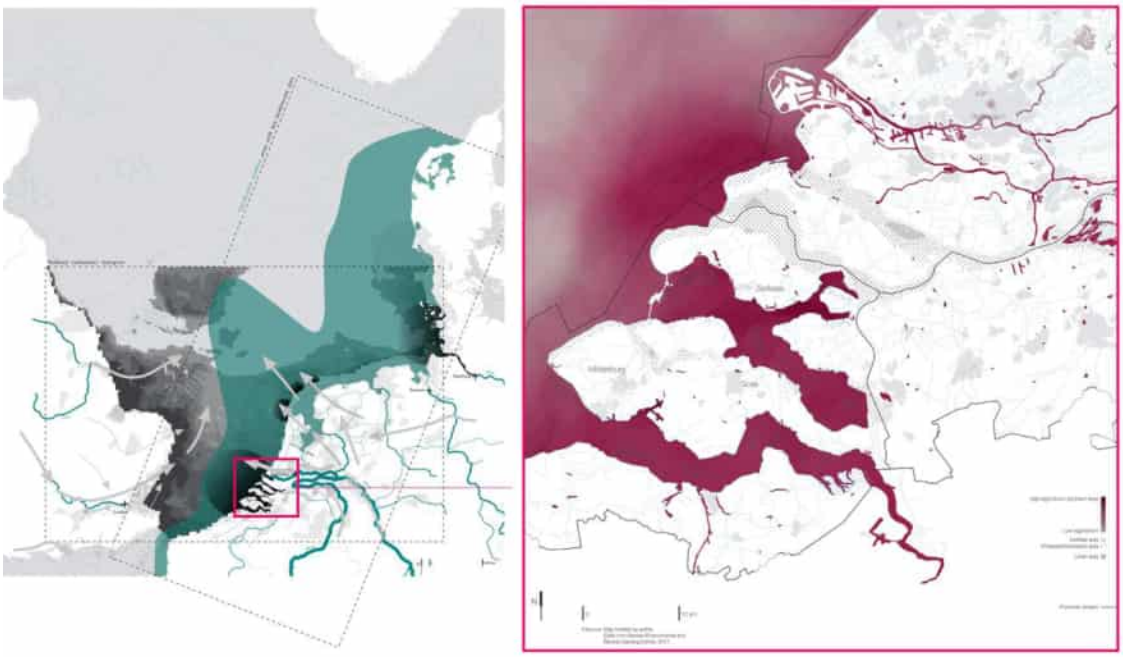

Figure 2. Areas threatened by harmful algal bloom [HAB] in the North Sea (left) and map of eutrophication levels in the Dutch-Flemish Delta. Maps by author.

This local disruption decreases dramatically the food resources for various species of birds that cross the deltaic territory on their migratory path to the South and, in the end, imperils a global ecological chain of species migratory paths from Europe to Africa. In this case, instead of addressing pollution as a negative yet inevitable side-effect of current economic activities in the Delta, there might be a positive alternative: to capture the pollutants causing eutrophication (nitrogen, phosphorus, CO2, algae) and facilitate processes that generate value out of them (food production, energy). These processes could trigger a shift in economy that will both re-instrumentalise the deltaic landscape as well as set the foundations for a bio-based economy in the future. Along this line, given that water could be the main medium for the new bio-based activities (aquacultures, wetlands, depoldering tactics), it is possible to introduce more space for the rivers and hence, build up more flexible and adaptable solutions towards future flood risk or the expected sea-level rise.

A hypothesis like this could come into being within the Dutch-Flemish Delta as it is a territory spanning across two major ports of the North Sea (Rotterdam, Antwerp) which contain a

high level of knowledge on processing flows and –given the inevitable fossil fuel depletion- could repurpose parts of their infrastructure into delivering big volumes of biomass and capturing or storing pollutants. At the same time, the whole area asks for a broader land use mix and a reconsideration of the rigid flood defence systems; a need that the indicated water-based solutions could most certainly address.

At the core of this proposal lies the transformation of underperforming crops (mainly arable farming, grasslands and flowers) into algae crops in enclosed tubular systems that do not require fresh water but contribute to wastewater treatment and convert discharged nutrients into valuable [bio]products. This is a huge advantage over traditional agriculture, which uses vast quantities of fresh drinking water and releases, through the extensive use of fertilisers, huge amounts of phosphorus and nitrogen in the water. Apart from enclosed algal systems, the proposal investigates the creation of new wetlands by re-flooding polders with high saline soil and non-profitable crops; establishing macroalgae ponds in their place may function as a model of filtration “layers” for agricultural and industrial discharges which would highly reduce the level of pollutants in the water and could bring back benthic and pelagic species that are forced to migrate at the moment.

In general, the idiosyncrasy of a system where pollutants are subverted into resources requires, on the one hand, the transformation of local industrial systems from linear to circular –closed loops of flows, semi-open systems- and on the other hand, a new material economy –circular systems that generate value out of pollutants and a market for renewable resources-. It is noteworthy that in order to project a vision and develop an efficient strategic framework for such a shift in economy, it is crucial to understand and work with the relationships between large-scale regional strategies and more detailed, local design solutions (see Fig. 3). In this case, the temporal dimension is of utmost importance; if we take into consideration the fact that fossil fuel depletion is becoming a reality and a shift in economy towards renewable sources will take place in the years to come, pollution will [hopefully] be reduced and pollutants might not constitute a considerable input for a bio-based economy anymore. This fact alone makes the proposed hypothesis a transition in time, an intermediate stage towards sustainable economic development.

4.2 On relevance and values

There is no doubt that climate change and its consequences (sea-level rise, flood risk, peak discharge) constitute a reality for all the coastal zones of the North Sea, with the Dutch coast being at the most vulnerable position. While it may be true that the Netherlands have so far invested in extensive flood defence systems, the Delta Commission (2008) still stresses the need to respond towards a 1.3-meter sea level rise by 2100. Given that almost one million people live in the studied area, it is extremely relevant to propose adaptive protection measures to these scenarios. In the proposed hypothesis, the shift in the production mode towards a bio-based economy in the area aims at using water as the main flow to base this economy and thus, introducing water-related uses like aquaculture, new wetlands, depoldering tactics etc. This action will inevitably provide more space for water (and hence, respond to a sea-level rise) while restoring the existing disconnection between a once seagoing population and the surrounding deltaic context.

Taking it one step further, the proposal contributes to the socio-economic resilience of the area by generating new productive landscapes, enriching the local economies and

harnessing the maximum potential of its metabolic flows and existing infrastructural systems. Since the project considers the pollutants causing eutrophication as a major input and incorporates *de facto* the current petroleum-based port infrastructure as the key field of processing all these flows, it shall largely contribute to the restoration of environmental stability and eco-services (new material ecology) as well as to job growth, new economic clusters and new socio-spatial constructs (new material economy).

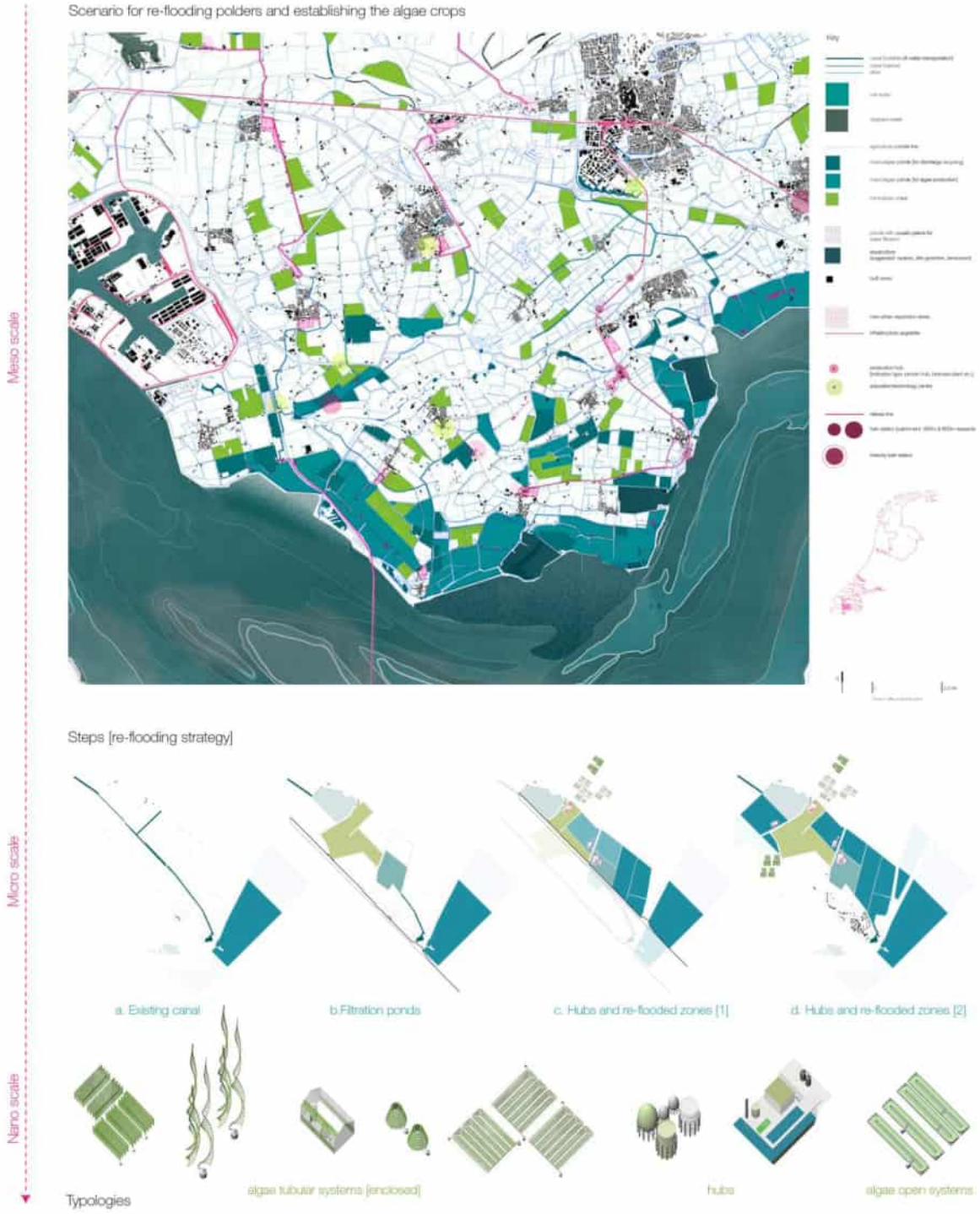

Figure 3. Design scenarios for the transition towards a bio-based economy in the Dutch-Flemish Delta. Zoom-in area: Zeeland, port of Vlissingen. Panel by author.

I put so much emphasis on strengthening local economies because the actual fallacies of our economic model urges local actors to confront the series of problems caused by globalisation and environmental degradation. Pursuing this argument as little as is done here, one could easily understand that instead of exhausting nature, the pollution theorem and the illustrative example of the Delta suggest working with nature, understanding and highlighting multifunctional and dynamic landscapes and generating open-ended systems of production; systems that are flexible and able to adapt to the same risks that capitalism has posed on its own structure.

5 Coda: Final conclusions

It is my conviction that any account of sustainable development unable to minimise the cyclical socio-economic crises of neoliberalism –and the environmental risks they entail- will be doomed to failure from the very beginning. What I have attempted to do in this paper is to question today's globalisation/growth-oriented paradigm and investigate a possible re-coupling of Economy and Ecology, away from an idealised image of pristine mother-Nature that is no longer relevant to contemporary society.

As I argued, a first step will be made only if disciplines like urbanism, landscape architecture, political economy and so on, succeed in restructuring themselves away from the dualistic characteristics of modernity. The key is to realise that capitalism, based on modernity's illusory impression that nature can be tamed, has considered ecosystem as an infinite field of cheap materials, resources and goods for too long. Since the results of this perception slowly deliver the *coup de grâce* to the system's structure itself (resource depletion, climate change, sea-level rise), it is high time we placed anthropogenic activities within nature so that the opposition between ecological and economic interests or needs is no valid anymore.

Naturally, the literature review elaborated in the third section clearly showed that these ideas have been long discussed within environmental scientists, economists, urbanists and other relevant fields and still share the common ground on which the problem is posed. Humanity has yet to find its place within nature, and the challenge of establishing an equilibrium between nature and the Anthropocene is subtly reflected in the slowly emerging sustainability paradigm. Having it as a basis for my pollution theorem, I illustrate a future material ecology where pollutants are subverted into inputs for new modes of production and landscape transformations. Going beyond theory, the operative framework profiled in the last section of this paper provides for the metabolic representation of urbanisation, a new material economy and –above all- a case study [Dutch-Flemish Delta] where localised production and logistics hubs will manage the desired fluidity of resources, flows, pathways and material. For lack of a new political or economic model at the moment, a final thing to acknowledge is that humanity has yet to experience this kind of paradigm shift; therefore, it will almost inevitably be discussed as either post-capitalistic, romanticizing or simply naïve. This is why I choose to close this paper by simply encouraging the reader to see it as a first attempt to investigate theories on the actual socio-economic and environmental transformations and to lay the groundwork for this potential shift to appear.

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PLANNING THE LIMIT - PROPOSALS FOR THE TRANSFORMATION OF PIREOS STREET

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Abstract

Athens has been greatly affected by the socioeconomic impacts of the financial crisis in Greece. Neoliberal policies expressed by recent legislation efforts, while they benefit entrepreneurship and investments, they cancel any effort of a unified planning of urban areas, leaving a lasting imprint on Athens' urban landscape.

Considering the current situation, it is vital to promote and enhance public spaces as an attraction of public life, to develop multifunctional zones, and transportation networks in a way which will promote the equal advancement of urban areas. Pireos street functions for the main connection between Piraeus port and the center of Athens. Its importance is a product not only of its course throughout the history of the city of Athens, but also of the industrial identity it obtained at the beginning of the 20th century. The gradual growth of Pireos' street climaxed during the 1970_s decade. But since then, the street's deindustrialization caused the abandonment of large industrial units and the overall decline of the areas around it.

The rejuvenation plans that are not fully implemented, the promotion of small scale land-uses, and the phenomenon of gentrification, are the main issues analyzed and solved in the current proposal. Although there has been extensive legislative effort to improve the area, analysis highlights the inadequacies that avert the area's overall improvement. Through this proposal, we intend to enhance the viable transportation network, develop multifunctional center connection zones, and reinforce the residential areas around Pireos street. Specifically, we pursue the allocation of new land-uses, enhancing the existing land-use, and creating job opportunities for the area's residents. This proposal adds new elements in order to rejuvenate the area, while preserving its industrial identity.

Keywords:

Neoliberal policies, economic crisis, Pireos street, urban planning, rejuvenation.

1. Introduction

The term neoliberalism is used to describe a sequence of actions that are dictated by the state, but are mainly encouraged by the private sector. Social and economic studies define neoliberalism as a phenomenon in which the control of economic resources is transferred from the state to the public sector. The main idea behind neoliberalism is to increase the role of the private sector in the economy and society, without any state regulation or intervention.

Neoliberalism emerged at the end of 1970's as a new way of restructuring international capitalism, and of restoring the necessary conditions for capital accumulation [1]. This type of development was encouraged by the social, economic, and political conditions during this period. The neoliberal governments were shaped based on the political beliefs of the liberal democracies, which included the right of the citizens for a better life, the development of competitive services, and the limited state intervention. Today, neoliberalism is constantly adapting to the contemporary conditions as the political and social landscapes change [2],[3].

The urban space is the result of three components: the private sector, the public sector, and the communities, that affect the city life. Production and consumption in urban areas are long term strategies that reflect the main principles of neoliberalism [4]. Sager [5] describes some policies that aim at more private involvement in the construction and operation of urban infrastructure: private-public partnerships, commercial city management, and the privatization of public services. Regarding the effects of neoliberal urban planning, it is stated that encouraging private investment can make it harder to provide services to people who are economically weaker.

Over the last fifteen years in southern Europe, the public sector has partnered with the private sector. The relationship has, so far, favored the construction of large-scale projects that strengthen the competitive positions of the cities. This is a very important issue of growth in economies that are constantly adapting to competitive conditions. Large-scale urban development projects are the result of a wide process of cities' restructuring, which is directly correlated with the changes in supply and demand in all spatial levels. In many cases, new planning tools had to be introduced to accommodate these projects, as the conventional planning tools have been rendered useless with the adoption of different regulations in national or regional level. In Greece, the economic development over the last decades caused many changes in urbanization and spatial planning. Most notably, the 2004 Olympic Games formed a basis for the creation of large-scale urban infrastructure, and since 2009 the economic crisis created new conditions for the regional and urban planning and the overall economic growth of Greece.

The metropolitan area of Athens lies between its isolated past and its recent attempts to become a global metropolis. Today Athens has two different aspects; the first is the aspect of a city that promotes neoliberal principles with the construction of large-scale projects, and the second is the aspect of a degraded city, where immigrants and the low-income class fight to survive. Over the time policies regarding the development of Greek cities, driven by neoliberal socio-economic principles, have created critical issues in the factors that form the urban fabric.

The space configuration is guided solely by the private sector, which tries to increase its revenue disregarding the financial hardships created by the economic crisis. Moreover, this behavior is encouraged and legitimized by the inability of the public sector to cope with the needs of modern cities.
This paper examines the area around Pireos street, one of the major arterial roads of Athens. The area has a considerable cultural capital, strong traces of deindustrialization, and strong trends of private sector intervention. Moreover, this paper attempts to redesign the area, taking into account the coexistence of public space with social infrastructure, the preservation of the area's industrial character, and the conditional encouragement of entrepreneurship.

2. The Case of Pireos Street

Pireos street is one of the major roads of Attica, which connects the center of Athens with the main port of Greece, Piraeus. Except for the importance of the roads' location, it is crucial to note its historical background as it is one of the oldest roads of Greece. It is dated back to 1836 and it is built on the remnants of the ancient Long Walls of Athens (461BC -455 BC) (Figure 1). Pireos street presents various elements, both positive and negative. The positive elements include its even landscape, and its geographical location which ensures adequate connection between Attica's infrastructure networks.

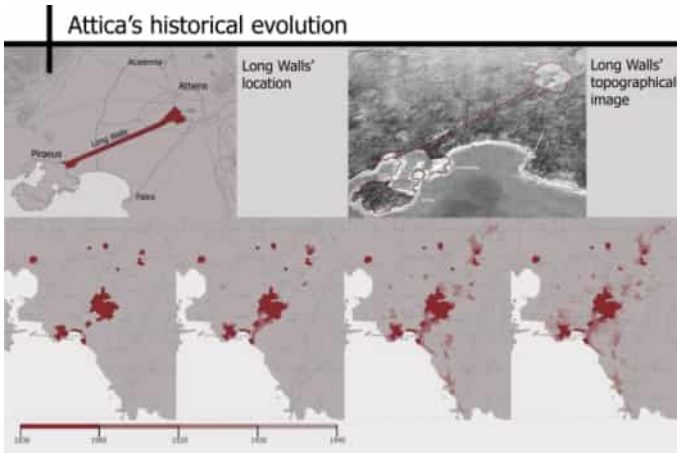

Figure 1.Historical evolution

By thoroughly analyzing the area around Pireos street, it is shown that the positive elements are not sufficiently exploited, resulting in the negative elements to outweigh the positive. More specifically, while Pireos street was thriving as an industrial axis until the 1980s, its deindustrialization created many problems such as the lack of unity and identity of the area.

After the removal of the most of the industries from Pireos street, the institutional framework created for its rejuvenation had an important role in its development. The 2004 Presidential Decree attempted to institutionalize the redevelopment of Pireos street, in order to promote the historical character of the road, the introduction of new land-uses, and the utilization of abandoned industrial buildings. The Decree provisioned the removal of polluting activities, the preservation of housing, retail trade and offices, as well as the enhancement of education and green spaces. However, these proposals were implemented to a very limited extent, which led to further dismantling of the areas around Pireos street

(Figure 2). The sense of fragmentation of the area also appears in the General Urban Plan of the municipalities to which the street belongs to, which present individual approaches, rather than a single, unified approach for the whole street.

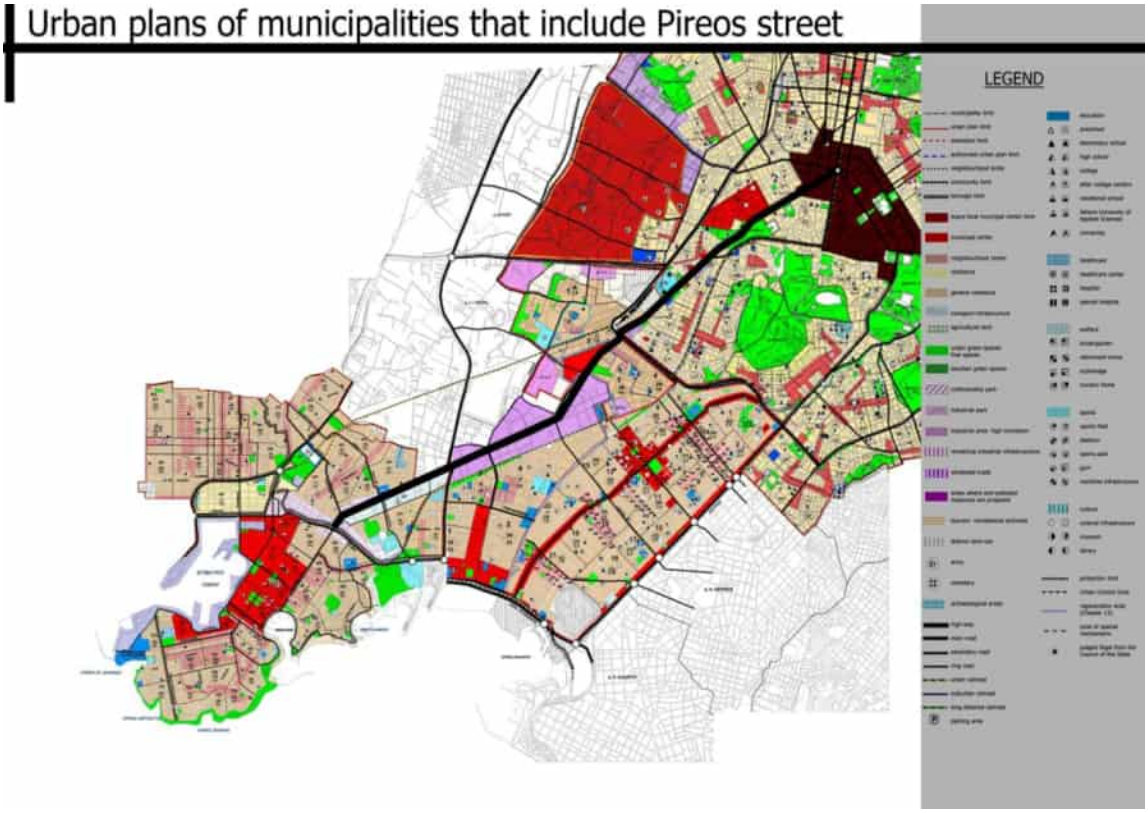

Figure 2. Urban plans of municipalities that include Pireos

By observing the networks of the areas around Pireos street, it is clear that they do not serve its purpose to connect, since they are not sufficiently distributed along the road. This results in, Pireos street to partition, rather than connect the areas around it. Moreover, while there is an adequate track-based transport network, a large part of it, is not supported by the existing pedestrian and bicycle networks. The unequal distribution of traffic networks is also observed in the green spaces network, as the green spaces are concentrated mainly on large suburban areas, and does not create a continuous network. Finally, there are several free unstructured spaces, which have not been utilized as green spaces.

The uneven mixture of land-uses has led to the existence of incompatible land-uses adjacent to one-another, which hinders residential development. In particular, residential land-use competes with other incompatible land-uses in the southern part of Pireos street, leading to the gradual abandonment of the area from its residents. Moreover, one can observe more problems with the existing land-use, such as the spatial placement of educational institutes without provision for supporting them by the current road network, the concentration of heavy industry on the southern part of the road, and the poor state of craftsmanship units and wholesale trade. Moreover, while retail trade is proportional to the scale and character of each area, it is concentrated mainly at the two ends of Pireos street, and it is not uniformly distributed in all the areas. A negative element that greatly affects the areas aesthetics is the existence of several abandoned buildings, which should be repaired and reused in order to preserve the area's industrial character (Figure 3).

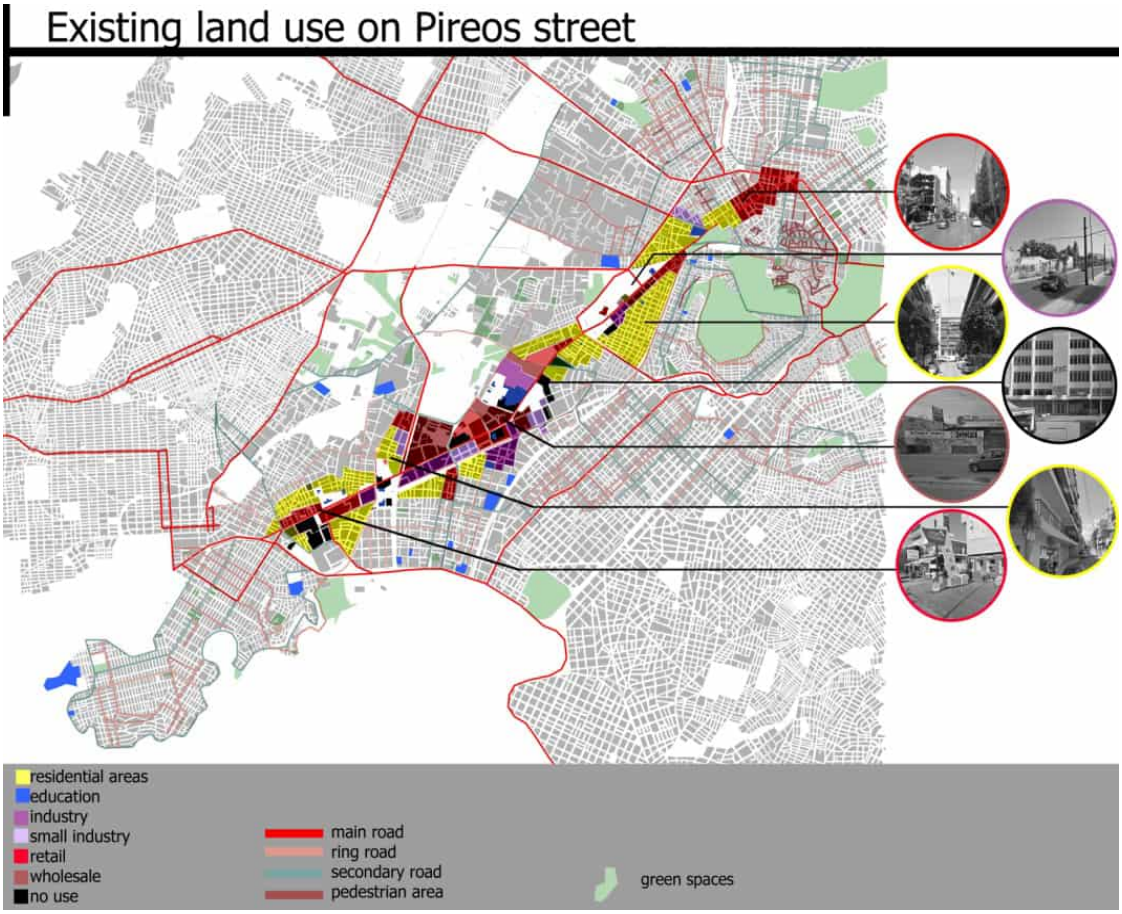

Figure 3. Existing land use on Pireos street

Particularly big part of Pireos street character is its cultural aspect. Many ancient monuments and archaeological sites are close to Pireos street; the majority of them are encountered in the municipality of the city of Athens, as there is missing a unified archeological site network. On the contrary, the history of Pireos street is not noticeable elsewhere, since the remaining buildings of the first and second industrial periods today are either corrupted by new additions or in a very poor condition. Most listed buildings are used by the industry, a fact that constitutes impossible their preservation, and their promotion as historical buildings, particularly in cases where their use does not respect their architectural character. Apart from industry, the main land-uses of the listed buildings are commerce, and culture. We conclude that the residential use is not reinforced, although it could be a chance to rejuvenate the areas in which the listed buildings are located.

By analysing the traffic network, it becomes apparent that parking is prohibited in most areas. This prohibition, however, is not enforced, creating obstacles to the pedestrian traffic and degrading the overall area's aesthetics. When observing pedestrian and bicycle networks, it is clear that there is no provision for those types of traffic networks, as there are no bike paths, few pedestrian walkways, and pedestrian traffic on many roads is obstructed by parking and small sidewalks. It is also evident that the traffic and the road density are gradually increasing from the municipality of Piraeus to the municipality of Athens, with the highest speeds recorded on Piraeus (Figure 4).

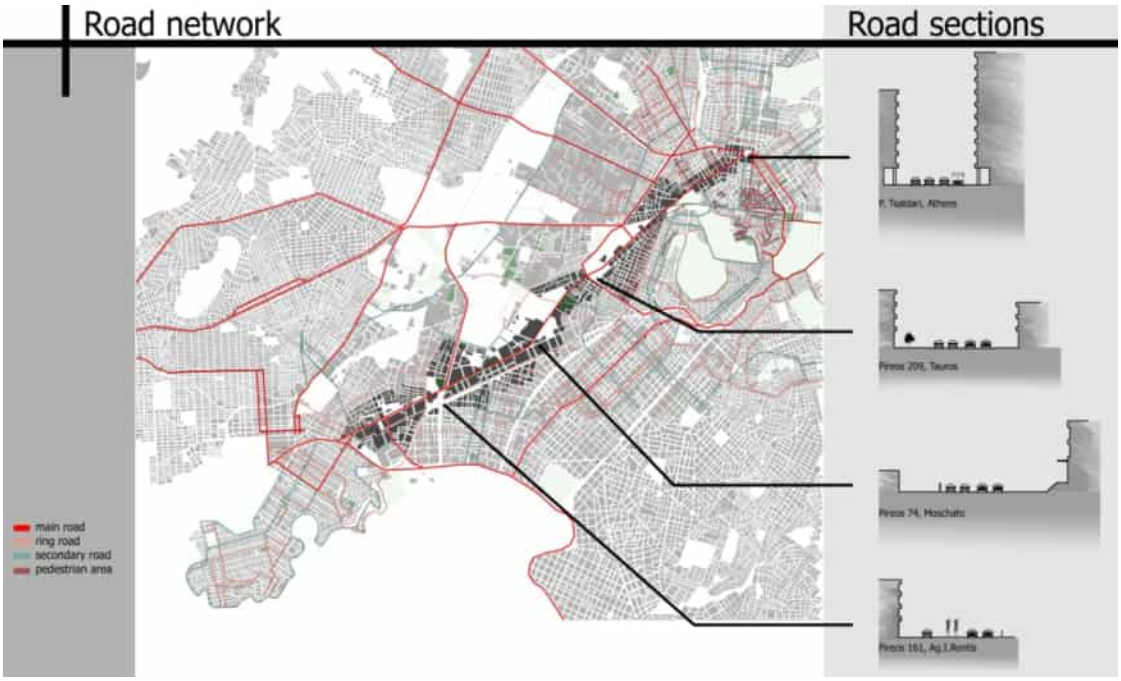

Figure 4. Existing road network

The built and un-built distribution in the area of interest is also another problematic element. In the southern and central parts of Pireos street, due to the sparse built environment, there are many free private spaces. The building environment around Pireos street varies, with the lowest densities occurring in the southern part and the highest in the north, but this change is not gradual. Also, most of the buildings around Pireos street do not present uniformity in height, with small heights being followed by large gaps. This causes confusion regarding the buildings' scale, compared with the size of the roads, and the open spaces**.** In the section of the street belonging to the municipality of Athens higher densities replace the big urban gaps and the frontal discontinuity along Pireos street. Moreover, lack of organization is observed in the building conditions, since zones with different building conditions are fragmented, and the regulations are limited to determining the built-surface ratio, while disregarding the minimum buildable lot size, and the built surface percentage. In the municipalities of Athens and Tavros there exist higher built-surface ratios along side with smaller ones, which leads to the coexistence of different heights and densities in the same area. In the municipality of Moschato the small built-surface ratios, and the low heights do not help to smooth the transition from the neighboring areas with higher densities, such as the municipality of Piraeus

3. Basic Proposal Principles

Taking into account all the problems, as well as the opportunities presented in the area of interest, this work proposes some basic principles for the rejuvenation of the areas around Pireos street (Figure 5). One of the main conclusions of the analysis above is the partitioning Pireos street causes to its adjacent areas. This phenomenon has to change using both designand institutional tools. For the successful rejuvenation of the area, it is of great importance to introduce a single, unified plan for all the municipalities along Pireos street. It is also important to treat each municipality differently in order to connect them, while preserving the character of each neighborhood. It is therefore crucial to make changes to

the road networks, in particular, to support pedestrian and bicycle networks, to create easier access to the area of interest. For the achievement of networks creation the existing green areas must also be connected and co-function with the new pedestrian and bicycle networks.

Land-uses are also an integral part of the connection and the rejuvenation of the area of interest. In order to achieve better connection between the municipalities along Pireos street, we propose to connect existing municipality centers via the creation of new rejuvenation cells. These cells are new land-use zones, which bring together the characteristic land-uses of each area, and connect the residential areas. Apart from the rejuvenation cells, it is also necessary to create generic land-use zones, which are compatible with each other, and will help develop housing. Moreover, the cultural land-use should be strengthened by the regeneration, and reuse of abandoned listed buildings, emphasizing their residential aspect in order to integrate them in the urban environment.

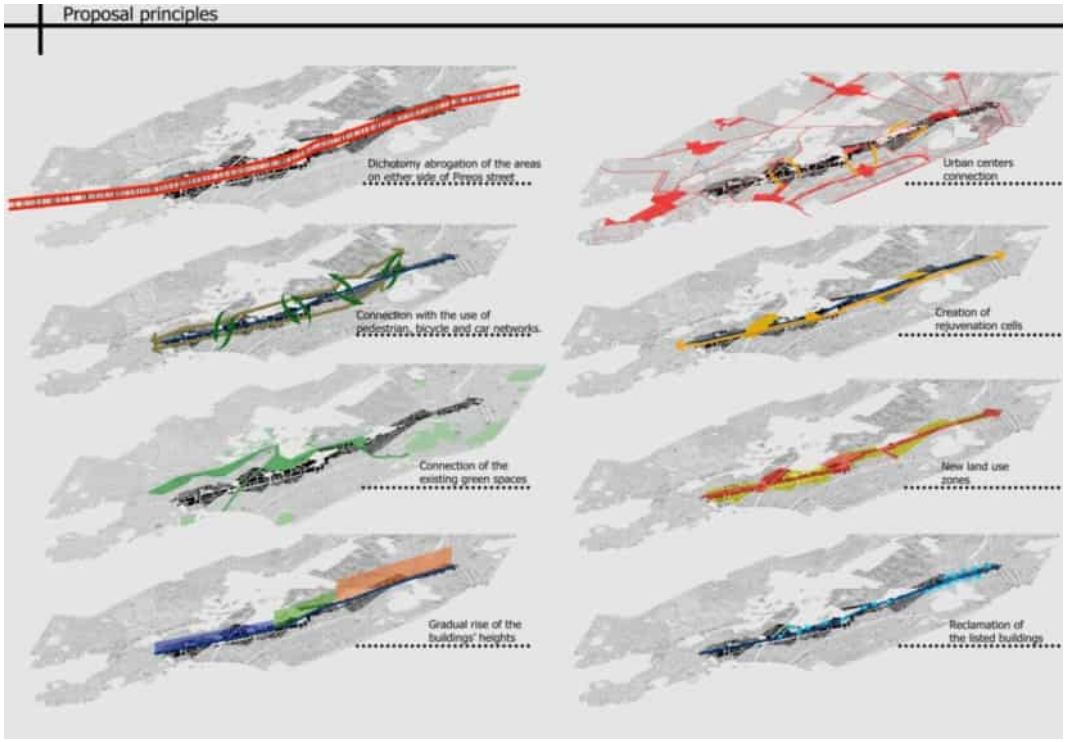

Figure 5. Proposal principles

In order for Pireos street to be efficiently and effectively rejuvenated, it is also important to make changes to the built environment. Initially, a gradual adjustment of the buildings' heights is proposed, in order to achieve a systematic gradation, with higher buildings in the municipality of Athens, and lower buildings in the municipality of Piraeus. It is also necessary to make changes in the built environment to create a continuous front along Pireos street and to balance the urban gaps with the large densities of the areas.

4. Proposed Land-use changes

After analyzing thoroughly the existing land-use conditions of the area around Pireos street, it was crucial to propose certain changes of the regulations concerning the land-use. Recognizing the problem of partition, we propose four different traverse zones for the connection of the existing municipal centers. The purpose of these zones is not only to

connect the existing municipal centers, but also to enhance their individual character by introducing new land-uses that will bolster the residential areas. Each center connection zone has a different character (aka different main land-use), depending on the land-use of its adjacent center. Furthermore, we propose the creation of land-use zones by introducing new land-use regulations (Figure 6). These regulations are planned to cover the purpose of each use and create a sustainable plan for the area of interest.

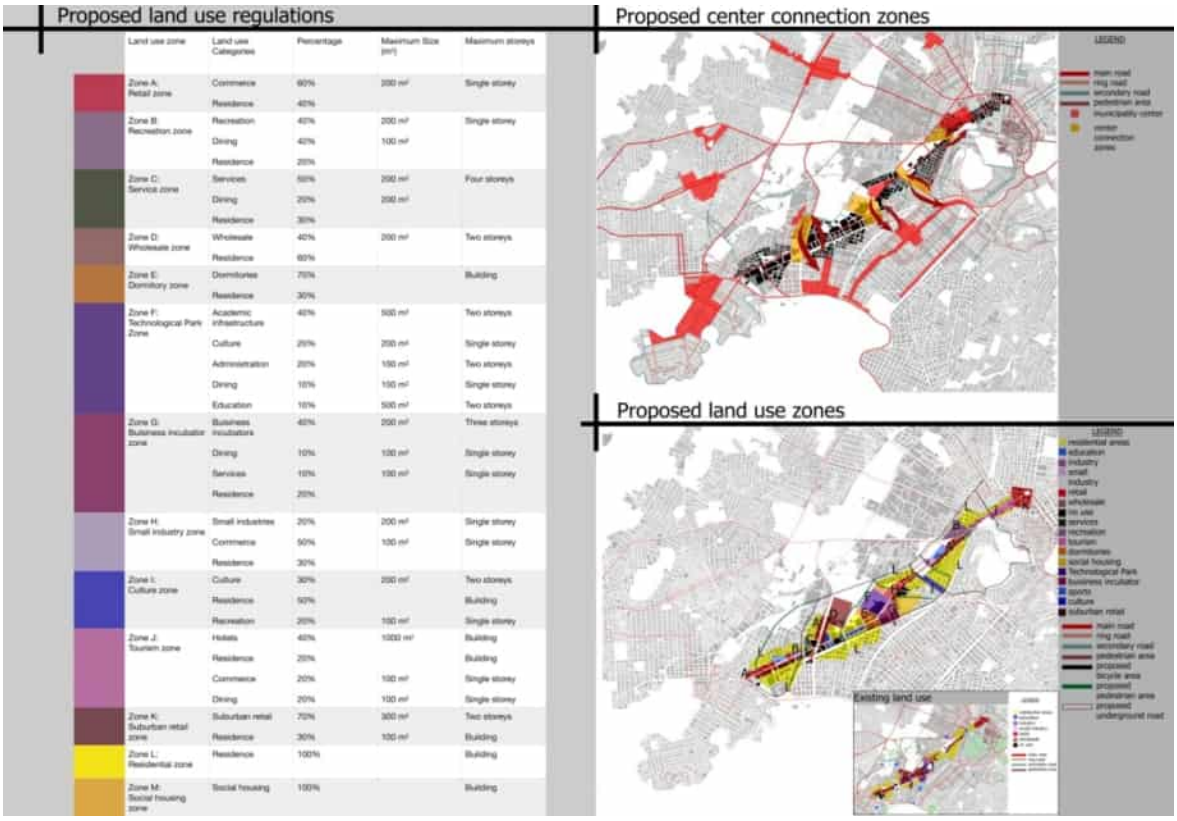

Figure 6. Proposed land-use change

5. Proposed Transport network

After the analysis of the existing networks, the lack of traverse connection roads and pedestrian roads was obvious. The goal of this proposal is to connect the existing municipal centers and the proposed center connection zones, by encouraging the pedestrian and bicycle networks. The proposed networks are developed mainly vertically on Pireos street, because of the need to connect the east and west parts of the road. In order to achieve better mobility of the pedestrians and bicycles, and encourage the use of public transportation, the networks that concern these groups connect the existing public transportation stations. Additionally, the new bicycle network-path is designed to follow the path of the ancient Long Walls and leads to the historical center of Athens, in order to create an interesting historical route through the city (Figure 7). Also, it was vital to change the look of Pireos street, by changing the width of the sidewalks and adding green zones along the road.

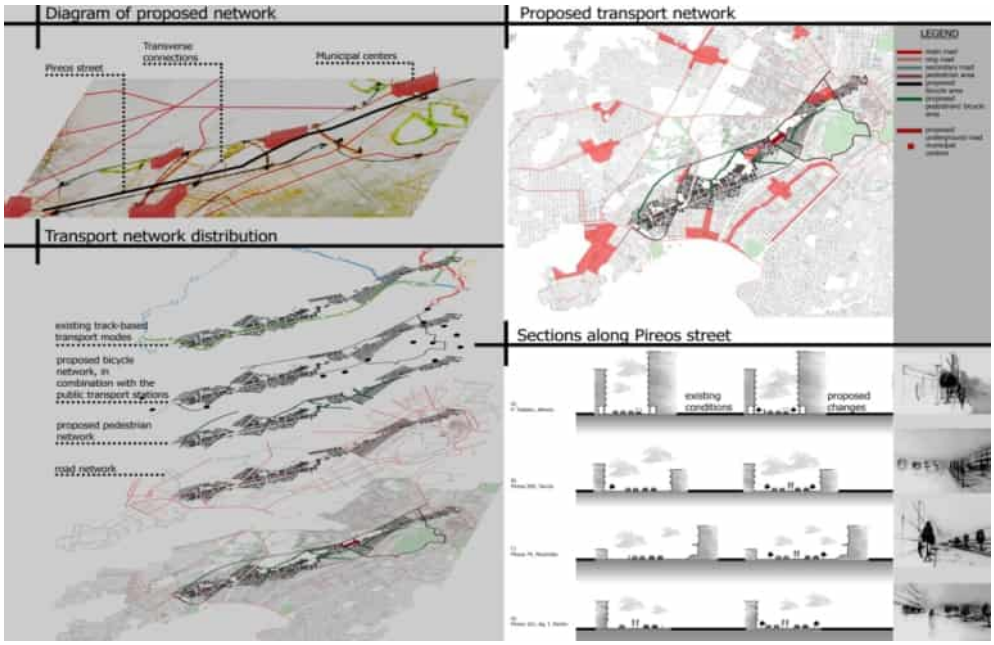

Figure 7. Proposed network changes

6. Proposed Building regulations

The main concern when examining the existing building conditions of the area of interest is the lack of even distribution of the density of the built environment. As a result of this conclusion, the goal of the proposed building regulations is to create a habitable built environment. More specifically, through this proposal we aim to create a denser built environment on areas with urban gaps and reduce the built surface on denser areas. Also, it is important to take into consideration the existing heights of the buildings, and create a skyline to protect the residential areas from the nuisance caused by traffic in the main road. It is crucial to note that the goal is not to change completely the area around Pireos street, but to implement small alternations in order to create a better environment for its residents (Figure 8).

7. Conclusion

In Greece, during the financial crisis, it is of great importance to propose solutions for cities planning, with respect to the needs of modern cities, and along with the coexistence of different socioeconomic conditions. A plan that takes into consideration the areas around Pireos street as a unit is necessary, and each individual section has to be planned according to its needs and peculiarities. Pireos street is a typical example of an area affected by neoliberal policies, which in the absence of public financial resources; transform a major axis of Attica into a space of private interests. The rejuvenation of Pireos Street should take into consideration the public areas and a network, which will make the area sustainable, and will encourage the coexistence of public and private sectors via regulations, ensuring the city is a place everybody can live in.

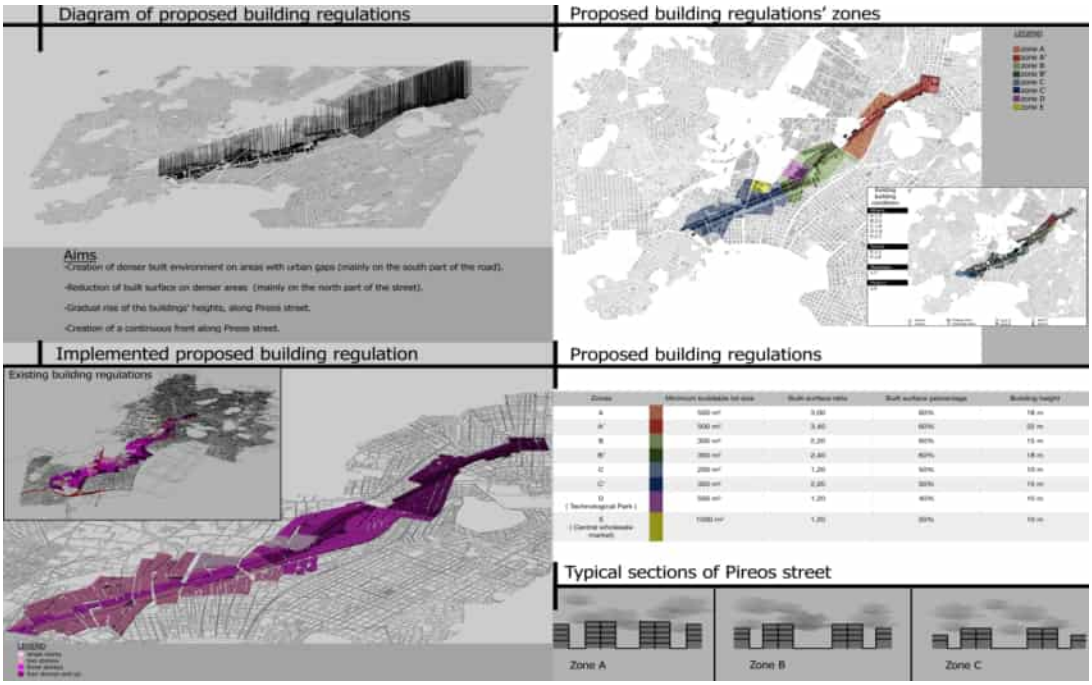

Figure 8. Proposed building regulations

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Figure sources

1. Figure 1, Historical evolution, personal work
2. Figure 2, Urban plans of municipalities that include Pireos, personal work
3. Figure 3, Existing land use on Pireos street, personal work
4. Figure 4, Existing road network, personal work
5. Figure 5, Proposal principles, personal work
6. Figure 6, Proposed land-use changes, personal work
7. Figure 7, Proposed network changes, personal work
8. Figure 8, Proposed building regulations, personal work

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SHADING ACTIVE TRANSPORT MODES ON THE HOMEWARD JOURNEY FROM SCHOOL

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Abstract

Australia tops the world's charts in occurrences of skin cancer and increasing regularity and intensity of heat waves, while concurrently achieving low rates of childhood physical activity. These issues converge in the challenge of protecting school children from excessive heat and UV exposure whilst simultaneously encouraging them outside to engage in active modes of transport.

This paper describes the case-study testing of a new tree-led design approach for quantifying shaded walking routes using the agent based pedestrian modelling tool "PedCatch", combined with geometric 3D proxy-object tree modelling and temporal solar impact analysis. The case study looks at an urban precinct surrounding a school, quantifying the shade benefit of different street design scenarios.

The results of this study demonstrate the potential for targeted strategic street tree planting in proximity to schools, providing the co-benefits of improving the comfort of active transport selections of children walking to and from school while also reducing their UV and heat exposure. This tree led urban design approach offers local government authorities, ways to mediate multiple and divergent concerns for climate amelioration, transport choices and population health.

Keywords

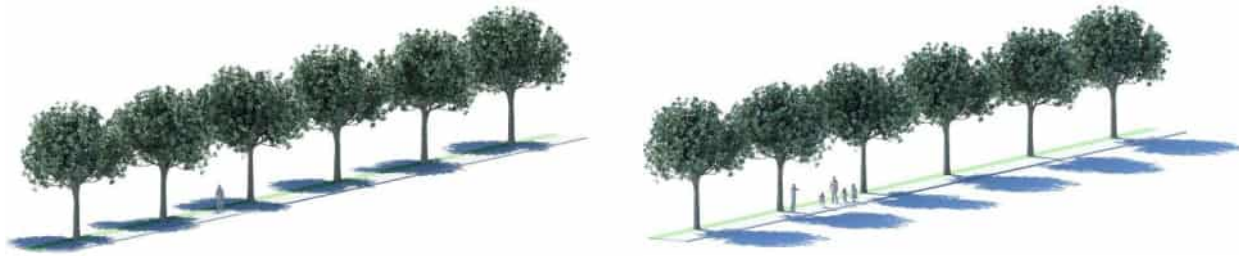
Street tree shade, Active transport modes for school journeys, shadow maps, Street design.

1 Introduction

Street tree design has not traditionally focused on ecosystem service objectives such as provision of shade (1). Depending on street orientation and tree form, height and spacing, footpaths can be left exposed at critical pedestrian use times(2) [Figure 1]. Typically, trees are either planted in symmetrically positioned tree rows either side of the street or, due to the substantial physical constraints of street environments, compressed into diminishing areas of least resistance (3) in the road between carparks, in median strips or within the footpath zone.

There are better places to put trees in the street which could maximise their benefit to people but designing for this outcome needs spatial consideration. The location of footpath tree shade is determined by street orientation, street width, the diurnal and seasonal sun path and the physical characteristics of the tree species, while the peak pedestrian use-time is governed by the land-use of the built context (White and Langenheim, 2014; Davies et al., 2017).

In this paper we use a tree-led approach to investigate the potential for increasing the shade to the footpaths of a school precinct during the homeward journey time frame.



a **b**

Figure 1: Figure shows the different positions of shadows on footpaths at different times of the day and the different levels of solar exposure for pedestrians traversing a footpath. (a) shows 3D rendering of a row of juvenile Fig trees.

2 Background

2.1 Children and physical activity

Children's physical activity (PA) levels have declined globally over the past two decades, while a number of associated health problems have increased (4,5). Children who use active transport methods for school journeys tend to have higher physical activity levels than peers who undertake these in journeys in cars (6). In Australia less than 30% of young children and 8% of adolescents achieve the Department of Health's daily activity recommendation (7). Despite these health benefits, in 2007 to 2008 in Melbourne, Australia, 42% of car trips

between 3pm and 4pm, coinciding with typical afternoon school run, were reported as 'picking up or dropping off someone' (8).

2.2 Mode selection and the built environment

A broad range of factors from convenience to cultural norms and environmental perceptions of safety contribute to decisions regarding children's school journey travel mode, however it is the quality of the built environment which provides opportunity for design and planning professionals to influence people's choice of mode (9).

Some studies show a seasonal drop in active travel journeys over colder months in moderate climates (10). However, hotter, drier cities with high rates of skin cancer such as Adelaide, Sydney or Melbourne, Australia which face climatic issues of heat stress and excessive exposure to Ultra Violet (UV) radiation, may see climate as a disincentive to active mode selection in warmer months. The homeward journeys of Melbourne's school children coincide in the Summer season with both the hottest part of the day (11) and for 85% of days, a UVI above 3, the level at which the World Health Organisation recommends limiting sun exposure to less than three minutes (12).

2.3 Tree canopy cover helps

Increasing tree canopy coverage in streetscapes within walking distance from school zones provides heat and UV protection for children and an incentive for behavioral change towards active journey mode selection in hot dry climates (13–15).

Built environments which include trees have been positively corelated with increased selection of active transport due to increases in the perception of safety and aesthetic value (16). These London and Taipei studies are cities with mild summer climates (16–18), while studies in the hotter drier Canadian and Victorian Summer correlated greater tree canopy cover with reduced numbers of heat related ambulance callouts (19,20). Tree canopy cover has also been shown to reduce both UV exposure and heat stress while concurrently increasing levels of physical activity in children in playgrounds and selection of active transport modes (21–24) .

Global recognition of the need to increase canopy cover for heat mitigation in cities with hot dry climates has resulted in a proliferation of urban forest policies alongside committed funds for their purchase, planting and maintenance (25–29). The real problem is the need to get these new trees in the most heat stressed areas of cities, and the most heat stressed areas are the already highly programmed and competitive streetscapes (30).

2.4 Quantifying shade

Shade can be quantified in several ways, though in general for ecosystem service benefit, it is calculated as the number of shade hours per day or for the most direct sun 12pm when the tree canopy outline and its shade are most closely aligned (2). Shade and other ecosystem services can also be calculated using allometric equations in software such as iTree, however this method is not responsive to specific infrastructure and site constraints (30). As this study is focused upon tree shade provide for children walking on footpaths near schools, rather than

quantifying a numeric ecosystem service we have instead identified a peak school leaving time of 3.30pm shown in (Figure 1), and measured shadow coverage along footpaths at that time of both existing and proposed conditions.

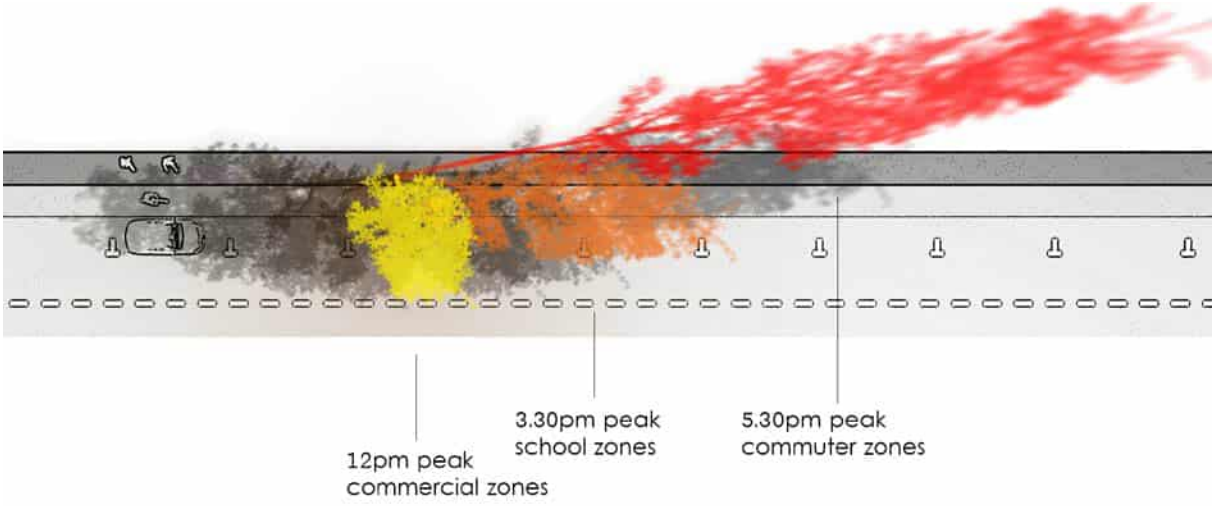


Figure 2: Composite hourly shadow map showing shade movement from 8.30am to 9.30pm, with lunch-time peak walking time shown yellow, the school children's home-time peak shown in orange, and office-worker home-time peak of 5.30pm, Melbourne, January 15th

3 Aim

The aim of the study is to help local councils prioritize decisions about placement of new trees in school precincts to increase shade provision for the homeward journey of school children. We ask the question - where do we plant street trees for maximum shade benefit?

4 Method

The method for this study has 3 parts:

Firstly, we used a flexible digital 3D modelling method to calculate shade provision of building form and street trees interactively. The method allows parameters such as different times of the day or year, tree form and spacing to be adjusted iteratively and return real time visual feedback which can be output as a raster (image) shadow map.

Secondly, we used an agent based pedestrian modelling method called PedCatch, as a way of measuring shade and exposure of pedestrians to full sun on the footpath on their way home from school.

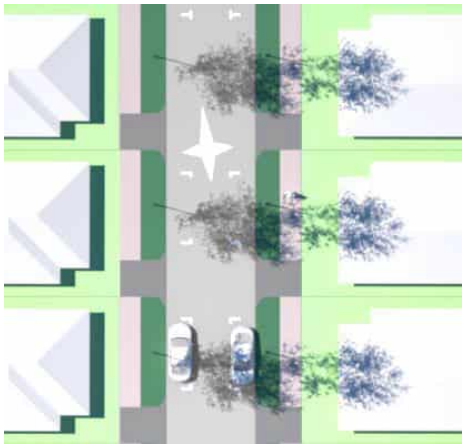
Microscale study models were used to establish site specific rules for tree planting for three scenarios; i) the existing street shading, ii) improved shading without infrastructural changes and iii) optimized shading requiring infrastructural or planning modifications. The rules developed for tree placement in each scenario were applied to a digital model of the site and a shadow map for each scenario was produced. The shadow maps were then analyzed

using the PedCatch approach (hidden self-citation) for quantification of footpath sun exposure. There are 5 steps to this process:

a) A model of the destination and context was built from spatial data sets.
b) The street network was categorized based on orientation, street configuration and street casement width.
c) a) and b) were then used to develop a suite of street design rules for each street category and for each scenario: i) existing shade, ii) improved shade without infrastructure change and iii) optimized shade.
d) The street design rules were applied to the appropriate streets in the site model using the proxy object geometric tree modelling method described in section 7.4. From the site model, precinct wide shadow maps of each scenario were produced.
e) The scenario shadow maps were then brought into the PedCatch tool described in section 7.5 and analyzed for changes in the level of shading to the walking catchment, aiming to quantifying the differences in shading benefit achievable from implementation of scenario ii) or iii).

5 Using geometrically accurate proxy-object tree modelling and temporal solar impact analysis system

The modelling of trees and their shade has significantly improved in the past decade. It is now practicable to digitally simulate large scale, flexible urban precinct models with several thousand geometrically accurate high-polygon proxy-object trees (hidden self-cite). Modelling platforms now routinely include geographic sun systems which allow shadow projections to a level of accuracy suitable for urban scaled analysis. These shadow projections can be produced for any time of year, any time of day and exported in a range of formats including baked shadow map images (raster images including shadows only). This system is described in detail elsewhere [hidden self-citation]. Using this approach where parameters such as tree spacing distance, position (eg. tree in road, in footpath, or in median strip), tree species and size can be adjusted with real-time visual feedback allowing rapid iterative shade impact testing for different street types and orientations [Figure 3 & Figure 4].



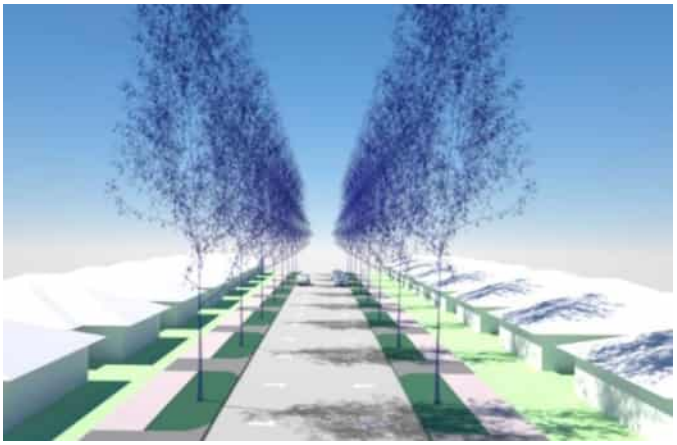


Figure 3: Traditional planting locations, North South street: spacing between trees should be reduced (adjacent canopies required) as shadows throw across the street rather than along it in this orientation

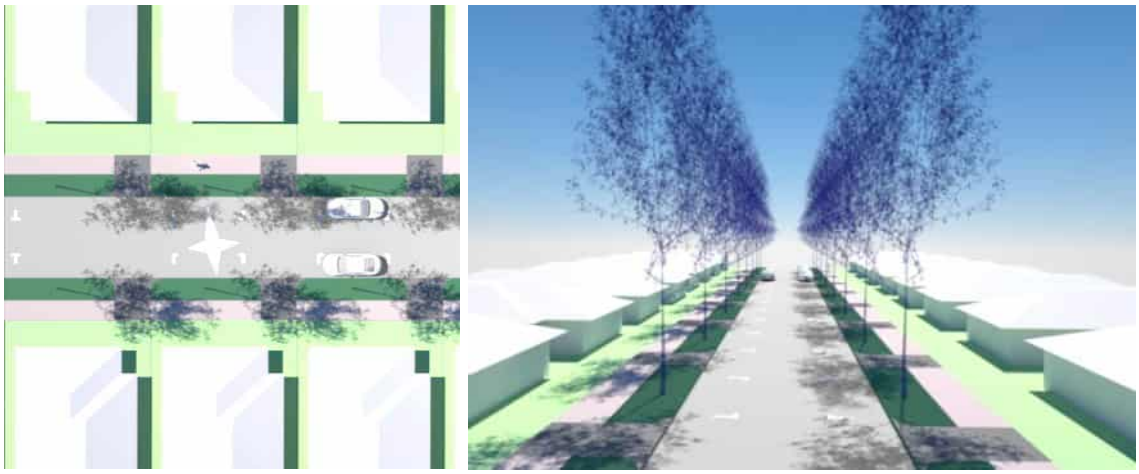


Figure 4: Traditional planting locations, East West street: These streets can take advantage of the shadow throw along the footpath, taller trees would reduce overall tree numbers and wider trees would improve the north footpath shading

This modelling approach is currently being used for ongoing research by the authors to analyse a comprehensive matrix of street types, sizes and orientations and tree positions, spacing and forms to produce a 'best-shade tree positions for your specific street type' guide. However, for the purposes of this study, we have used a specific site to filter the street types and orientations. This process will be discussed later in the paper where we describe the application across a case study site.

6 Measuring shade and exposure of pedestrians on their way home from school using the PedCatch approach

To assess the impact of street tree shade for children walking from school in Summer, we have used a variation on the PedCatch.com tool developed by [hidden self-citation]. This tool is a simple agent based pedestrian accessibility modelling approach that calculates walking catchments or 'ped-sheds' for specific nodes such as railway stations or, in this case, schools. Pedestrians (agents) navigate through the street network to calculate walking catchments based on time such as the commonly used 10 minutes' walk.

The benefit of this modelling approach is that it allows for agents to measure other factors that contribute to walkability, in this case, shade. For this study, we used a prototype version of the online PedCatch tool developed in Rhinoceros 3D with the Grasshopper visual scripting plug-in [hidden self-citation 2017]. The tool uses pixel value sampling of a raster-based shadow map (such as those produced using the method described above), to identifying where an agent is walking in shade or is unshaded. A threshold can be set for maximum sun exposure time after which an agent expires or stops upon reaching that threshold. The model can then measure the impact of shade for different times of day as illustrated below [Figure 6] where tree shade provided on a North-South at mid-day (a) is

significant reduced in the afternoon (b). This approach can also assess shade impact at a meso or precinct scale and applicable to assessing walking journeys of school children – illustrated below [Figure 7]. This process is described in more detail elsewhere [hidden self-citation].

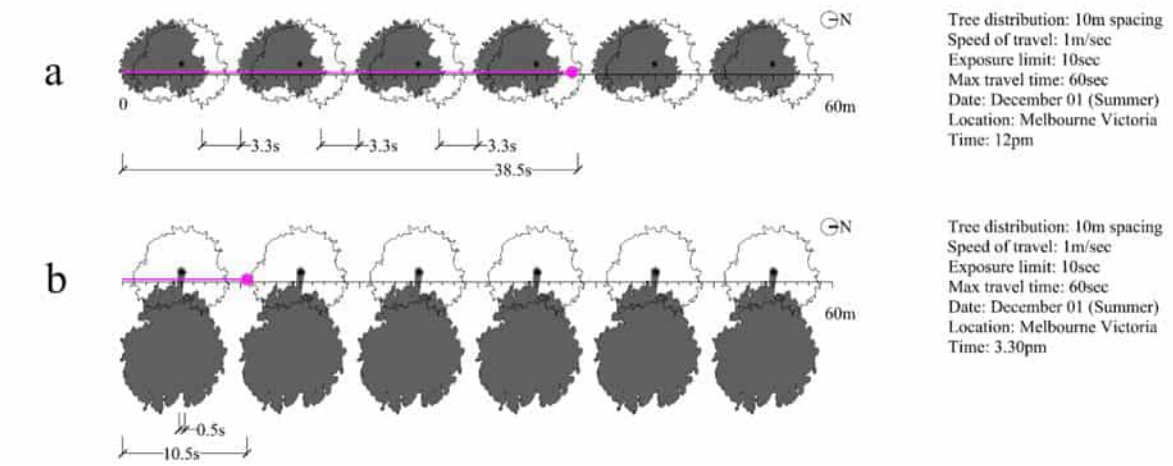


Figure 5: Shows different levels of solar exposure for a pedestrian traversing a single footpath moving at 1 meter per second, with a maximum walking time of 60 seconds, and maximum solar exposure time of 10 seconds, with trees spaced at 10-m

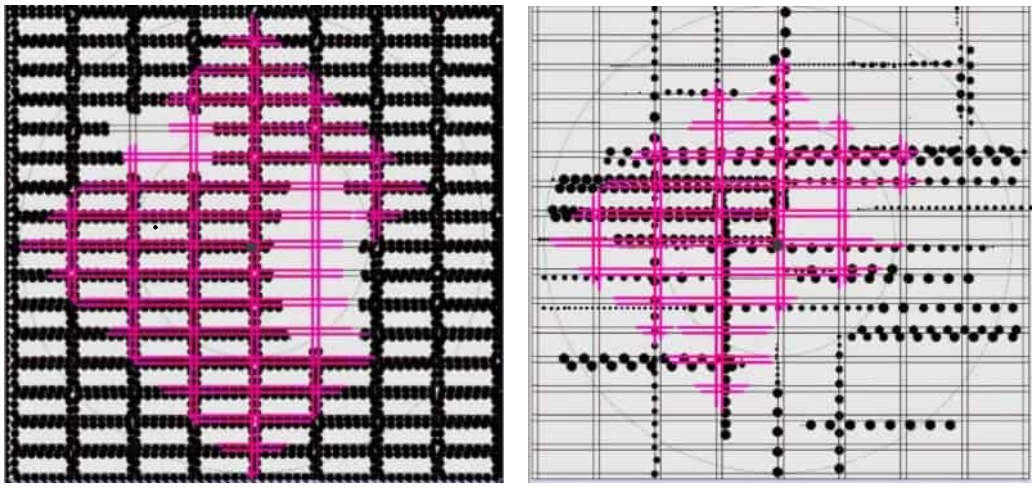


Figure 6: Shows tree shade bitmap with illustrative tree arrangements; (a) shows reduced catchment under a full-shading pattern due to clear areas increasing solar exposure; (b) shows a catchment closely contained to the spread of tree-lined avenues [XXX hidden self-citation]

7 Application on a school precinct

7.1 a) A model of the destination and context built from spatial data sets

GIS spatial data sets of Cadastre, building footprint and heights, road centre lines and existing public tree inventories are increasingly available and increasingly accurate however there are still many limitations to how this data can be visualised in its native GIS format (31).

The data sets used for this model were freely accessed through AURIN and DataVIC websites. Melbourne Water Corp. provided the footprints and height data of habitable buildings, Vicroads Corp. provided street casement data and road centre lines and Cadastre were provided by PSMA (Public Sector Mapping Agency). These data were overlaid in a projected Co-ordinate system and built into a 3D model in Autodesk's 3DsMax. The existing tree inventory data, provided by the relevant local council was also projected and used to inform proxy object tree placement [self-cite].

Figure 7: data driven site model with existing tree locations informed by tree inventory data set

7.2 b) Categorise the street network

The streets of the site within the 800m walking catchment were classified into typologies based on orientation, street configuration and street casement width.

	7° NNW /SSE Streets	East side	West side
01	15m road casement Driveways 30% of surface		
02	20m road casement Driveways 30% of surface		
	35° NW/SE streets	East side	West side
03	20m casement Driveways 30% of surface		
04	60m casement Driveways 30% of surface		
	7° ESE / WWN Streets	North side	South side
05	15m casement Driveways 30% of surface		
06	20m casement Driveways 30% of surface		
	21° ENE /WSW streets	North side	South side
07	60m canyon Driveways 30% of surface		

Figure 8: Seven major categories were established with only minor variations in the street configuration within each category

Most of the precinct conformed to a grid pattern on a 7° angle, with predominantly 15m and 20m wide streets. Most streets had individual driveways into narrow lot frontages which constrained tree planting opportunities to median strips.

7.3 Develop a suite of street design rules and possibilities

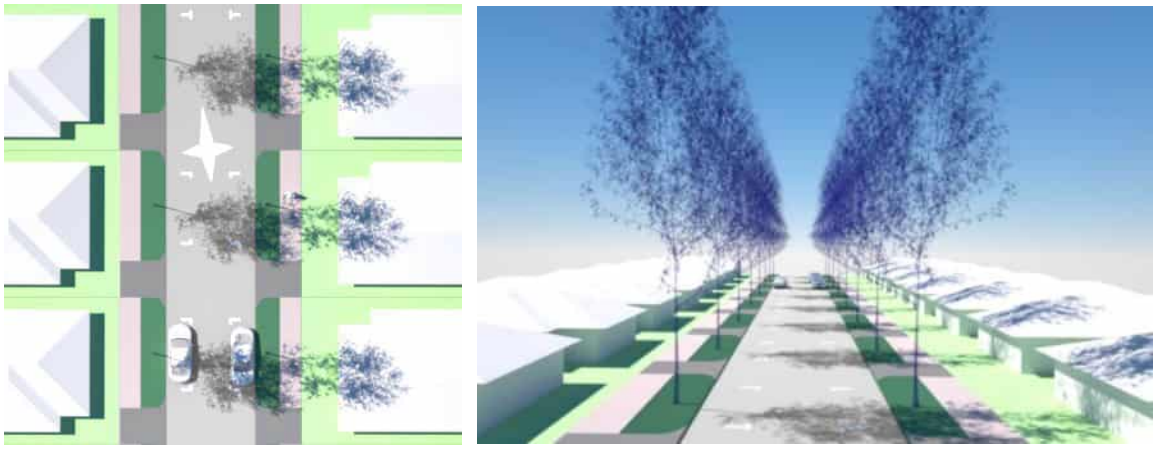


Figure 9: Existing condition shading, North South streets with 15m casement

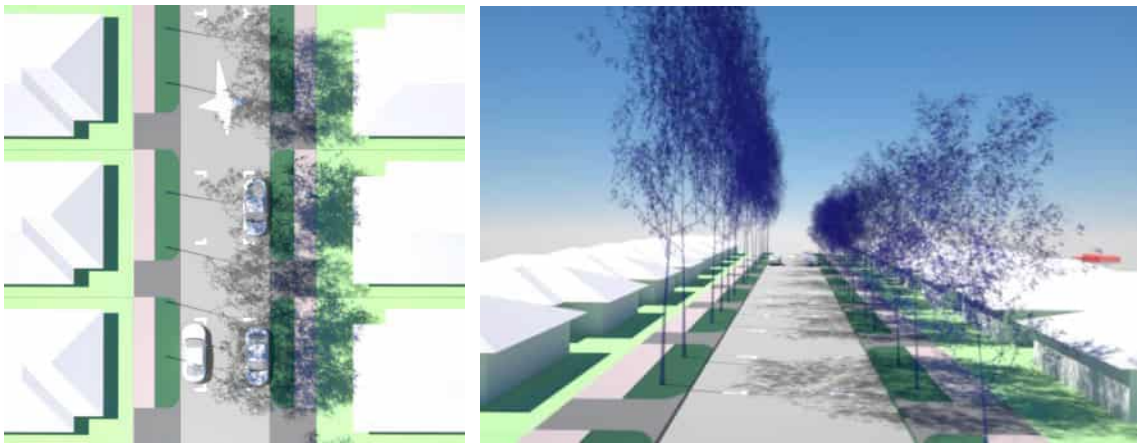


Figure 10: Improvements with no change to infrastructure using larger trees on the west median and closer spaced, smaller trees in the eastern median

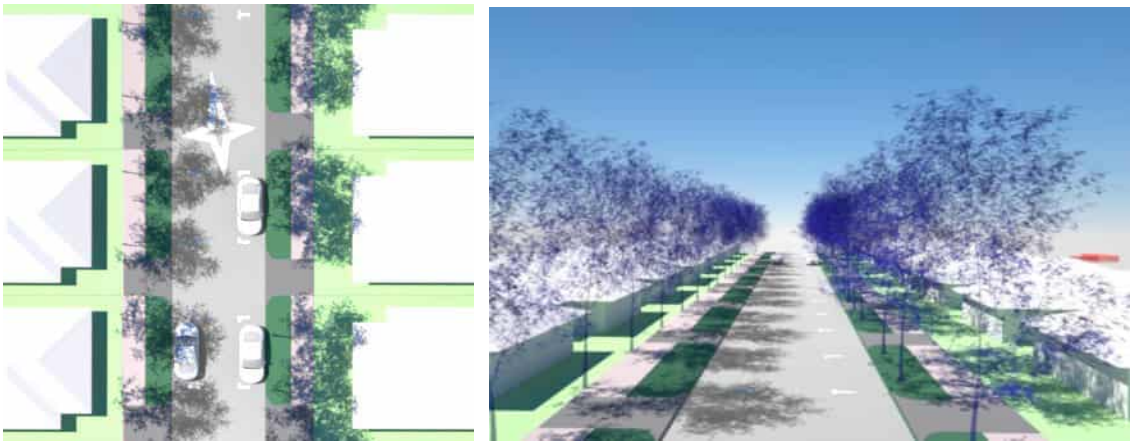


Figure 11: Optimal placement of trees at the property boundary on the western footpath would involve either footpath re-alignment or private front setbacks to have mandated planning regulations for canopy trees

While inter-seasonal shadow length variation is large, intra-seasonal variation is much slighter. The date of January 15th was selected as the mid-point and median of the Summer season shadow fall.

A detail model of a 100m portion of each category of street type was then modelled and used to assess i) existing ii) improvement without infrastructure change and iii) optimal planting scenarios, [Figure 9, Figure 10, Figure 11] show an example of this process for one street type category. Part of the process of micro scaled modelling was to ascertain how much of the footpath it was even possible to shade and what could most readily be achieved. A very simple scoring system was developed to help prioritize decision making.

Score for existing conditions 15m street casements with driveways

	Less than 20%	20-40% shade	40-60% shade	60 -100% shade
East footpath	0			
West Footpath	0			
East bike path	N/A			
West bike path	N/A			
TOTAL score				0/6

Score for improved conditions: No modifications to infrastructure

	Less than 20%	20-40% shade	40-60% shade	60%-100% shade
East footpath				3
West Footpath	0			
East bike path	N/A			
West bike path	N/A			
TOTAL score				3/6

Score for improved conditions: Optimal scenario

	Less than 20%	20-40% shade	40-60% shade	60-100% shade
East footpath				3
West Footpath				3
East bike path	N/A			
West bike path	N/A			
TOTAL score				6/6

Table 1: Shows how much of the footpath on both sides of the street it is possible to shade in each scenario

7.4 d) Precinct wide shadow maps

Figure 12: LEFT shows the precinct-wide 'baked' shadow map and RIGHT shows a detail blow up of the shadow map of existing tree locations.

The tree placement scenarios ii) and iii) were then applied to the precinct model. these were then rendered out as a shadow map of both built form and street trees using the texture baking onto a georeferenced ground surface [Figure 13].

7.5 e) Analysing the changes to shade benefit

The shadow map renders were then mapped to the vector street network in the PedCatch tool and analysed with a 10-minute walking catchment with a maximum limit of 3 minutes of direct solar exposure. When we ran this catchment with unlimited exposure control it is very clear that the existing shade conditions at 3.30 in this school walking catchment is exposing school children who use active modes of transport, to UV for unsafe periods of time (14).

We overlaid the shaded walking catchments of the three scenarios a) existing, b) improved and c) optimised Figure 15. The optimisation of shade to major thoroughfares showed a slight improvement to the shade catchment area, with its greatest contribution being improved access over the large 60m road which bisects the walking catchment to the north west.

Figure 13: Shadow map of the existing conditions 3.30 pm mid-January; pink shows the 10-minute walking catchment without an exposure limit blue shows a three-minute exposure limit.

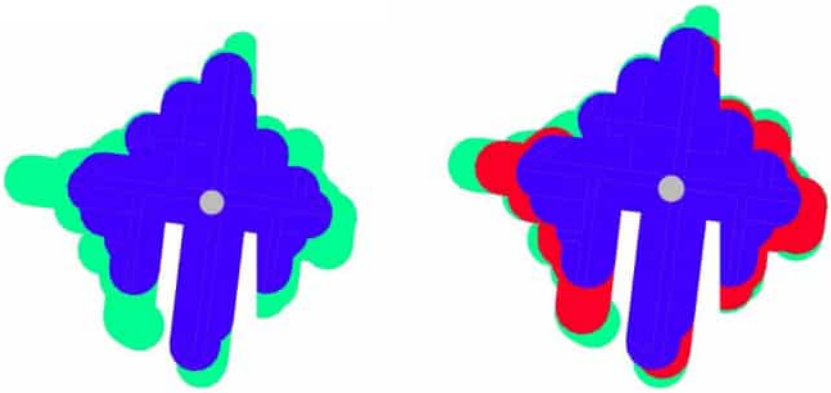


Figure 14: Overlay of the existing shaded walking catchment in blue with the shaded walking catchment of scenario ii) in red and scenario iii) in pale green, using a 3-minute exposure limit

8 Discussion

We have tested the application of a quantitative method to visualise the shade benefit of street tree design options, in a school precinct walking catchment which can output a clear visualisation of shading options, useful for communication between design and engineering professionals who can have differing concerns about the configuration of streetscapes and the community.

The output catchment maps show a conservative increase in the lengths of shaded walking paths however the increases are not as great as we would have expected. The modesty of the increase in catchment size could be due to several factors; A) The three-minute exposure limit is being extinguished when the agents are coming across difficult to shade areas such as intersections and crossings. B) Not all shade is equal; the shadow maps produced from the 3D

tree models output a greyscale image which varies in intensity just as the shade from real trees do, an aspect which may be causing some 'shaded pixels' to read as 'full sun pixels' and further investigation is required. C) In the case of the adjusted infrastructure model we used a staged approach, only optimising the shade to the major thoroughfares of the precinct as this scenario would be both costly and difficult to negotiate with private property owners for local councils.

The parametric precinct model can be reused to output shadow maps of other days and times which can in turn be analysed for shade provision if more than one pedestrian peak needs to be designed for or analysing the impact on light availably more trees might have to streetscape overshadowing in Winter.

The 3D high polygon trees used in this study are a generic model due to the scale of the analysis and efficiency in model building. It is however only a time constraint which would allow greater specificity in tree species models and their nuanced shade qualities.

The need for shading on both footpaths has been debated as pedestrians are not tied to a direction of travel like cars or cyclists. It has been argued that pedestrians can therefore chose to cross to the shady side of a street (30). This argument is valid for narrower, low traffic volume streets but on busier and wider streets where traffic signal waits are required– adding crossing times to commutes, impinges on total walking catchment times and total distances achievable in 10 mins. In a school zone this might represent an increase in the number of road crossings required for a child's daily commute home, both a disincentive to walking and an increased risk of traffic accidents.

While our optimised planting scheme did not make a very strong difference to the catchment it shows the potential for very targeted tree planting optimisation schemes to reduce UV exposure times and disadvantage for students required to cross very wide roads to get to school.

The analysis of level of shade and walkability together brings into question walkability indexes which report higher connectivity, or more crossings per hectare as more walkable. If reduction of heat stress and UV exposure is weighted more heavily then higher quantities of intersections which are exposed due to vehicle turning visibility issues, become less walkable precincts (Giles-Corti et al., 2011).

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RE-CONFIGURING THE CENTER, AN URBAN PROJECT FOR DOWN-TOWN BRYAN, TEXAS - USA.

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Abstract

Contemporary cultural congestion defines the individual experience, at the beginning of the 21st century, as a result of coexisting with a series of dichotomies such as: global / individuality; subjectivity / inter-subjectivity; rationality / irrationality; end of history / genealogy of history, individual / particular ethics, etc.

Fundamental works of Architecture and Art, those which still have a place in historic memory despite the time elapsed since its construction, are those who managed to integrate the spirit of its time with tradition and cultural specificity, those who managed to merge established tectonic and spatial values with individual creativity, and created a dialogue of coincidence of local and foreign aspects, new and existing conditions, merging the present and the past at a particular moment.

Architecture is generated from a series of interlocking events from different social levels, and being an Architect involves a global awareness of the movement of these events. Making Architecture means, among other things, to articulate the different dimensions of society at a particular time.

Octavio Paz says …" *To be truly modern, we must first encounter our tradition* …"

It operates at different levels, it is a discipline that combines experience, image, concept and use, and by definition merges the outside projection of image with interior, psychological space and the notion of collective.

One of the conditions inherent in being an Architect is the search for innovation. It is there where much of its spirit exists within the condition of a globalized world. The Architect must be an enhancer of ideas at all levels and a visionary, that projects into the future meaningful concepts that become concrete realities, not only as visual constructs, but also as social fabrications.

This exploration represents an attempt to transform Down-Town Bryan, in Texas - USA. It proposes the development of different strategies on the re-construction of the city, in urban and sub-urban areas, either formal or in-formal spaces, incorporating identity, collective

memory, history, industrial development and technology as resources for urban / architectural processes and as re-activators of territory for private and public spaces.
Under an optic of social innovation we are able to develop strategies and dynamics of participation that emphasize individual and collective identity from the different communities that are involved in the design process.It develops tools and tactics of action + cooperation that enable and empower people with their own surroundings and its transformation.

Similar to many Texas communities after 1840's, Bryan began as a small-town stop along the state's expanding railway system. The land had been granted by Spain to Moses Austin. In 1871 the city of Bryan is incorporated to the Houston and Texas Railroad system. The original urban plan for Bryan is a perfect grid intersected by the railway tracks that generate a disruption on the original plan, but with a particular aspect. *The lack of centrality*. As the kingdom of New Spain, the province of Texas shared with Mexico the basic law of the common sovereign of Castile. This law went essentially unchanged during the tumultuous fifteen years of Mexican Texas (1821–36), but after the Texas Revolution, the Republic of Texas adopted the law of England in preference to that of Spain. This change also affected how towns and cities were conceived and planned.

This research-project i*n-progress* unveils some of the conflicts between the laws of Indies in southern United States and its later development under the optic of the automobile. It focuses on inner city areas left behind by a massive migration to the suburbs, which began in the late nineteenth century, accelerated in the 1920s with the revolution of the automobile. It analyzes how sub-urban land developed as a consequence of highways after world war II, and how it produced the decline of city centers in the U.S.

Keywords: urban design; public space, centrality, down-town, mobility.

1. Introduction

The urban *text* of towns and cities have been built over centuries of history and every generation contributes with this process of superimposition of different aspects which influence and determine the spatial structure of the urban space as a dynamic entity modifying its apparent reality. Behind all this, lies an innumerable collection of not only physical aspects, but also social, economic and those which are part of individual experiences in time. If we want to understand this urban-architectural transformations and their contemporary meaning, we must first analyze the inherent process which defines the actual character in a particular time to the city. Michel Foucault suggests that the idea of space is a condition defined by ordering principles understanding it as …" *relationships between points and elements which can be formally described as series …and communication networks*…" systems of order. [] Michel DeCertau on the other hand, refers to the transformation of the urban space as part of a process of stratification by introducing the notion of *permanence*. The city, behind its appearance in a specific moment contains within it "…*revolutions of history, economic mutations, demographic superimpositions*…" [] All these aspects remain not only as layers which generate an

articulated and fragmented physical and visual space, but also as a kind of space-time collage as experiences in the minds of the inhabitants, as *collective memory.*

2. Texas as a Décollage

A collage is a simile of reality. it is not fiction. Our space is created and organized through the juxtaposition or collision of particular events on specific moments which gives form to the spatial condition. Colin Rowe talks about it in a rather pragmatic way when he says that the idea of city as a consequence of intentional collisions. He argues that we don't have a *nature*, we have a *history*. In other words, the difference between man and other creatures exists within the fact that we have a memory. Furthermore, we could understand the process of construction of the city as a *Dècollage* to refer to Kurt Schwitters and his *Merz* and the french artist Francois Dufrènne who introduced a more dynamic and almost violent aspect to the collage in which a series of glued components [as opposed to the collage] are removed by cutting, erasing and scraping fragments of the original sometimes destroying it completely. A Dècollage can clearly be understood as a metaphor of the process of urban spatial operations as we can see for instance in the impact of the industrial revolution on the traditional city, in which the renovated modes of production and mobility radically transformed the urban condition of space.

Texas was a very dynamic province in mid eighteen century. An undetermined territory as a buffer zone in-between different forces that occupied the whole region. Spain, France, Mexico and Native Americans collided in this territory creating a very particular problem to analyze. The Hasinai was the original land between the Trinity River and the Río Rojo that also included part of what we know today as Louisiana. Texas was an important part of what constituted the reign of New Spain and it depended directly from the Viceroy of the Audiencia of Mexico in terms of administrative and military issues, and from the Archbishop of Guadalajara in relation to Ecclesiastic matters. Besides the missions, it was almost an exclusive military territory.

Figure 1. Décollage. Mimmo Rotella.

3. The Laws of Indies and the Missions

The Mission as well as the Presidio were places for the occupation of the territory of the frontier. The religious role was to spread the christian faith, to extend, maintain and christianize the different groups along the borders. They were also state agencies financed to develop specific government agendas. Christianity was the essential condition of european society and it was a very effective tool as well. The work of the missionaries was also to incorporate the natives to the civil life. Hence, the Missions were designed not only as seminaries, but also as industrial and agricultural schools. The central concept of each Mission was the *Pueblo* or Village. The natives had to be disciplined and controlled in a well defined place and kept there by force if necessary. Religious and industrial instruction were imparted through a communal organization with a very limited autonomy as a small european city. Through the Laws of Indies, the natives had to be instructed in their own native languages, but there were to many dialects and most of them did not have the necessary terms for communicating the christian message. As a consequence, the whole process was developed in Spanish.

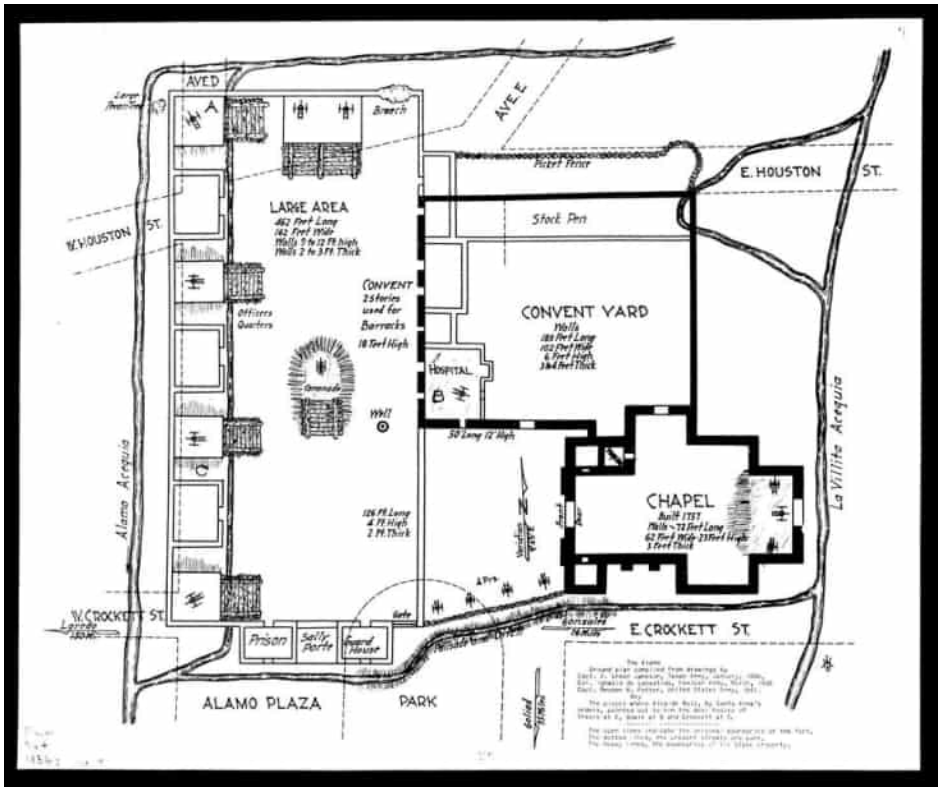

Figure 2. The Mission of San Antonio de Valero.

The mission was designed as a temporary structure. The missionary would stay at one mission until his initial labor was concluded, and then he would continue to the next one and so on. According to the laws of indies, these structures were to be passed on to the secular clergy natives after a period of ten years. This Law was based in the southern experiences such in Mexico, Perú or Venezuela. The local conditions and particular characteristics of the natives from the North were very different. The Comanches and the Apaches for instance,

were very violent and the missions had to remain much lounger in order to develop their work. This generated a very different process of occupation and development of towns and cities in Texas, especially those in the southern part of the province.

4. The Grid

After the Land Ordinance of 1785, the towns and cities in the whole nation were divided into one-mile sections. The majority of those founded after this date, followed what was established by the grid, determining how the urban configurations would develop and defining specific conditions for streets and urban blocks. The grid idealizes the expansion of the city long before it becomes a reality. Towns and cities quickly developed in the US during the industrial revolution. Many were transformed through fragmentation and dispersion of different uses in which churches, factories and housing re-located outside down town areas and they turned into almost exclusively commercial spaces and where racial barriers emerged during the late 19th and early 20th centuries.

Urban space is a reflection on social and economical systems. The city in the US was generated from the grid in most cases. However, it was developed under very different circumstances from the european urban strategies in which the center or the old city was limited and protected by a wall. Centrality was determined by the cathedral and the plaza surrounded by other churches and monasteries. In addition, the Town Hall shared the importance of the central condition as a reflection of power and control and where other civic buildings and the market were organized as well. This scheme was then implemented in south and central America by Spain through the Laws of Indies. North American cities were never dominated by a single religion. In addition to the British colonizers, the protestants, the Catholic church and Jewish were also present and much later the Muslims, Hindues and Buddhists. Due to such diversity, it resulted impossible for none of them to take control of the center and occupy a higher position in relation to the public space. It was a radically different process than in South America. Towns and cities in LatinAmerica were determined by the grid which necessarily conducts to the *Center* and its streets converge at the plaza together with the Cathedral and the Governor's Palace. The grid and the defined center in such case reflects the homogenous religion and the hierarchical society present.

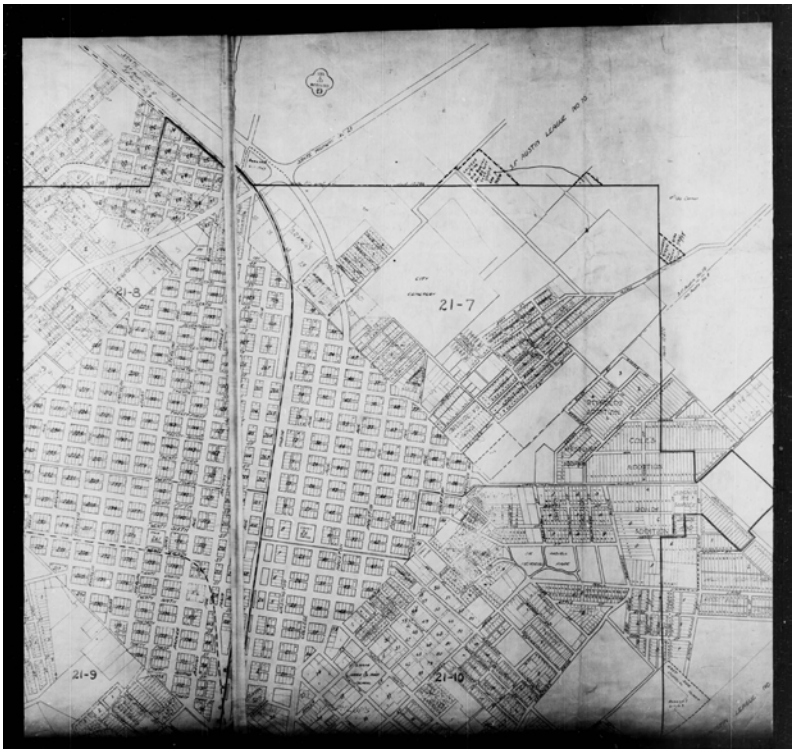

Figure 3. Bryan, TX 1927. from University of Texas Library.

5. The Down-town

It seems that the notion of downtown first appeared in New York City around mid eighteen hundreds. Manhattan inspired the concept when it expanded north from its original boundaries. Down-towns in the US mutated in early 1900's into specialized commercial districts in which housing disappeared almost completely with very few exceptions. The new modes of transportation were responsible for the implementation of new urban strategies in which the train, automobiles and later highways generated that down-towns were emptied, as a consequence of offices, industries and housing new spatial necessities. The automobile allowed an unprecedented separation and stratification of the urban condition. American down-town areas, especially in small towns, are characterized by the absence of activities beyond offices, cultural buildings and local retail .

6. Bryan, Texas. A case study

It is a contemporary condition that many small towns in the US have suffered a process of depopulation. The countryside is associated to small towns as its complement. They are now inhabited in a more provisional way. Koolhaas refers to this process as a totally new condition which takes place in the countryside. "*…an essential question is ignored - what are those moving to the city leaving behind*…?" He sees the countryside as a new frontline for transformation. The small town and the countryside are connected to the city. They depend on each other, hence we cannot understand one without the other.

Similar to many communities in Texas during the 19th century, Bryan began as a stop in the state railroad system. Most of those stops ended up as ghosts-towns after the modes of transportation changed during the 1940's and 50's and also as a consequence of the rural-to-city migration. The economy of Bryan, is specialized in mining, quarrying, oil, gas extraction; educational services; agriculture, forestry, Fishing and Hunting. As many cities in the United States, Bryan is characterized by a social condition that pretends the absence of racial segregations and spatial separation reinforcing the barriers between blacks and whites, native and immigrants, rich and poor. The value of private property has depended on the absence of and distance from manufacture industry and minority communities. The suburbia has been more attractive than down-town areas due to developers commercial strategies outside the cities in which more easy benefits and many possibilities of land development generating the characteristic urban sprawl.

Figure 4. Bryan, TX 1920's. from University of Texas Library.

There is a tendency of reverting this process in many US cities. There are two important precedents in Texas. One is a renovation plan for Fort-worth that started in 1979 as a consequence of the initiative developed by Bass Brothers enterprise. The project incorporated the restoration of historical buildings, the construction of new mixed-use buildings containing housing, commercial spaces and offices. Sundance Square represents an extraordinary innovative urban design. The entire proposal is based on regaining space from the vehicle in downtown and develop important pedestrian networks such as boulevards and plazas all interconnected with a system of parking spaces and public transport throughout the city center to increase mobility in its wider sense. Perhaps the most interesting operation due to its significance, is the interruption of Main Street, the axis that connects the Town Hall and the Convention Center in the middle of downtown, merging two existing blocks in order to create a plaza which con-

stitutes now the most important civic center with commercial activities, services, office buildings and more relevant, housing. Other example also in Texas is based on a mayor urban strategy. Klyde Warren Park in Dallas has become an extraordinary public space in the middle of the Arts District. It is a Plaza/Park built on top of the highway in a high-density area of the city. It generates great social activity through the introduction of multiple programs such as housing, entertaining, food and green space to an existing cultural area.

7. The Proposal

The history of contemporary urban planning has been that one that has developed notions and strategies for the creation of public space in order for the city to promote, frame and develop social relations through either formal or casual encounters of their inhabitants. Contemporary urban theorists suggest that there is a strong connection between citizenship, civic virtues and community with the notion of a collective space developed within the city. Recent approaches to looking at the city, especially city-centers focus on high-density low-rise housing, pedestrian areas, plazas and parks as a consequence of participatory strategies with communities, in which empowered citizens contribute through different social dynamics to rethink the city from a closer perspective with a stronger local sense.

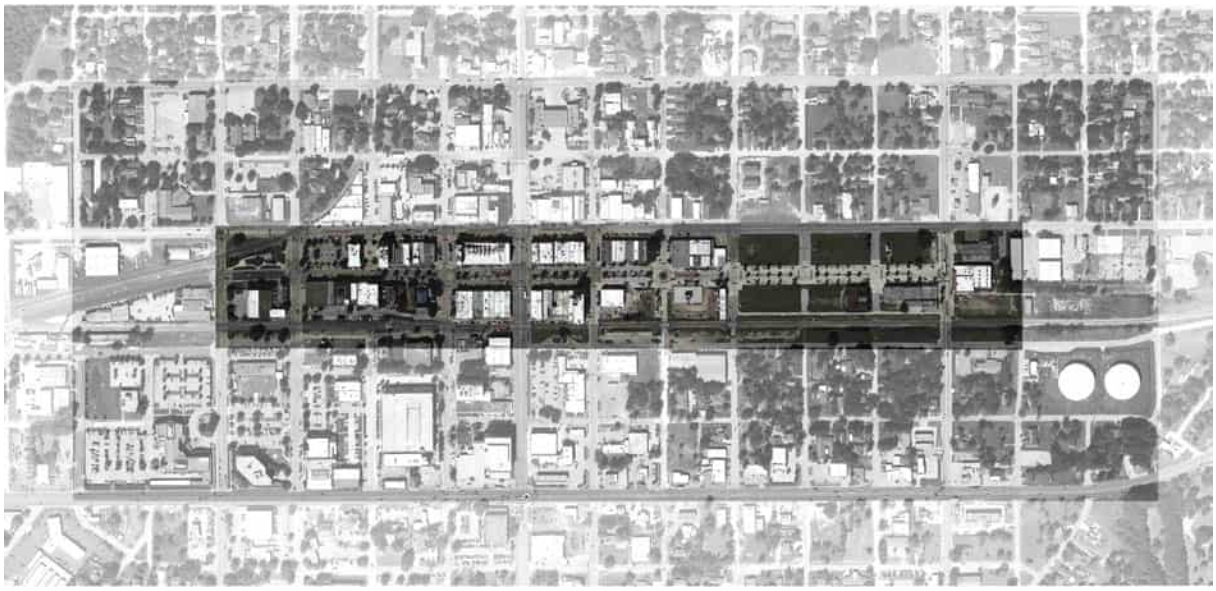

Figure 5. Down-Town Bryan. Existing condition, Central axis on Main Street.

The project consists in re-imagining down-town Bryan, with its collection of renovated historic buildings to accommodate the desires and necessities of 21st century residents. Important aspects such as new mobility concepts, to work and live [near or in] city centers and to reconnect with green spaces and natural landscapes.

The proposal consists in three main operations:

7.1 The Plaza: A major central public space as a civic and communal space activated by a series of programs from mixed-use housing buildings to hybrid offices, service and cultural spaces. In addition to the plaza, an underground parking space is proposed as a response to the existing demands and to increase the offer of parking space of the future development.

7.2 The Boulevard: It is based on the displacement of the linear parking space which constitutes a barrier for the perception of the street and its buildings on either side, as well as for pedestrian mobility along and across Main Street. The boulevard connects two im-

portant poles. The Ice House on the North and the Park on the South side.

Figure 6. Proposal for central boulevard on Main Street and plaza. *in progress.*

7.3 Hybrid Programming: The insertion of mixed programs in particular sites along the central axis and Plaza in order to densify and activate downtown through a constant urban dynamic.

The social dynamics have changed and expanded to incorporate social media and other elements of contemporary technology. Traditional spaces in the city such plazas, parks, even

streets or cultural spaces are more related to their role in terms of their impacts on the culture of consumption. One of the most important urban operations has been the re-insertion of housing to down-town areas. The demographic condition has changed since mid 20th century. The social and economical demands of products and services have suffered important alterations. This transformation has generated the appearance of new architectural and urban typologies. 21st century down-town is focused on local residents than shoppers, tourists or accidental visitors. It is beginning to transform into a very particular european version but dominated by a more elitist condition.

We can understand the city as a product of the succession of layers in which events are physically recorded living tangible footprints subject to interpretation. This visible information can

represent a series of mechanisms of historical mediation between the past individual and collective experiences and the present necessities to be able to find possible links for urban and architectural interventions with a deep sense of *place*.

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MADRID RÍO, A 21ST CENTURY URBAN GARDEN FOR A HISTORIC CITY

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Abstract

The urban renewal of the Manzanares River watershed, in its passage alongside historic Madrid, has meant for the metropolis of Madrid the latest and most risky commitment to urban renewal. This action has created for the city the largest green space that currently exists in the metropolis and that supposes a new ecological framework of coexistence between the historic and the modern city.

Figure 1. The new Bridge designed by Dominique Perrault and the historic Toledo Bridge coexist in the same space

A macroproject whose performance involved important civil engineering actions, such as the burial of the M-30 motorway, the first circular ring of traffic that surrounds Madrid, environmental engineering with the canalization of the Manzanares River, urban and landscape design for the 1,210,881 square meters in wich the linear park spreads, with the participation of international prestige architects in the design of the bridges that connect one riverbank to another, monumental restoration applied to existing historical bridges, such as the bridge of Toledo and the bridge of Segovia and rehabilitation of the surrounding urban spaces and a plan of rehabilitation for the houses located to his side.

This operation has been the clearest political commitment to make the city of Madrid a 21st century city, with a vision of territorial and environmental rebalancing that applies criteria of sustainability, urban landscape, social integration and inclusive accessibility.

Keywords

Urban garden, ecological balance, sustainable metropolis

1 Introduction

The Manzanares River, as it passed through Madrid, was synonymous with a scar, a separation between the historic city and the outskirts of Madrid.

Figure 2. Madrid seen from the prairie of San Isidro, by Francisco de Goya | Source: Prado Museum

This situation generated from 2003, the approach of one of the most important actions of urban renewal of the XXI century in a European city. This through the realization of three independent projects and complementary to each other:

1º the great project of civil engineering that it meant the burying of the M-30, (the road that circles the municipality and that ran along the banks of the Manzanares),

2º the execution of “Madrid Río” Project that involved the creation of a large linear park in the released ground, to public use and with the objective of integrating both banks of the river and

3º the "Plan for Urban Renovation of the Manzanares River environment" which is a decisive contribution for the incorporation of the buildings and private free space to the Manzanares Urban Transformation Project, a through the rehabilitation, the revitalization and the sustainable renovation, of its contribution to the creation of the environmental axis of the Manzanares River and to enhance the value of the urban landscape, thereby promoting a new urban model based on criteria of quality and excellence.

The work, promoted by the then Mayor Alberto Ruiz-Gallardón, was developed by the Municipal Government and the Operational Program of the Urban Planning and Housing Area. He described himself as "pharaonic" and indebted the City in more than 6,000 million euros.

However, despite the fact that the debt continues to weigh on the accounts of the city of Madrid, preventing new investments, the benefits for the city are evident.

2 "Madrid Calle 30" Project: the great engineering work

In 2003, Madrid City Council decided to start an ambitious urban remodeling project by burying M30, one of the city's main ring roads. This ring was built at the end of the 60s being the first belt of the city. To the southwest of Madrid the route of the highway coincided with the route of the river, running both parallel for almost 6 km. The river was trapped between the circulation lanes that passed both banks. So, any relationship between the citizens and the fluvial environment disappeared, and the channeled river became completely isolated, inaccessible and invisible. Between 2003 and 2007 the underground work of the west arch of the M-30 was carried out in the area of the river, a work that made possible the elimination of traffic on the surface and the consequent liberation of more than fifty hectares of land previously occupied by the roads of the M-30. Another one hundred hectares were added to this surface, corresponding to the different underutilized soils adjacent to the highway.

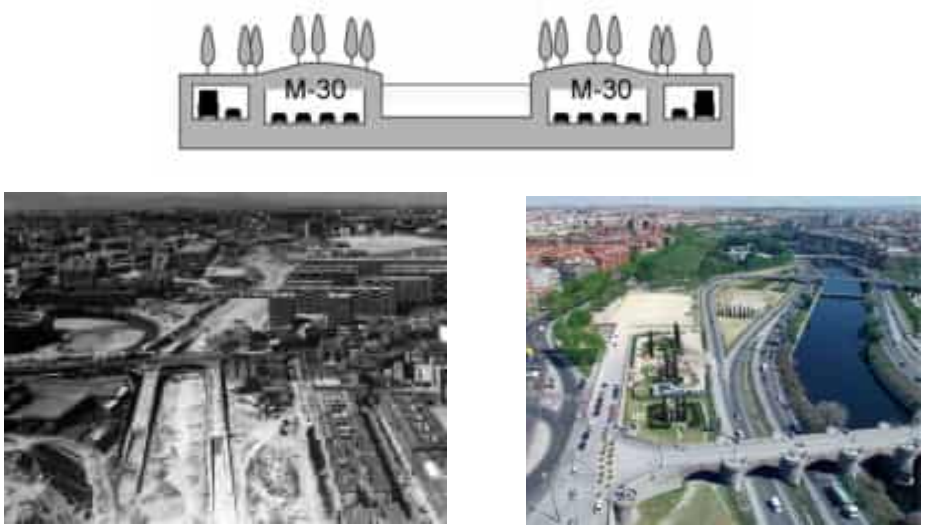

Figure 3. Madrid between 2004 to 2011, the New "Calle 30" | Source: City of Madrid

3 "Madrid Río" Project: the urban and environmental bet

The Madrid Rio project arose as a result of an International Ideas Competition organized by the City Council in 2005, with the aim of obtaining proposals for the planning and urbanization of this great vacuum. The aim was to design a large urban park, 6 km long and 1,500,000 m2 of surface, on both banks of the river. The contest gathered in its second phase six invited studios of recognized international prestige (Peter Einsenman, Herzog & de Meuron, Torres and Martínez Lapeña, Navarro Baldeweg, Dominique Perrault, Kazuyo Sejima / SANAA) and two others selected in a first phase, that was open and anonymous.

Finally the winning proposal was that of the team led by Ginés Garrido and formed by an association of architecture studies of Madrid: Mrío architects (Burgos & Garrido, Porras & La Casta and Rubio & Álvarez-Sala) in collaboration with the Dutch study West 8.

The fundamental principle of the winning project was to connect Madrid with the valuable outer territories that surround the city from the mount del Pardo in the north to the fertile fertile valleys cultivated in the south. The system of infrastructures and rings that enclosed the city made impossible the continuous connection between the urban landscape and the natural environment. With the development of the proposal, the Manzanares River becomes the point of connection between both environments, through the construction of a tree-lined corridor on its banks and the implementation of several bridges and footbridges that cross the neighborhoods and overcome the main infrastructure of traffic that made contact impossible.

Figure 4. Madrid Río Project | Source: City of Madrid

4 Plan for Urban Renovation of the Manzanares: comprehensive action

The Plan continues the process of urban transformation initiated with the burial of the M-30 and the execution of the Madrid Rio Project on public land, proposing a comprehensive strategy for intervention in the construction and private free space in the recovered river axis. Also in the fabric of social and economic activities of both margins, through an innovative proposal in sustainable Rehabilitation, Revitalization and Renovation of the building and the urban scene, which will transform the relations between the historic center, the river and the bordering districts.

4.1 Areas of actions

In **the public sphere**, the investment has been of a public nature and without generating any profitable use.

In **the private sphere**, the aim is to streamline an adaptation process in accordance with the transformation carried out through the Calle 30 and Madrid Río projects, contributing to this new process through public participation, through aid to the residents to renovate all the facades and back of the river. This initiative supposes, without a doubt, a new opportunity for the neighbours included in the geographical delimitation of the Plan, of renewing their homes with the impulse and the municipal collaboration.

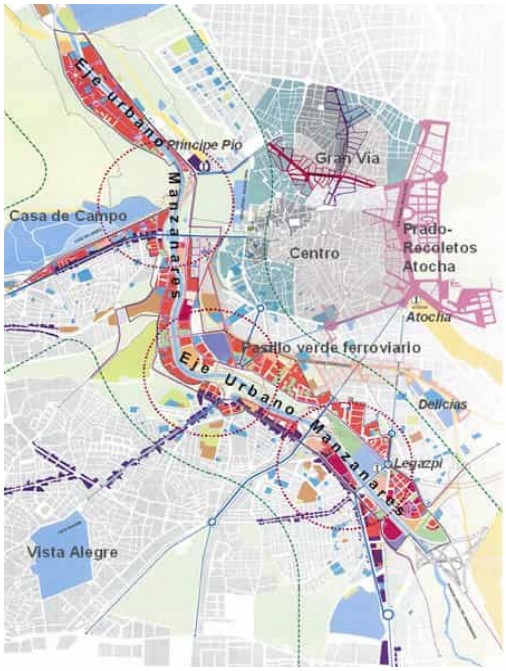

Figure 5. Areas Madrid Río Project | Source: UPM

4.2 Diagnosis for the action

The diagnosis is part of a unitary information process where the need to act in the following aspects is highlighted:

• Urban structure: Residual space, several times planned as a green corridor, which until the Madrid Río Project has not been possible to carry out.

• Sociological structure: Presence of 21% of the population over 65 years of age and 11% of the population under the age of 14.

• Uses of the building: Majority residential area with need to incorporate other activities.

• Housing quality and conservation: Localized conservation problems in the oldest building. Stresses the lack of accessibility, with no elevators or ramps, in 499 buildings.

• Economic activities: They have remained outside the urban transformations, having a great potential for social revitalization.

• Urban scene: The area has suffered a homogenous deterioration due to the impact of the M-30.

4.3 Type of actions

4.3.1 Rehabilitation of the Building

It means giving value to the building and private free space with the aim of improving and adapting to new functional, environmental and aesthetic criteria. Possible application to 22,000 homes.

The intervention can occur simultaneously in a complementary and non-exclusive way. Sustainable rehabilitation always occurs simultaneously with the other types of rehabilitation.

4.3.2 Revitalization and renewal

It involves the incorporation of new uses through the modification of the urban and architectural framework, with replacement of the existing building or with new construction, generating urban centers that promote the social and economic transformation of the area.

5 Values

5.1 Architecture

The park that accompanies the river also structures buildings, monuments and bridges, which are an important part of the history of Madrid, and which the Madrid Río project has rehabilitated to put them in value, facilitating their accessibility for their use by citizens. In this way, a great historical and cultural axis has materialized.
If we go through the park or from north to south, we find, among others, the Puente del Rey, which forms a monumental group with the **Puerta del Rey**.
Puente del Rey was built in 1816 and it is one of the historic junctions between the oldest part of Madrid and Casa de Campo.
Casa de Campo did not always belong to the people of Madrid: it was bought by King Felipe II to the Vargas family in the 16th century, it was a royal preserve, since it was integrated with the natural environment of El Pardo, and the town hall did not acquire his property until 1931.
Of this monumental set, besides the bridge, there are only six columns that were part of the old entrance door to the Casa de Campo (and that already appear in the map of the city that Pedro Teixeira made in 1656).
Thanks to the Madrid River Project, the door has regained its original architectural position and shape, in the form of a semicircle, according to the historical cartography of the city, after a rigorous study carried out by expert historians.
Further on, on the left bank of the Manzanares River, it is **the Hermitage of the Virgen del Puerto**, from the 18th century, designed by the architect Pedro de Ribera and commissioned by the Marqués de Vadillo. Its surroundings have been remodeled with the creation of new gardens (with an area of 67,000m2) that frame the beauty of the hermitage.
The Hermitage of Virgen del Puerto had to be reconstructed almost in its totality after the Civil War and it has remained cornered for decades, by effect of the road that surrounded it. The Madrid Río project has made an important effort in this area to recover the historical image of this monument, recreating the gardens that originally surrounded it and the historic alignments of the trees.


Figure 6. Puerta del Rey


Figure 7.The Hermitage of Virgen del Puerto

A little further down to the south we find **the Segovia Bridge**, 16th century, the oldest in the city. It is the work of the architect Juan de Herrera by order of King Felipe II.
The burial works of the M-30 allowed the consolidation of the bridge and later it was subjected to cleaning and improvement operations, and it was framed between landscaped areas, monumental fountains and ponds

The next historical reference of the area is **the Bridge of Toledo**, which King Felipe IV ordered to build in the 17th century. The initial project is due to Juan Gómez de Mora in 1649, although it has been rebuilt several times, the last one, in 1732, by Pedro de Ribera. As in the case of Puente de Segovia, it was the subject of consolidation works during the refurbishment of the M-30, and the Madrid Río project has carried out its cleaning and restoration, surrounding it with a landscaped area reminiscent of the labyrinths of baroque gardens.

Figure 8. Segovia Bridge

Figure 9. Toledo Bridge

We finish the report with the building of **the old Matadero** (Slaughterhouse) of Madrid, a clear example of the industrial architecture of the city of the early twentieth century. It is a large group of about 150,000 square meters of surface that has been the object of an important rehabilitation and functional transformation driven by the City Council.
Matadero has been constituted in the new cultural centrality of the south, dedicating itself to new forms of artistic expression. Matadero currently serves as an anteroom for the Art Walk that begins in Recoletos-Prado and continues along the Atocha-Legazpi axis.
This tour brings us closer to the center and the south of the city, and allows us to get closer to the great museums such as the Prado, Thyssen-Bornemisza, Reina Sofía, Caixa Fórum, the new headquarters of the City Hall in the Palacio de Telecomunicaciones de Cibeles, the Casa Encendida or the Price Circus, among others.

Figure 10.The old Matadero

5.2 New Bridges

In addition to the 22 bridges that have historically crossed the Manzanares, the Madrid Río project has improved the transversal circulation by adding 11 new footbridges, which connect neighborhoods that were previously separated.

Figure 11. The total 33 bridges

Among the new bridges highlights the one designed by Dominique Perrault (French architect who won the second prize at the International Competition of the Madrid-Rio Project), which is the main entrance to the park of Arganzuela and an important piece of pedestrian and cyclist connection that links the Paseo de Yeserías to the Avenida del Manzanares. The sculptural character of the bridge gives new perspectives to the landscape of the river. With 250 meters in length, it is traveled through a pedestrian and cyclist platform. On it is located a unique steel structure with a helical shape, which gives the building a bridge-sculpture character.

Figure 12. Perrault Bridge

Its route is developed in two sections: one from the Paseo de Yeserías to the Parque de Arganzuela and another from this to the Avenida del Manzanares. The two converge in an open square located on a small hill in the park. The bridge is fully accessible to people with any type of disability, for which it incorporates specialized signage, with tactile, audible and easily visible elements.

6 Landscape

In the Madrid Río urbanization project, we must not forget that we are acting mostly on an infrastructure that is underground; 40% of the soil is formed by the slabs of the tunnels covers that measure more than six kilometers in length.

The solution adopted has been based on the use of vegetation as the main construction material. The project establishes as a general strategy the idea of implanting a dense vegetal layer, of almost forest nature, wherever possible, that is to say, making a landscape with living material, on an inert underground substrate.
The proposal is specified in three landscape units or main green areas. First, the corridor that runs along the right bank of the river. It is the structure of fundamental continuity that runs through the entire park longitudinally and it receives the name of Salon de Pinos.

1.The Salon de Pinos joins the park from the Puente del Rey to the southern knot, and also around different landscaped areas that contribute to facilitate access and to value the historical and architectural references that exist in the field.

The Salón de Pinos is built on the tunnels and has an average of 30 meters width and 6 km in length. Over 9,000 Pinus pinea, Pinus Halepensis and Pinus Pinaster, of various sizes and shapes, have been planted on the concrete slab covering the passage of automobiles.
A controlled prolongation of the pine forests of the mountain range located north of Madrid has been created.

Figure 13. The Salon de Pinos

Accompanying the Salón de Pinos in its linear route, we find various gardens, such as the lower gardens of the Segovia Bridge (the oldest bridge in Madrid), which have an area of 39,000 m2 and facilitate access to this monument, whose origin dates back to the sixteenth century. There are located two large fountains and two river gardens, with two ponds on each shore.
In the lower gardens, 13,345 m2 of prairie have been planted, with low water demand and 332 new trees of eleven different species.

Figure 14. Low gardens of the Segovia brigde

Or the new Virgen del Puerto gardens (with an area of 67,000m2), on the northern section of the Salón de Pinos, on the left bank. These gardens have been designed to enhance the beauty of the hermitage there, which for decades was cornered and was not accessible to the people of Madrid because of the road that surrounded it.
The Madrid River project has made an important effort in this area to recover the historical image of this beautiful monument, recreating the gardens that originally surrounded it, and the historic alignments of the trees.

The new gardens of Virgen del Puerto, where 1,520 trees, 14,450 bushes and 32,000 square meters of meadow with low water demand have been planted, are designed for the walk between El Rey Bridge and Segovia Bridge through its two kilometers and a half of pedestrian routes, or to ride a bike for its almost 300 meters of bike lane, and also for the stay contemplating the Manzanares River and the fountains from its 198 benches.
In addition there have been evoked the ancient washings that existed in this place, by means of the construction of different tanks lined with stone of granite.

Figure 15. New gardens of Virgen del Puerto

Following the route we can reach the Aniceto Marinas Garden, which will connect to the historic gardens of the Campo del Moro, and further south we arrive to the Matadero gardens, which contribute to highlighting and enhancing the new cultural complex of Matadero Madrid, the result of an important rehabilitation in this historic building
The gardens of the Puente de Toledo arise where the "Salón de Pinos" meet with one of the monumental bridges of Madrid, that of Toledo, built between 1718 and 1732.
With an area of 40,000 m2, take advantage of the bridge of Toledo in a double sense: On the one hand they make up a space designed to be seen from the top of the bridge. That becomes a viewpoint and offers a new and unprecedented view of Madrid, reproducing a vegetal figurative motif.

On the other hand, the gardens incorporate the Bridge of Toledo, which is a baroque structure designed by the architects Pedro de Ribera, as an object to admire, to touch and under which to pass. For this, the arrangement of the hedges of ligustrum, vivurnum and laurus is organized so that it forms a series of lines that take as reference the baroque gardens of the Bourbon period, although with a contemporary language. Two types of deciduous tree, Albizias and Liriodendros, have been planted between the hedges. They will open their cups as parasols in the hot summer of the city. Also, at this point, a grandstand has been built to allow the closest approximation to the water surface of the river, and the best contemplation of the arches of the old bridge.

Figure 16.the Aniceto Marinas Garden and Toledo Bridge

2. The 2nd field of landscape is the new monumental stage that definitively links the historic center (represented by the Royal Palace and the elevated cornice of the city) with the largest park in Madrid (the Casa de Campo, of more than 1,600 hectares). Different solutions have been proposed, addressing with extreme attention the context in which they are located: La Huerta de la Partida, Avenida de Portugal and Plataforma del Rey.

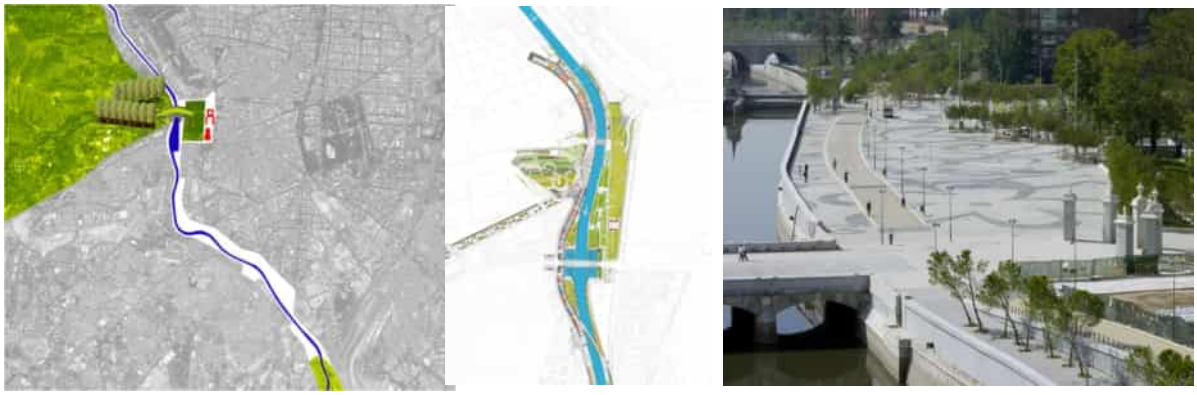

Figure 17. Huerta de la Partida, Av. De Portugal, Plataforma del Rey

Plataforma del Rey is a multipurpose space of 12,000 square meters that hosts many outdoor activities that until its opening did not find a suitable setting. It is located in the area between Avenida de Portugal and the access to the Casa de Campo by the Puerta del Rey, by which it receives its name. The platform is elevated with respect to the orchard of the game.
La Huerta de La Partida is located next to the access to the Casa de Campo by the Puerta del Rey, and is an enclosure created in the sixteenth century linked to the House of Vargas and next to Meaques Creek. The recovery of the character that it had historically, was possible thanks to the action on the axis Cuesta de San Vicente-Avenida de Portugal, that allowed to communicate it with La Casa de Campo.
The recreation, with a contemporary language, of the Huerta de la Partida is to rescue the memory of the place as it was conceived in the sixteenth century, the atmosphere of

orchard populated with fruit trees and the freshness of the fertile plain of Arroyo de Meaques.
The action includes the conservation of large-sized trees in the orchard and the planting of 873 fruit trees: 140 walnuts, 79 pear trees, 112 mulberry trees, 21 almond trees, 46 olive trees, 37 hazel trees, 159 plums, 214 apple trees, 21 fig trees, and 44 pomegranates
In addition, and because the Arroyo Meaques (to the south), that crossed the orchard, was canalized since the 70s, 480 meters of length of its channel have been recreated.

Figure 18. Huerta de la Partida, Av. De Portugal, Plataforma del Rey

The avenue of Portugal: In its design have been used a total of 1,400 trees: 700 cherry trees, of different types such as Prunus Avium, Prunus Avium Plena, Prunus Padus Watererii and Prunus Yedoensis, which evoke those of the Jerte valley; 500 specimens of Plátanos and another 200 Poplars of the Populus Alba type.
The paving of the boulevard has been designed on the basis of irregular small cobblestones of limestone and basalt, in the manner of Portuguese custom, which extend over an area of 22,000 square meters.
The design is made up of large stony "islands" that recall the silhouette of the cherry blossom on which the cherry trees will grow and whose sinuous contours will serve as a seat for passers-by.

Figure 19. New Av. De Portugal Area

3. 3rd area: Finally, in third place, the Argazuela new Park was planned. It includes the Matadero's contemporary creation center. The park represents the largest area of intensive landscaping on the left bank of the river (33 Ha).
It is the most extensive project executed of and one of the fundamental pieces of Madrid Río. The action incorporated a green zone with strategic position in the district of Arganzuela, which through the new network of bridges and footbridges, becomes part of the system of green areas that transcend their relationship with the neighborhoods to become key pieces of the urban structure.

The ancient park was remodeled and extended along the eastern bank of the river, from the Toledo Bridge to the Greenhouse, located south of Praga Brigde. The objectives of the project were to improve pedestrian accessibility and contribute to the integration of two unique spaces of its environment, such as the buildings of the cultural complex Matadero Madrid and the old Fruit and Vegetable Market.

The park contains areas for children's games, ranches, cycle paths, skating rink, sports courts, space for concerts and outdoor shows, and an information and guidance center. In addition, 2,450 new trees were planted.

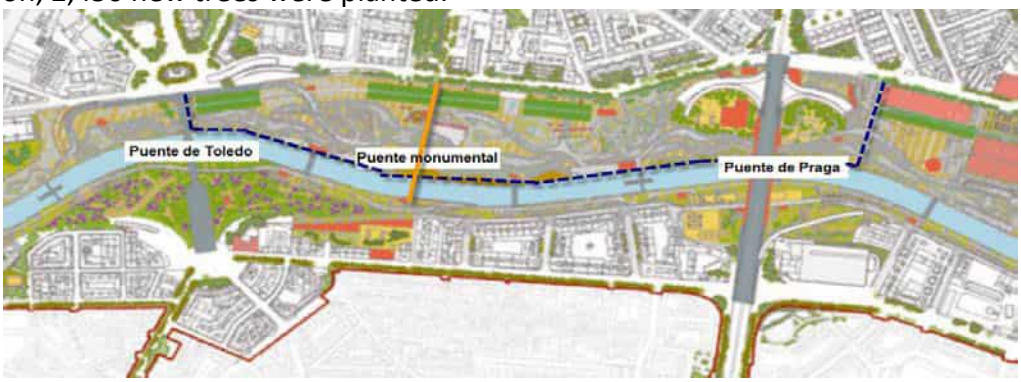

Figure 20.The river berween Toledo Gate and Praga Gate

Figure 21. Spaces for children

The park also houses the urban beach imagined by the children participating in the Madrid Río children's and youth competition and which is a stationary space from which to evoke the sea. The project was developed through different strips parallel to the river channel that order the different activities through the creation of unique spaces.

- A field called Dry River, formed by a fringe bordered by vegetation and reminiscent of river channels that dry in the summer turning into passable passages.
- A second area, a tree-lined avenue along the park, with gentle slopes, that can be traveled by cyclists and skaters.
- A third area, the so-called Slow Path, which runs through the park adapting to the irregular topography of the land and where you can walk.

Figure 22. Arganzuela new park

The urban beach turns into reality the winning proposal of the competition held in 2005, where 3,525 school children participated. The beach is located in the heart of the new park of Arganzuela.
It is formed by three aquatic oval enclosures in which three different effects alternate: surface sheet, where the users can lie down and soak themselves; water jets of height and changing effects, capable of producing different effects, and clouds of water spray. The rest and stay areas, more than 6,500 square meters of surface and almost 300 trees, will complete the scope of the urban beach. It only works in the summer period.

7 Future projects for the Manzanares River

The urban development of the area occupied by the Vicente Calderón stadium, which was the seat of Atlético de Madrid until 2017, is still pending.
The place of the stadium, and the next occupied by the Mahou beer factory, will host an urban project with green areas and housing buildings with an average of 8 heights.
An earlier urban operation, devised in 2009 and paralyzed in the courts, envisaged towers of up to 20 floors and two skyscrapers of 36 floors. Another differential point is that the M-30 will not be buried but will be "covered".

Figure 23. Vicente Calderon Stadium aerial view

The new proposal has reduced the buildability of the area in exchange for Atlético de Madrid taking less economic burdens from the operation. It will be the City Council who will fully fund the cover for the M-30, with a cost of between 50 and 60 million euros.

Figure 24. two proposals for Vicente Calderón Area

8 Conclusion

The Madrid Río project has been a great improvement for the city of Madrid.
The Manzanares, which once was a border between neighborhoods, is now an axis of union that allows you to travel its course and reach places like the Royal Palace, the Casa de Campo or the San Isidro Park, enjoying the great new green area created around it.

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URBAN PLANNING AND DESIGN FOR OPEEN SPACES IN THE NEIGHBOURHOODS OF KHARTOUM STATE –SUDAN

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Abstract

The paper reviewed about residential neighborhoods in Khartoum city in terms of urban planning of urban open areas and their uses by the population and the extent of their suitability of survey and its relation to the density of population and infrastructure. The paper presents the concept of urban open spaces and urban public squares, their importance, their diversity, how they are managed, and the contribution and participation of the population in the development and upgrading of these open spaces, which are considered to be some of the only playground spaces for children's games. And their social events. In Khartoum, urban open spaces represent the main place for residential and social gatherings of some neighborhoods.

The paper tackled the theoretical approach, field research and the questionnaire of some of Khartoum's major neighborhoods and concluded the results of the classification of the urban open and squares of the neighborhoods according to the type of the survey and the density of the population and the recommendations expressing the interest of the urban areas by the decision-making and urban policies in the presence of an environment suitable for urban entertainment activities and children's games and other events Social .

Keywords: - urban planning-, open spaces – residential- neighborhoods - density - urban design, grouping

1-Introduction

There is in Khartoum city a number of residential neighbourhoods vary in planning, which in turn reflected on the shape and area squares within the residential neighbourhoods Khartoum is considered in this period of high population density in some of these neighbourhoods and noted for this field research and the presence of several problems in the design of those urban open spaces and squares,

which reflected negatively on it as it has become useless in some of those neighbourhoods and became parking lots and we find that the general concept of the areas within the neighbourhood is also different from the area of another, we find that the studies of urban design and the behaviour of the community reflected on the use of public spaces near the house or far from the residential area.

There are some concepts and views of the outher Helen Woolley.

That the Neighborhoods urban open spaces are those that are part of the neighborhood in two ways.

First of all they are physically further from home, except on rare Occasions. Than domestic urban open spaces. This means that to use neighborhoods urban open spaces one has to make a very specific decision to do so. This may be different from some domestic urban open spaces which one can almost treat as an extension of the home. The decision to use any particular neighborhood urban open space thus requires a journey of some sort—whether it is 200 yards or further. In some communities such journeys will be—or should be—made on foot, the walk to the park or school being a good example.

Unfortunately many such journeys are in fact made by car, some by choice on bicycle and some by necessity are made by public transport.

It is anticipated that in general the distances travelled to neighborhood urban open spaces will be limited length, although there are some who travel outside their own physical.

The second

way in which neighborhood urban open spaces are part of the neighborhood relates not to a physical issue but to the social context. The people that one might meet in the range of neighborhoods urban open spaces are likely to be the people who live and possibly work in the area. This could involve different networks of people such as residential neighbors', workmates, parents,

Those spaces considered as neighborhood urban open spaces are, playgrounds, playing fields and sports grounds, school playgrounds, streets, city farms and incidental spaces. Parks can be considered to be the most democratic of urban open spaces because they are available to all.

Different types of urban open spaces can be used at different stages of a person's journey through life—childhood, adolescence, early and late adult life and finally the later years of life.

A typology has thus been suggested from the user's point of view which consists of three groupings of urban open spaces —**domestic, neighborhoods** and

Civic—based upon the concept of home range. There are two reasons that this tripartite grouping might be helpful.

The first

Is a physical one and relates to the physical distance the spaces are from home.

The second

Measure is social and relates to the people one might spend time with, meet or just see in these different spaces. The experiences of the three groupings of urban open spaces suggest three social levels of familiarity, sociability and anonymity. Although any of these three social experiences might take place in any of the three types of

urban open space, in general there is likely to be a transition of experiences between them.
Thus domestic urban open spaces are physically associated most closely with the home and socially are likely to be used mainly by the family, friends and neighbors. Neighborhoods urban open spaces are physically not directly related to the home but to the neighborhood and community within which one lives.
Socially, these spaces will be used not only by family, friends and neighbors but also, predominantly, by others within the community who are likely to live within the vicinity of the space, Civic urban open spaces, then, are those that are set within the urban context but which are, usually, physically farthest from the home or are places at strategic or specific locations and from a different physical part of the conurbation. With the transition between these three groups of urban open spaces—from domestic to neighbor-hood to civic—there is an increasing likelihood that user s will know a smaller percentage of the other users.

1-2 Domestic

Urban open spaces are those open spaces in the urban context that are physically closest to home—they may also be the open spaces that are valued most at different times of life. These include spaces that are integral within a housing area, private gardens, community gardens and allotments.
The first two are those most closely linked with the home because they are the physical setting within which the home is placed.

1-3 **Community gardens**

May be associated with a small group of family houses, a small block of flats for professional people or perhaps a group of bungalows for the elderly. Community gardens are thus shared physically but the use of them may not be a shared experience—it may be that one might be the only user at a particular time. On the other hand community gardens also provide opportunities for getting together with a small group of people—whether children for play or adults for a cup of coffee and a chat.
Allotments could be considered to be an extension or, for some, a replacement of the garden

One of the important elements around this issue is that of the quality of, and resources provided for, the design and management of the open spaces that are provided. Bland spaces are not what people want and will not provide a good quality of life, while well-planned, designed, built and maintained spaces, with community involvement

1-4 Historically playgrounds were considered to be a means of isolating children from the dangerous city. A greater variety of experience and opportunities for skills' development is available to children who are not restricted to using only playgrounds.

The street, when safe enough, places in front of houses and a range of other spaces in the neighborhood are all invaluable for play opportunities. Many authors have written about the importance of the 'city as playground' (Ward, 1978; Abercrombie, 1981; Dreyfuss, 1981), accepting that traditional **playgrounds** do not and cannot provide the entire play opportunity that children require. However; for many

children the opportunity to develop skills through play comes, at least in part, in the form of a playground, often in the local park.
Such playgrounds are usually provided and maintained by local authorities and because of this we will now consider playgrounds.
A conventional playground contains moving equipment such as a roundabout and swings and fixed equipment such as slides and climbing frames, with tarmac or in some situations a rubber-based surface in order to reduce the impact of any falls from equipment. But these playgrounds have not tended to include the opportunities for manipulating the environment identified in some of the evidence as being important for children and what they like to play with (Hart, 1979). Increasing industrialization in developing urban areas, coupled with changes in farming techniques during the eighteenth and nineteenth centuries, led to increased pressure on land in the UK, resulting in specialization and eventually the concept of land use planning, zoning all land for a specific use. This resulted in many areas where children used to play no longer being available for this purpose. The first equipped children's play ground

1-5 Squares

P and P Goodman

(Communitas, 1960)

Squares are one of the oldest types of open space within a city and thus usually exist in the older parts of cities. Market squares were initially part of the temple precincts and therefore not accessible to all—increased access developed in later years. The separation of the marketplace from the temple precinct took place in Mesopotamia and Greece. The market was a by-product of the 'coming together of consumers who had many other reasons for assembling than merely doing business' (Mumford, 1966). Thus the marketplace became the place where people met or gathered and where news was exchanged. This social function of the marketplace has continued to develop in a range of urban open spaces. Many mediaeval European towns had a square around which were major public buildings —a church, customs house, hospital, town hall. In many instances when Europeans from these cities voyaged across the oceans and landed in America they built new towns and cities with the market square at the heart of the development (Loukaitou-Sideris and Banerjee, 1998).

Most squares are clearly defined by the built form that surrounds them, and are in fact contained by the walls of such buildings. In most instances the city square is linked to the street pattern of the city centre. In America the square may be the result of the omission of buildings within a square of the grid system of the city. In a European city the square may be purposely designed into the city fabric or may just be the widening of a road as it diverges around a landmark such as a fountain, a memorial or a statue (Huckster, 1977). In some cities, such as Florence, extensions to squares were the result of the demolition of buildings in order to make way for grander schemes. Some of these squares were purely devoted to markets and had residential properties for the different types of traders associated with them—and workshops, arcades and shops. Meanwhile some cities developed the civic square in order to segregate the retailing functions from the civic activities (Girouard, 1985).

The use of squares may have been for more than just markets. Fairs and events also took place in these urban spaces and on holidays and festivals activities such as bullfighting, fire-eating, acrobats and fireworks were not unknown. In addition the use of squares may have been for more than just markets. Fairs and events also took place in these urban spaces and on holidays and festivals activities such as bullfighting, fire-eating, acrobats and fireworks were not unknown. In addition many squares, in different parts of the world, were and are still used as part of a religious ceremony or procession.

1-6 -Plazas

Plazas are larger urban spaces than squares, not small, confined areas but significant spaces in size. They may be designed for one purpose but used for others.

2-Density

Consideration of the issue of housing density must also address the importance of open space to people's daily lives. In addition, how this vast number of houses are designed and built will have an impact on a range of social issues that should not be ignored. The proposal to use underused and derelict land or brown field sites for housing in cities is to be welcomed, especially if colonized areas of such sites are retained as a basis for a green structure, but this should not be at the expense of the provision of the many benefits and opportunities that open spaces provide in urban areas. Increased densities of housing are being suggested by many people and to some extent this is a good thing for community building in an urban area, but as we have seen in section one urban open spaces are also good at helping to develop a sense of ownership and community.

3- **Methodology**

This study research evaluated the case studies of many type of urban planning and design open space in Khartoum the method tested and evaluated the open urban spaces in the neighborhood the tools will be employed in this study including: Direct Observation, and questioner survey , Activity Mapping, Survey and, Photos. The evaluation criteria are grouped into two categories including, -Design Framework, - and Social diversity.

From analysis and observation for urban open space planning in Khartoum neighborhoods and with change of a growing population, the community of Khartoum city has placed importance on open space and amenity in their developing Public places form an essential part of the urban design. This study critically assesses three urban open spaces types their urban design and planning features. This observation and will identify which planning and design characteristics contribute to how well-used a public space is overall as well as the satisfaction of the needs of the users of the space three types of community public garden , domestic open space and neighborhoodard garden to evaluated of which were considered to be healthy and well used, figure[1] explain the urban planning in Khartoum by the Sudan Survey Department in 1952, four years before Sudanese independence and in the year of the Egyptian Revolution, which supported the separation of Sudan. We noticed that in the urban planning open space areas and the centre of city, and public garden and the residential plots.

Table [1] evaluation criteria

Design and planning Framework	Social diversity	Local governmental suport
Accessibility	Food Facilities	Land use
Identity & Focus	Public Accessibility Functionality and Attractiveness	transport
Seating	Enclosure	safety
Legibility	Allowing access to and experience of nature	Maintenance and rehabilitation
Sustainability and climate response		Security Guard
Connectivity and way finding		

In Table 2 are explained the measuring and comparing squares to criteria. We put weights to measure the specs which are given for each shape measurement week good v.good exellent

criteria	Garden open space domestic	Public garden	Garden neighbourhood
Design and planning Framework			
Accessibility	w	e	g
Identity & Focus	e	e	w
Seating	w	e	w
Legibility		v.g	g
Sustainability and climate response	e	v.g	w
Connectivity and way finding	e	e	e
Social diversity			
Food Facilities	w	e	w
Public Accessibility	w	e	g
Functionality and Attractiveness	v.g	e	w
Enclosure	e	e	w
Allowing access to and experience of nature	e	e	w
Local governmental suport			
Land use	e	e	w
transport	w	e	w
safety	e	e	g

Maintenance and rehabilitation	g	g	w
Security Guard	w	v.g	w

FIGURE [1]

In figure [2] there is new urbanization with change of a growing population in Khartoum we noticed that the number of plots and the relation of open spaces shapes and numbers in figure [3] there is domestic garden with the plots.

FIGURE [2]

In figure [2] there is high residential density.

FIGURE[3]

FIGURE [4]

View 1* source MID TOWN SUDAN
High density residential area with urban design elements and land scape architecture

View[2] Public garden communities with urban design elements

The recommendation
The **work of cultural nights and surveys helps to attend the community and create entertainment programs for children**

View [3] =pen space playground neighbourhood garden in the residential high density area

The result and view explained the neighbourhood garden of **need children's playgrounds, seating and lighting and rehabilitate the ground football field as well as need a track for running.**

Addition of design elements to create a more interesting space

Improve lighting coverage

View[4] Main open space road The urban location, which includes a group of students with the presence of places of shade and elements of urban design


View [5] green open space area group community View [6] domestic garden ----

The result explained the closure of garden and the semi public use encourage the residential to care and clean and it need seats and a venue for social events


View [7] Open square garden neighborhood; View[8] Open square with landscape architecture

The result explained that there is no interest at the local government level there are no places to sit No one cares about it became a place for parking of some passersby Recommendation for view 7&8

- Set the limits and boundaries of the garden
- Setting the seating areas
- Full lighting Place a and place to drink water

- Encourage the population care of the garden and make regulations for not being used as car parks or a place to collect garbage

View[9]

View[10]

For public garden in view [9 and 10]the results explained It is a good place to see each of **the wonderful plants and places to sit by the number of its proximity to the main street. Frequented by people from faraway places** the recommendation **Site circulation should be carefully considered and adequate space allowed for queuing traffic waiting to be served. Queuing traffic should not interfere with pedestrian movement or back out onto adjacent streets.**

- The few negative aspects are the occasional noise levels from the cars at the adjacent intersection and the maintenance levels.

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URBAN STRATIFICATION AND MIGRATION, CASE STUDY OF FIKIRTEPE, ISTANBUL

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Abstract

Urban space is formed in the historical process by vertical and horizontal relations of layers formed by many different factors. Each historical period constantly changes the place that it shapes with its own unique circumstances, in fact each layer formed as a reason or result of the previous layer. One of the factors of urban stratification is the migration. The population migrating from one place to another can lead to the formation of a new housing fabric. In this context, Fikirtepe district of Kadıköy, which is one of the sub-centers of Istanbul, was chosen as a study area because it was seen as an example to be able to reveal the social and physical layers emerged from the migration which not only from rural area but also other urban area. The Fikirtepe district is one of the slums in Istanbul, which is the result of migration to the city in the 1950s with industrialization. By the 1980s, the settlement in Fikirtepe district was transformed from single-storey slums into an unplanned apartment building. In the 2000s, the region is in the interest of the capital as an urban rent area that will soon become a residential area for upper income groups because of the close to Kadıköy. After 2005, large-scale projects started to be designed with the region declared as an urban transformation area. However, due to constant changes and uncertainties, the reconstruction process has been extended and Fikirtepe has become a ghost area within 10 years. Those who sell their homes will not be able to return because they will not be able to live in the new luxury houses to be built here due to their income. While this layer of the slum community in Fikirtepe forms another layer horizontally in the city, when the transformation in the region is completed, a new population consisting of the upper income group will form a new layer which is formed vertically. In short, in this study, it was aimed to reveal the urban space effect of the urban stratification caused by migrations in the city.

Keywords

Urban Transformation, Urban stratification, Migration, Housing, Squatter, “Gecekondu”

1. INTRODUCTION

Triggered by industrialization in 1950s throughout Turkey, density of migrations from rural to urban boosted the population in cities and following that created the problem of housing. This situation has especially effected large cities like Istanbul, Ankara, Izmir. This study intends to generalize the concept via Istanbul considering the fact that although each city experiences its own urbanization, there are also shared ones in common. Migrations from rural areas unexpectedly increased the population and generated a need for accommodations. Due to the fact that state could not provide housing that responds to the needs of accelerated population, this layer was formed in the periphery of the city walls or around industrial buildings as the slum tissue. From 1980s onwards, while the rural to urban migration has continued, also internal displacement within the city has begun. The urban fabric continued to be in a state of constant flux for various reasons such as: changing location of the industry, formation of sub-centers, construction of bridges on Bosphorus, regulations in zoning plans, transposition of capital to the construction sector, changing housing areas of income groups with the increase of population. In the 2000s, the slum areas, which were previously seen as far from the center, were now located within the sub-centers of the city and became attractive settling spots for the middle and upper income groups. However, with the start of urban transformation movements, the housing layer of squatter-apartments has started to be replaced with large-scale housing projects. Besides this generalization, there are unique developments and layers available in every district of this multi-layered city, Istanbul. The layers of the historical city center and the factors that form these layers are much more diverse, while the layered texture formed in the new settlement areas with the growth of the city has been formed by different dynamics. In other words, each layer actually creates new vertical and horizontal layers, either due to the reason or result of the previous layer.

In this context, Fikirtepe region of Kadıköy district is selected as an example in this study to enable reading the social and physical layers emerged from the migration from the rural to the urban and to reveal the effect of these changing-layers on urban space. Although first layer observed in Fikirtepe dates back in 5000 BC, there is no trace of settlement is available from Byzantine or Ottoman Eras. After 1957, the population that migrated from rural started to form the new layer of Fikirtepe, as the first slum region of the Kadıköy district. [1] By the 1980s, the settlement in the region was transformed from a squatter-tissue into unplanned apartment buildings. In the 2000s, the region, becomes to attract capital as an urban rent area that will soon become a residential area for upper income groups with its closeness to a new sub-center, Kadıköy. In 2005, the zoning status of the region was changed and in 2007 the phrase urban transformation was entered into the master development plan, and following that, capital oriented and large-scale projects began to be designed. However, this process of transformation has been prolonged with constant changes and uncertainties and Fikirtepe has become a ghost zone in 10 years. Property owners who sell their houses to construction companies are moved to the surrounding areas, causing a new layer to be formed, while the residences that have been vacated have fallen into disuse because the demolition procedures have not been completed. In addition to the demolition of the vacant houses, the building elements removed from the buildings are used in other cities and distributed as another horizontal layer.

To sum up, in the layered-structure of Fikirtepe, different social and physical layers have effected urban space both in vertical and horizontal axis. In this context, it is aimed to make an exemplary case study on Fikirtepe, considering the physical layers formed in region within the historical process, to show that cities are composed of many different layers.

2. Physical Layers in Fikirtepe

2.1 Neolithic Layer

The settlements that revealed the structure of Istanbul in the Neolithic period and were excavated first in Anatolia are Fikirtepe and Pendik. During the construction of the Baghdad Railway in 1907, prehistoric settlements in Istanbul were discovered [2]. In the same period, J. Miliopoulos, an engineer who was in charge of the construction of the railway, also found settlements in Pendik and Fikirtepe. Fikirtepe was excavated by Kurt Bittel and Halet Çambel on behalf of the Department of Prehistoric Studies in Istanbul University between 1952 and 1954, but it could not be dated for a long time. In the following years, the research of Mehmet Ozdogan, conducted by the Istanbul University Prehistorical Studies Department has revealed that the settlement of Fikirtepe dates to the Neolithic Period [3]. The first settlement in Fikirtepe was around 5000 BC in the Late Neolithic period [4].

Figure 1. Illustration of Fikirtepe Culture (by Mustafa Kalemci) [3]

The settlement of this period at Fikirtepe was founded on a slightly sloping slope of 26 m high ridge, facing the South and southeast (Figure 1). It is thought that the hill, which is bounded by Kurbağalıdere on one side and bounded by the valleys on both sides, is connected to the sea in ancient times. In the Neolithic period, the life style and production activities of the communities living in this region were developed parallel to the geography of the region. The alluviums carried by Kurbağalıdere enabled productive agricultural activities along the coast. In addition to coast, hunting and agricultural activities have been the main activities that shaped the economic life in Fikirtepe in the past due to the extensive hunting opportunities of Marmara Sea, and rich forest areas of historical Fikirtepe settlement [2]. Moreover, the settlement of Fikirtepe influenced very large areas in the

historical process, and today, a concept called Fikirtepe Culture[1] has been established [5]. Furthermore, the importance of the Fikirtepe Culture that lasted quite long stems from the documentation of how food-based life, agriculture, animal husbandry and pottery production were transferred to the European continent [2].

The Neolithic period in which the transition from hunter-gatherer to agricultural society is experienced marks one of the breaking points in human history [6]. Being one of the most important Neolithic settlements within the city of Istanbul is increasing the importance of Fikirtepe. In 1981, the prehistoric Fikirtepe was registered. In 2010, the boundaries of the mound were determined and the area was registered as a 3rd degree archaeological site. In this way, the pre-historic Fikirtepe has been preserved in a more defined way through the legislation, but no study has been conducted on the preparation of the Conservation Master Plan for the area [3]. If preservation cannot be achieved during the ongoing urban transformation process, there is a possibility that the traces of the Neolithic Period layer will completely disappear.

2.2 Squatter Layer

Although the first layer of Fikirtepe was formed in the Neolithic period, it was not settled in this region during Byzantine and Ottoman periods. Until 1950, the only settlement in there was a hunting lodge belonging to Sultan V. Murad, and the rest of the region is composed of the areas of recreation and pastures [3]. Later on settlement started in Fikirtepe after 1957, as the first squatter layer of the Kadıköy district. The squatter layer in Fikirtepe is formed of two different layers. As the squatters of the first period were one-storey and jerry-built, the second layer is increased in a vertical way as an unplanned apartment blocks. At this point of study, in order to better understand the squatter layer in Fikirtepe, it is useful to look at the definitions of squatters as “gecekondu” in Turkey, development and change processes in general.

When urbanization levels of underdeveloped and industrializing countries cannot meet the needs of the population that flows into the city through migration, cities whose population has increased more rapidly than their possibilities, and when the housing requirements of the population who come to the city with migrations cannot be met by legitimate means or

[1] The Neolithic societies, which were first proposed by Özdogan [5] and referred to as “Fikirtepe Culture” in the literature, were named after the settlement in ideatepe district. It is used as a general definition of communities with similar characteristics in the Marmara region and in a geography extending from the Eastern and southern parts of the sea to Eskisehir. According to Karul (2016),

“It reflects the interaction of hunter-gatherers living in and around Istanbul with the farmers from the more inner parts of Anatolia. Fikirtepe Culture is dated roughly between 6500 and 5500 BC and it is understood that the settlements close to the shore are located on the edge of the bay or lagoon. These settlements, located close to the coast, spread on an area of approximately 150-200 meters in average, where archaeological filling thickness do not exceed a few meters. These structures, as revealed in the excavations of Fikirtepe for the first time, have an architectural tradition consisting of round-shaped mesh clubs with a diameter of 2.5 to 4 meters with a slightly piled base. In this method, tree pillars that knitted with thinner branches like baskets are covered with mud brick mud on both sides. Huts were placed at irregular intervals, and the open spaces between them are arranged in the form of courtyards where daily work is maintained. On the floors of some huts, graves ,which imply living with their dead ones, were found. In the graves, similar to the mother's womb of a child, the legs were pulled into the abdomen and buried sideways, and grave gifts such as pottery and bone tools were left on the sides of the skeletons.”

by state, “squatter” has emerged in the urban space [7]. According to Kray, squatters emerge in societies that perform industrialization very slowly, despite the rapid transition of market-oriented production in agriculture and the acceleration of population in cities [8]. Tekeli defines the concept of squatter as a form of settlement and living that is created in cities by a workforce that cannot be absorbed by a cutting-edge sector of a developing country with a technology taken from the outside [9].

First, groups who had no regular jobs or income, engaged in more marginal affairs [10], and who had not been able to obtain housing in the city through legitimate means, began to build squatters, which were close to the city's labor market but were not conducive to environmental conditions, usually located on the territory of the state owned lands [1]. The first generation of squatters in the 1950s, is a structure, which inhabitants carried out the construction process with their own labor, built for the purpose of the use of migrants, who were pushed by the countryside [11]. In the second period between 1960 and 1970, the economic and political role of the squatter was strengthened. In this period, improvements have been made in squatters as well: nearby environments have been arranged, residences were built as single storey houses with paint and garden, and filled with the most widely used durable and semi-durable consumer items of the period. In the 1960s and 1970s, with the laws and amnesties regarding, the squatters have the right for infrastructure, and then subjected to rent. With the expanding boundaries of the city, these old squatter settlements remained in the city center, the land values have increased, and this process is followed by a “building up” rush. All these developments triggered illegal housing and thus created multi-storey squatter neighborhoods in all large cities, following Istanbul [12].

In the period between 1970 to 1980, the construction process of squatters has become completely commercialized and “land speculation” has begun. One of the most notable phenomena in this period is the emergence of squatter estate firms that find the land for the poor and built a squatter. In this period, due to the rapid inflation, land prices have risen considerably, and the importance and value of the squatter areas have increased after access of transportation to the slum around the city. The period marks the transformation of squatter houses, especially near the places where the high income groups settled, to multi-storey apartment houses by owners with sufficient economic power, whereas slum houses without sufficient financial capability are given to contractors in return for their land. The most important concern of the squatter owner is to convert the housing and land into money or apartments at the most convenient time in the accelerated inflation [7].

Figure 2 – 3. Squatter Layer of Fikirtepe [URL 1]

In this context, the squattering process in Fikirtepe has similarities to those in Istanbul. After 1950, the population was boosted as the migrants from the rural gradually settled in the region. In 1969, Fikirtepe met its “muhtar” and in 1971, it was divided into there regions as Fikirtepe, Devrim (Dumlupınar) and Educational Quarter [5]. The traces of the construction, which had taken place in the 1940s until the 1980s, can be seen from satellite images (Figure 3-4-5). For nearly 40 years, Fikirtepe has been living in the apartments transformed from squatter. After 2000s, in Fikirtepe, life and physical environment changed completely in order to urban rent increased because of the urban, economical and political dynamics changed.

Figure 4. Satellite images of Fikirtepe in 1944 [5]

Figure 5-6. Satellite images of Fikirtepe in 1971 and 1982 [5]

2.3 Urban Transformation Layer

The social and physical layers in the slum tissue of Fikirtepe had become the identity of the region, yet due to the risk of earthquake the transformation of the buildings, which are poor and unplanned, has come to the agenda. However, one of the reasons why this region is declared as an urban transformation area is not only because of the risk of earthquake, but also because of its relationship with the city center and transportation axes of the region, which makes Fikirtepe a valuable urban plot that capital groups are interested. Yalçıntan and Çavuşoğlu have pointed out that projects developed under the name of transformation and renovation among urban interventions have become much debatable in recent years because of the application methods that have pulled quarters away from their histories and inhabitants. In a similar fashion, it is inevitable that the urban transformation experienced in Fikirtepe will erase traces of the physical layers and displace the social layers, prior to itself.

Urban transformation in Fikirtepe was first introduced with the “1/5000-scale Kadıköy Center and E-5 (D-100) Motorway Mid-Point Master Development Plan" declared in 2005 and some parts of Fikirtepe, Dumlupınar, Eğitim and Merdivenköy regions are taken to legend as special project areas. In 2007, the phrase urban transformation was added to this

plan [5]. Since Kadıköy Municipality did not prepare a 1 / 1.000 plan until 2010, the authority to make 1 / 1.000 plan has passed to Istanbul Metropolitan Municipality (Yılmaz, 2016). In January 2011, Mayor Kadir Topbas declared Fikirtepe as special project area and a very high development right (4.14) which was not granted to almost any part of Istanbul was recognized to Fikirtepe. (Karul, 2016). With this new zoning status of Fikirtepe, a high-level and high-density urban layer will appear in the area. Due to the project which has undergone many legal changes in the process, it has been implemented only after 2014. At the end of almost 10 years, the first construction license was issued in February 2014 [13].

With the help of the satellite images of Fikirtepe, we can keep track of the changes of the urban tissue in the region during 2007 to 2017 (Fifure 7-8). In 2007, the region has a dense apartment tissue developed without planning. As the result of the new development plan, the old parcels will be rebuilt as an island/city block, so in 2012, we see that the demolition process in two islands in the region is completed (Figure 9-10). In the year 2014, we see that the demolition process is continuing but a new construction activity has not yet begun. With the issuing of construction licenses in 2014, we are able to read that the construction of high-rise buildings has begun and the demolition process is continuing rapidly in the islands that were not demolished yet (Figure 15-16). In the latest satellite image of the region we have (Figure 13), in 2017, it is possible to see that construction continues on the islands near D-100, but in other regions the process is slower and therefore life has moved to other areas as construction and demolition continues.

Figure 7. Satellite images of Fikirtepe apartment fabric in 2007

Figure 8. Satellite images of Fikirtepe apartment fabric in 2011

Figure 7. Satellite images of Fikirtepe / it is seen the demolition process in two islands in the region is completed in 2012

Figure 8. Satellite images of Fikirtepe / the demolition was continuing in 2014

Figure 9. Satellite images of Fikirtepe / the demolition was continuing in 2015 and the new construction started in 2015

Figure 10. Satellite images of Fikirtepe / the demolition and also construction was continuing in 2015

Figure 11. Satellite images of Fikirtepe / the demolition and also construction was continuing in 2017

In this context, the long-lasting urban transformation process of Fikirtepe is studied in three layers: the ghost layer emerging with the beginning of demolitions, the layer that formed by outcrops resulting from destructions, and high-rise layer that will be present after the transformations.

2.3.1 Ghost Layer

During the implementation phase of Fikirtepe urban transformation project, enormous problems have emerged. Within the scope of the project, it is planned to build larger city blocks based projects by combining existing small plots. According to Ayik (2014), this method of implementation has caused some problems. The first of all is the kind of people whose aim is to buy signatures from existing owners and sell them to large construction companies, “baggers,” as defined by the locals of Fikirtepe. Moreover, the fact that the community does not know the companies and that the state did not engage in a function of leading community in the project can be considered among the fundamental problems of the community since the beginning of the project [5]. In addition, this situation has led the people to seek for the rent of their own place. The inhabitants of Fikirtepe sought to give

their urban living spaces to construction companies from the possible highest rate and this situation pushed the expectations and demands within the community for the project back into the background. Because of the demolitions made on island basis, the right owners who did not want to give their homes were forced to give their homes by not being able to resist the destruction that took place around them (Figure 12).

Figure 12. The process of demolition of the last remaining gecekondu in Fikiretepe [URL 2]

While the companies which have started to collect land deeds, began to demolish areas, yet uncertainties and changes in the implementation of the plan has continued. From 2005 onwards demolitions have begun, however only after 2014 new constructions could begin. During this process, the area was completely empty because of the houses that were evacuated or collapsed, but the demolition was not completed. For this reason, the region is still a ghost zone in which construction and demolition activities continues. On the other hand, refugees and drug addicts have settled on the evacuated streets and homes, and the region has become completely insecure. The population living in the region was mostly moved to Fındıklı and Ünalan, and partly moved to Zümrütevler, Kayışdağı and Bulgurlu neighborhoods to form a horizontal social layer [5].

Figure 12. Ghost layer of Fikirtepe [5].

2.3.2 Horizontal Layer – Wreckages

A study by Atay and Ceritoğlu (2016) on wreckers revealed another face of the demolition process during urban transformation. They have examined the wreck-yards of wreckers

within the scope of the construction culture brought by the totalitarian urbanism that has functioned through the mechanisms of "demolishing, reconstructing and displacing" with the construction culture of squatters. As an actor derived from the impossibilities of the construction of the slums, wreckers are described as individuals or places where building elements such as windows, doors and vitrifications have accumulated and re-circulated. [14]

The windows or doors in the wreck yards are kept waiting for re-use as they are, and the buyer purchases from windows of different sizes by choosing the most appropriate window size for their own home (Figure 13-14). Even if the old window frames can be processed in the workshop and brought to standard dimensions, it can be said that the window openings of the house to be built are shaped according to the window frames at hand. Wreckers, which can be perceived as an extension of the squatter layer, is now a major resource for the second-hand building material market with the demolition in the context of urban transformation [14]. The building materials purchased from the wreckers are used in the second-hand housing markets in cities such as Düzce, Izmit, Balikesir, Giresun, Ordu, Trabzon, in summer houses and village houses (Figure 15).

Figure 13. Dismantling of the doors for reuse before destruction in Fikirtepe [14].

Figure 14. The doors in the wreck yards are kept waiting for re-use [14]

Figure 15. The wrecks relocate to other cities [URL 3]

In short, before the demolition of the building stock, which will be demolished with urban transformation, the usable building elements are spread as a horizontal layer extending to other cities. In addition, dust cloud formed during the demolition process continues to exist in the region as a layer of air pollution, while rubble formed by demolition processes will be taken to the sea as a filling material and will appear as a filling layer that will change the coastal border.

The result of urban transformation is not only the physical or social change experienced in the vertical, but also in many aspects the impact areas are emerging in the horizontal layer. These newly formed layers also trigger other layers.

2.3.3 High-Rise Housing Layer

Once the urban transformation is complete, the area will turn into a multi-storey, high-density settlement (Figure 16). The Urban Transformation Project has granted the region an island/city block consolidation and floor area ratio increase. Consequently, Fikirtepe is now one of the areas where urban rent is enormous. Because of its relationship with the city center, it has become the focus of attention for capital-holders. For this reason, it is envisaged that there will be no urban transformation in the region except gentrification; the old inhabitants will be displaced and new low-income neighborhoods will be formed, and the Fikirtepe region will be transformed into a region where the upper income groups

settled. Besides, mixed-use high-rise residential projects including business complexes, offices, shopping areas and housings are designed for the region to replace squatter apartments.

Figure 16. High-Rise Housing Layer of Fikirtepe [URL 4]

3. Conclusion

Fikirtepe district, part of a city formed by stratifications, is one of the most important regions where the Neolithic, squatter and urban transformation layers of Istanbul are dated. Fikirtepe, which has provided the enlightenment of the Neolithic period of Istanbul with several areas such as Pendik, Yarimburgaz and Yenikapi, contains a layer that has entered into the literature as Fikirtepe Culture by giving its own name to the Neolithic period settlements in the Marmara region. However, there is a danger that traces of the Neolithic layer of Fikirtepe will be completely erased, as Fikirtepe is declared as an urban transformation area after being a dense squatter tissue without planning, yet it will be transformed still in an unplanned manner without a master development plan. The boundaries of Fikirtepe Mound archeological site should be defined, and mound should be unearthed.

On the other hand, the squatter layer of Fikirtepe, the first squatter region of Kadikoy district on the Anatolian side of Istanbul, is one of the most important areas to understand the phenomenon of squatter in the urban history of Istanbul and Turkey. First the squatters began to be established in a fractured way, then the squatter population created a large influence on Turkish politics and therefore has become a tissue of apartment buildings with many amnesties proclaimed, then the squatter establishes its own social structure which becomes a non-negligable factor within the city culture. Considering all these fundamental issues that can be related to the fields of different disciplines, it is important to document and maintain the squatter layer of Fikirtepe.

With the announcement of Fikirtepe as an urban-transformation area as the construction sector of the locomotive of the economy in Turkey during the same period, it is possible to

see how the Fikirtepe construction was realized for rent. A planned transformation could not be started in the area following constant changes. As a result, the region has become a ghost zone and the crime rate has been increased. With the transformation, the user of the region had to change places for no return. When the transformation is completed, higher income group will migrate to this region and create a new layer of life.

In Fikirtepe these three physical layers are actually shaped by different migrations. Neolithic settlement was formed by the migration of the hunter-gatherer communities to this area as the agricultural communities. The squatter layer was formed with the migration from rural to urban with the introduction of industrialization and with the settlement of the population coming from the rural by their own means. Finally, with urban transformation, the squatter population ,composed of lower and middle income groups, migrated to other neighborhoods for transformation, yet when the transformation is completed, there will be an immigration movement consisting of the upper income group, which will result in gentrification. In short, these three layers of Fikirtepe appear as fundamental in order to be able to read the layered structure of Istanbul and to expand literature.

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CONTEMPORARY PROPOSAL FOR AN ENERGY EFFICIENT HOUSE BASED ON TRADITIONAL DESIGN PRINCIPLES

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Abstract

Sustainability design principles that aim at improving the quality of future developments have to consider the past architectural models, the so-called *"archetypical forms"*. The design characteristics of traditional houses have improved through a continuous trial and error process, resorting to passive and environmentally friendly measures and thus, leading to a cultural identity. The respect for the heritage is of great importance for a sustainable development.

This paper presents the design principles for a contemporary dwelling, inspired by the rural household specific to North Moldavia's archetypical architecture. Several principles are reinterpreted from shape and house configuration to building materials and techniques.

A multi-criteria energy evaluation was performed in order to optimize the technical solution. The energy assessment highlights the specific annual energy consumption, CO2 emissions, heating demand, air conditioning and electricity costs, and daily temperature profiles.

Keywords

Traditional house, energy efficiency, sustainability

1 Introduction

A comprehensive approach to sustainable design must take into account aspects related to material use and thermal efficiency as well as cultural identity. The return to traditional design principles and implementation of innovative technologies have emerged in response to problems that society faces today, suggesting paths for sustainable development. Although buildings are significant resource consumers, during both construction and exploitation phases, focusing on energy alone does not ensure that a construction will be sustainable [1].

The issue of sustainable development should be addressed in a regional context, with respect to specific socio-cultural premises. Considering all these aspects, the analyzed project takes into account archetypal dwelling and constructive principles as well as

materials used in Romanian traditional architecture. Although used from ancient times, renewable building materials, such as wood, wood fiber, clay or stone, are perceived by professionals and beneficiaries in Romania as having limited applications. In the latest 20 years new structural typologies have been developed, enabling the use of these materials in terms of increased comfort. The project proposes hybrid solutions to exploit the organic qualities of traditional materials by implementing advanced technologies in achieving an efficient house.

2 Learning from tradition in the context of sustainability

Sustainable development, while following to improve the quality of life for future generations, must include the past heritage by learning from building solutions that endured the test of time. Regional architectural elements have been designed not only for aesthetic purposes, but also for increased comfort in relation to specific microclimatic conditions. Passive design principles, as well as means of ensuring the durability can be delineated from vernacular architecture. Centuries of evolution in unaltered climate conditions and use of available local materials have led to selection of the best constructive solutions.

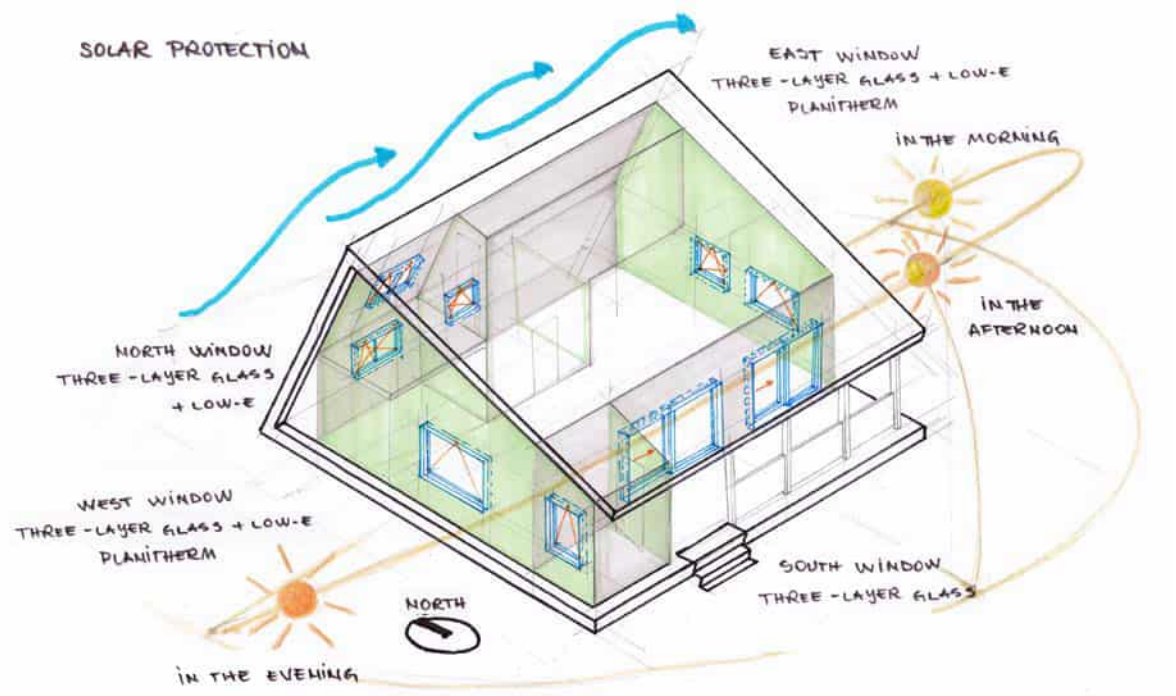
From a global perspective, in which the sustainability rhetoric includes the respect for the "needs of the present, without compromising the ability of future generations to meet their own needs" [2], the legacy of the past has to be outlined in the design process. Also, the social and cultural realities are best emphasized by analyzing the past. This assumption is well suited for the field of constructions, where, due to building's long lifecycle and other variables (amount of details, requirements, specific climatic and cultural conditions, etc.), the changes and innovations evolve slower and require validation over time.

Several scholars have argued that cultural and identity preservation must be added to the definition of sustainability. Thus, Kholer, in 1999, establishes that a sustainable building has three components: ecologic, cultural and economic. Young [1997], Elkington [1997] and Kohler [1999] also emphasize the importance of cultural considerations [3]. When referring to the housing issue, Amato[2006] argues that the concept of sustainability "embraces the intertwined environmental, social, cultural and economic aspects" [4]. Benzerzour and Boutte [2010] argue that the only constants in the sustainability endogenous process, which starts again every time are the region, the location and its inhabitants [5]. Al Jamea [2014], observed that cultural identity is absent from the contemporary Saudi house developments and proposes the inclusion of traditional space arrangements and functions, as a sustainable principle [6].

In Romania, during the modern period (historically placed between the two world wars) has emerged an architectural movement with a real concern for integration of archetypical design elements and functions in house projects, leading to the *Neo-Romanian* style. In the communist era, the massive urbanization of the country generated a migration from villages to towns, with an increase in cheap houses demand. The apartment buildings were developed with functional international space requirements, generating a lot of social and cultural malfunctions and, in the end, a feeling of uprooting and rejection. Having experienced the failure of imported models for living, we must recognize the quality of vernacular design and its function within the local society, thus including cultural conditions as a sustainable premise.

2.1. Prispa House, a Romanian model of vernacular sustainable design

A good practice example among young Romanian professionals is the energy efficient "**Prispa**" house. The single family dwelling was developed for the Solar Decathlon Competition in 2012 with the purpose of integrating traditional design elements and providing an affordable ecologic solution easy to be implemented in rural areas. The sustainable solution lies in both underlining the essence of Romanian tradition and integration of passive design elements with modern technologies, figure 1. The concept house is capable of producing 9501 kWh/year from own resources, representing a good example for vernacular passive principles that can be incorporated successfully in a "*Near Zero Energy Building"* design [7].



Source: http://http://prispa.org/sde2012/house/

Figure 1. Passive elements of design adopted in "**Prispa**" project

3 Integration of archetypical principles in a contemporary house design

The project evolved as a reinterpretation, in a contemporary manner, of the *barn/shed* from the Romanian vernacular household. This compact and efficient building is rediscovered and reevaluated through geometric operations of decomposition and re-composition meant to ensure the expressivity of a contemporary dwelling, while maintaining the essence of the humble rural annex. Apart from the main concept, various other architectural characteristics specific to Northern Moldavia houses are integrated.

The volume was adapted from the traditional barn and the house's shape along with the large console on the southern side allow for shading during summer, without compromising passive solar intake in winter time, figure 2.

Figure 2. Rendered perspectives of the proposed house model

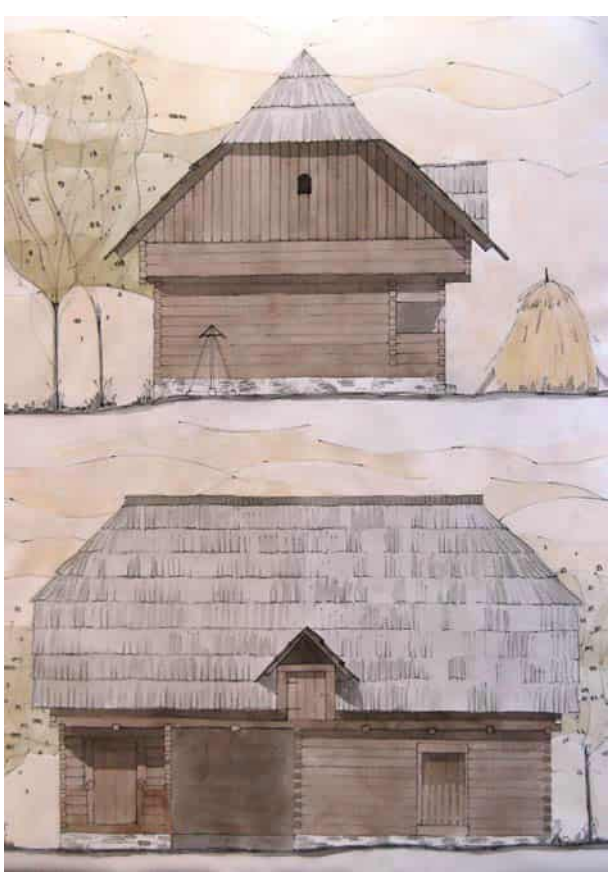
The veranda, a characteristic intermediary space of traditional Romanian houses is reinterpreted and integrated into contemporary architecture. The goal is to obtain a continuous space transition between the interior and exterior. The attic space is in a direct visual relation with the ground floor through the staircase opening. Also, the staircase is in the proximity of the fireplace – a central element in the overall house composition. These elements are highlighted by the generous light filtered through the greenhouse, conveniently south oriented. The association of glazed space - chimney - staircase fulfills not only an aesthetic purpose, but also serves for improving the energy efficiency, because the fireplace and the floor finishes can be made of high density materials, thus ensuring thermal inertia.

3.1 House orientation

Archetypical Romanian houses are always oriented towards South, ensuring thus a maximisation of solar gains and, most importantly, protection from the dominant Northern winds during harsh winters, aspect achieved by outward roof extension, even if this means turning the house backwards in relation to the street, figure 3. Similar, in the proposed house design, the passive concepts follow the north-south duality. The project proposes a generous glazing and orientation of the main spaces towards the South direction, in contrast with a more opaque facade and orientation of the secondary spaces in the North direction.

Figure 3. Orientation of traditional houses in Northern Romania

3.2 Shape and proportions



Surveying done in second year practice at Faculty of Architecture G.M. Cantacuzino, Iasi

Original figure

Figure 4. Traditional barn and proposed design scale and proportions

A characteristic for traditional houses in Northern Moldavia is the classical proportion with a ratio between height and length of 2/3, 3/4 and sometimes 1/1, depending on altitude, figure 4. As a response to regional climate parameters (strong winds and abundant rains), the shape of the roof is sloped, with longer slopes oriented in the direction of prevailing winds in the area. The height of the roof depends on the region, with a moderate gradient for the plains' houses, approximately 2/3 of the height of the walls, and more abrupt slopes, surpassing 1/1 ratio, in mountainous parts.

Early in the design process it is important to establish a correct balance between architectural aesthetics and compactness index, the latter influencing the energy efficiency output. The compactness index is defined as the ratio between the external surface and the indoor volume (S/V). Traditional houses have a good compactness index, as a result of energy and material optimisation.

Taking into account all the above mentioned aspects, the main goal of the proposed model is to deliver a compact solution that follows traditional house proportions. The final result would be a contemporary reinterpretation of the traditional house, a model that can be inscribed in a parallelepiped, with the base of 10x10 meters and a height of 7.5 meters, achieving, thus, the ratio specific to vernacular houses.

3.3 Intermediary space

Figure 5. Large intermediary space (veranda) of a traditional house

The transition areas in traditional Romanian houses - the verandas – are designed with a dual purpose, providing both shading in the summer and sheltering from winds during the cold season.

For the proposed house model, the traditional veranda concept was reinterpreted in contemporary manner, but maintaining the same function. The objective was to create a large shaded terrace oriented towards South and, also, a smaller intermediary space that marks the entrance, situated on the Northern facade. The protected transition areas maintain the traditional passive function, protecting the interior from overheating during summer and allowing direct solar gain during winter.

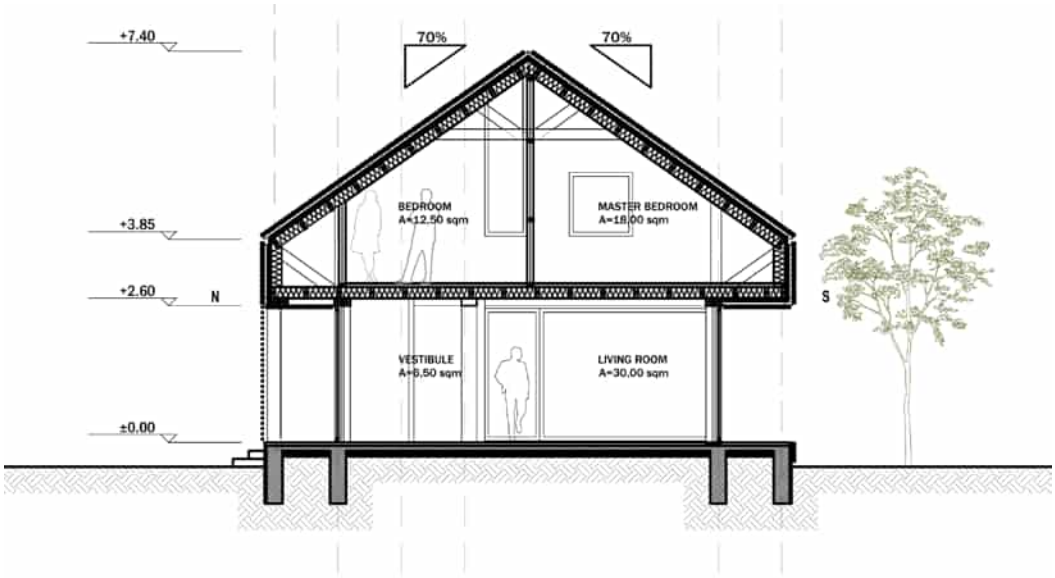
3.4 Materials

The use of locally-sourced materials was proven to reduce energy impact in implementation phase by more than 200% and reduce impact from transportation by up to 600%, compared to a typical house supported by a concrete structure [8]. In a comparative energy efficiency assessment between traditional Cyprus houses, dwellings with adopted western design and well-insulated modern houses, Florides et al. [2001], the results have shown that the archetypical model was the most efficient in terms of heating and cooling demands [9].

For the proposed house project, the focus was on the use of local materials (wood for the structure and exterior finishes, clay and stone for thermal mass elements, wool and wood fiber for insulation). These materials also create a healthy environment, providing both good insulation and vapour transfer. The wooden structure combines platform framing with trussed beams, a modern solution based on archetypical building techniques that optimise the use of resources. Traditional materials have indisputable ecological qualities, low embodied energy, while wood and wood fibers are the only renewable resources for building structures.

3.5 Functionality

The proposed model was designed to respect the vernacular way of living and all the rooms are in a direct spatial and visual relation with the main living area (aspect inspired from the traditional indoor space that used to be organized around the hearth). From a functional point of view, the ground floor and attic space ensure the comfort for a small family of two members, allowing for an additional bedroom for 1 or 2 children. In order for the house to adapt itself to contemporary lifetime scenarios, some functions had to be reconfigured. Therefore, the kitchen (traditionally situated in a separate annex - summer kitchen) had to be integrated in the house. Also, the attic (usually a storage space in the traditional configuration) was adapted for the sleeping area, figure 6.



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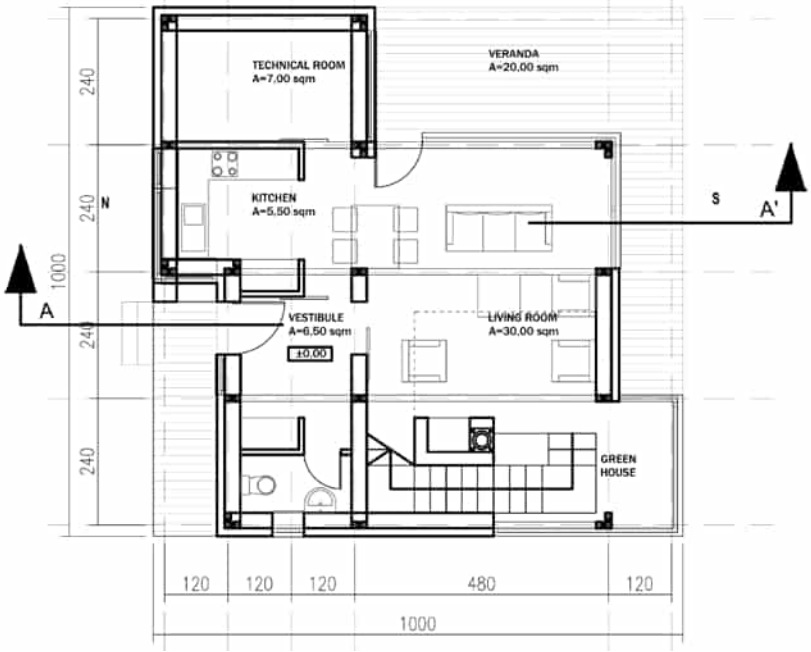

Figure 6. Ground floor plan and section

4 Thermo-energetic analysis and optimisation

A thermo-energetic analysis for the proposed design was simulated with the ArchiCAD Eco Design Software, figure 7. The evaluation was performed on the basis of an accurate 3D house model, the values for the thermal resistance for each element (wall, roof, slab, etc.) being calculated according to the Romanian methodology and standards. The location coordinates have been set for the town of Iasi and specific site elements (vegetation, surroundings, etc.) have been hypothetically considered at an average level.

Energy Consumption by Targets

Target Name / Energy	Quantity kWh/a	Primary kWh/a	Cost RON/a	CO_2 Emission kg/a
Heating	2593	3109	643	64
Cooling	2377	5533	252	170
Service Hot-Water	6483	7134	509	76
Ventilation Fans	0	0	0	0
Lighting & Appliances	2077	6231	664	448
Total:	**13531**	**22009**	**2070**	**760**

Figure 7. Energy and environmental performance

The carbon footprint can be better assessed through the CO_2 emission rate (6.21kg/m^2a), as illustrated in the figure 7. The energy demand has been calculated taking into account the air quality and indoor temperature during the cold and warm seasons. The goal was to optimize the energy consumption in order to minimize indoor temperature fluctuations that were kept in the range of 20^{o}C and 26^{o}C all year long.

5 Conclusions

The annual heat energy demand is 21.19 kWh/m²a, a small value that can be attributed to implementation of passive design strategies.

The main idea of the house presented in this paper follows the reinterpretation of the traditional barn with contemporary space configurations, the result being a highly energy efficient compact volume.

The archetypical principles that were applied to the contemporary design can be summarized as such: exploitation of the South direction in the spatial configuration and protection of the Northern façade from the prevailing winds (optimum glazed-opaque ratio); maintaining a classical ratio between house height and length of 3/4; integration of the south oriented veranda that fulfils a double purpose – shading during summer and allows solar gain during winter; use of ecologic local materials.

The contemporary approach included functional reconfiguration and integration of a greenhouse area oriented towards the Southern direction. The overall objective of this house project was to address the sustainability issue in a regional context, emphasizing the socio-cultural elements of the traditional Northern Moldavian houses. The final result of the case study provided a contemporary house model that integrates archetypal characteristics and constructive principles as well as local materials used in Romanian traditional architecture.

Acknowledgements

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ARCHITECTURE OF EMPTINESS IN *FAVELAS* : GREEN WALLS AND INDIGENOUS GRAPHISM AT MACQUINHO | MORRO DO PALÁCIO, BRAZIL

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Figure 1. Green Wall Prototype. Bioclimatic Indigenous Architecture.

Project André longo & João Vicente Guimarães. School of Architecture and Urbanism/UFF, 2016.

Transcultural Logic and Common Goods in Architecture and Urbanism

In collaboration with the Center for Human and Social Sciences-CSIC and the Pro-Common Laboratory, MediaLab-Prado, Madrid, the project analyzes the Brazilian participative urban space created in 2013, defined by the political and cultural performance of a new middle class articulated by networks, aiming to contribute to the joint knowledge of academics, artists,

hackers and activists in the sense of establishing a language capable of expressing the multifaceted world of common goods.

The *Commons Lab* aims to structure a discourse and a series of actions and activities related to this concept. *Procomún* (Commons) is a new term that seeks to express a very old idea: that some assets belong to everyone and together they form a community of resources that should be actively protected and managed. That community consists of things we inherit or create jointly and hope to leave to future generations.

The *Commons Lab* brings together people from various fields including philosophy, ecology, hacktivism, law, architecture, design, urban planning, art, journalism and economic policy. The first stage was carried out between June 2007 and February 2008, with conclusions written up by Professor Antonio Lafuente in *Laboratorio sin muros* (Laboratory Without Walls). Afterward, several work groups were formed that meet periodically and work online to debate and plan actions that help to raise awareness about the value of various aspects of 'the commons' and dangers that threaten them.

In the transcultural logic - defined by the transformations that occur in the friction of distinct cultures -, academic knowledge in architecture and urbanism turns to a discussion in the field of anthropology and digital technologies, aiming at finding viable solutions to the current impasse of Brazilian megacities relating the occupation of the public space, housing and mobility that define the quality of urban life.

The project explores the logics of urban design responsible for spaces of socioeconomic exclusion and disciplinary schemes of public-private control. It contrasts Brasília's occupation with daily violence in Rio de Janeiro, comparing the modern design of the capital with spaces of power, and updating of a supposed citizenship by focusing on the architecture of *favelas* such as Morro do Palácio, in Niterói, Rio de Janeiro.

The self-reflexive aesthetics that structure the hyperindividualist consumption encouraged by the digital universe symbolizes a relevant vector for the identity affirmation of individuals, leading them, in real time, to the political participation of spectacular character reified by the mass media. The transcultural field study intends to exchange the academic university language with the popular language of *favela* builders and the inhabitants of Morro do Palácio discussed in the seminar "Bioclimatic Indigenous Architecture" ministered at MACquinho by the faculty of the University Federal Fluminense/UFF. The Pilot Project of Green Walls and Indigenous Graphism focuses on issues of transcultural communication through technical innovation, aesthetics and ecological sustainability at MACquinho, Secretary of Technology, City Hall of Niterói, Rio de Janeiro, Brazil.

Figure 2. Fulni-ô Indians´ Performance. Photo Jefferson, MACquinho 2017.

Emphasizing a reflexive exercise in critical self-assessment based on the analysis of typical constructions of Brazilian indigenous cultures (‘ocas’ or longhouses), and in pursuit of the promotion of a culture of peace and nonviolence, of global citizenship and the appreciation of cultural diversity, the Green Wall and Indigenous Graphism´s project was carried out on April 29, 2017 by students of Architecture and Urbanism, Agroecology and Environmental Engineering in University Federal Fluminense/UFF, amid the tension generated by the death of a representative of drug trafficking by the police.

The manifestation of urban violence has raised tensions that have apparently already been resolved in the relationship of residents with the barracks of young traffickers occupying the community. This project featured dance and handicraft by Fulni-ô Indians, aiming to ensure that residents of that community and university students could acquire the knowledge and skills necessary to promote a sustainable lifestyle by emphasizing artistic activities and performances of arts and crafts, music, and dance.

Symbolic Capacity of Culture and Urban Design at *Favelas*

The symbolic capacity (Sahlins 2006) is the essence of culture, without which human bodily inclinations would lack a pattern. According to this anthropologist, having confined the body

to the symbolic organization of existence, the human being does not survive without culture. In this light, culture is fundamentally, ***source of power*.**

The Brazilian Creative Economy of Culture has the function of overcoming:

1) Inequalities between regions: Those that concentrate more companies attract the bulk of the sponsorships;

2) Inequalities between producers: Agents that are more organized have greater access to companies and attract more resources;

3) Inequalities among sponsors: Those with higher revenues can support more projects;

4) Inequalities between types of projects: Projects that have greater marketing impact get more sponsors;

5) Inequalities between artists: Companies prefer to associate their brand with already established names.

Figure 3. Workshop of Indigenous Graphism at Wilma´s Bar. Photo Dinah Guimaraens 2017.

The ongoing Urban Design Project at Morro do Palácio focuses on visual arts and crafts (64.3% of Brazilian cultural production), dance (56%), and music (53%). The creative economy of culture expresses the insertion of slum dwellers in the Brazilian music and imagery industry. Cultural products advertised and sold abroad amount more than 80%. The project derives

from a participatory attitude that allows the residents of Morro do Palácio to become members as community agents, artists, curators and teachers.

The objectives of the project are:

1) Disseminating the cultures of *favela* populations of Rio de Janeiro|Niterói through exhibitions, performances and workshops.
2) Establishing a database of traditional *favela* cultures in relation to their visual arts and crafts, music and dance, medicine, gastronomy, tourism and ecology.
3) Allowing community agents, the access to digital technology, with the creation of new digital artistic products.
4) Stimulating the self-determination of *favela* inhabitants at the local, national and international level by creating a collaboration network among communities.

Figure 4. Indigenous Graphism Design by Carol Potiguara. Photo Dinah Guimaraens 2017.

State of the Art

The digital environment acquires the same anthropological, economic and political relevance that historians and philosophers point out in relation to the natural and urban environment. The adaptation to the city constitutes the construction of a second nature that differs from diverse forms of social life, from most primitive and reduced (clans and communes) to most abstract and gigantic (megalopolis or nations).

The nature we speak is symbolic and connects with all streams of people, words and goods that draw upon the networks that sustain life in common, including the streets of our cities, but also the festivals, laws and knowledge that have been produced by mankind over time and that can not be privatized. Living in society gave rise to an endless number of forms of organization that can be revealed through a framework that shows the hierarchies, dependencies and functions of each of the parties that conform them (Lafuente 2012).

When we discover our organization chart, we can perceive the machinic structure of human life, that is, the automatisms with which we count on for things to work. But there is something that can not be grasped in a flow diagram but has to do with the interactions between people, at the margin of which interaction takes place between human and non-human actors. This informal part of the relationships, proliferative and of low intensity and density (Delgado 2007), which is essential for things to work, should be considered and considered as a common good built among all. Consequently, it does not belong to the chiefs, nor to any committee of representatives.

In the digital society of late capitalism, all social life, anthropologized, becomes culture and the densification of theatrical and ritual dimensions of politics make it a fundamental scene of public life (Martín Barbero 2008, pp. 14). International neoconservatism, which prevails in contemporary late capitalist society, leads to a shift of state parliamentary competencies to neo-corporeal gray areas of private enterprise, leading to a decrease in the legitimacy of political system and, consequently, bringing about ungovernability, and an inflation of claims arising from the decoupling between administration and public formation of the will (Habermas 2015, pp. 227).

Such a densification of the theatrical and ritual dimensions of politics in the digital universe stems from the transesthetic era of hyper-modern aesthetization of consumer markets that extrapolates the spheres of production, having reached ways of life, relationships with the body, and taste for fashion, shows, music, tourism, cultural heritage, home decoration, and architecture and urbanism at all levels of society.

The hyperindividualist regime of consumption disseminated by digital media is hedonistic and emotional, or aesthetic, leading to the pleasure of discovery, evasion and non-compliance with conventional codes of social representation (Lipovetsky & Serroy 2015, pp. 27-31). The self-reflexive aesthetics that structures this hyperindividual consumption encouraged by the digital universe symbolizes a vector relevant to the identity affirmation of individuals, leading them, in real time, to spectacular political participation that is reified by mass media.

The design logic of modern architecture and urbanism in Brasilia will be compared as a living picture to that model of self-construction architecture and urbanism of *favelas* in the urban centers of Rio de Janeiro and Niterói, from the concept-form of Tschumi (2010).

The deconstructivist *motto* that allows us to *read architecture as text* represents the core of the postmodern thought of digital revolution and the possibility open by the computer to convert any information (text, sound, image, video) into a single universal language (Santaella 2003, pp.59).

The results of this transcultural research aim to contribute to a deepened academic perception, with practical results to be achieved in terms of sustainable urbanism, on new contemporary public space of the Brazilian megacities, now extremely politicized. The inseparable accelerated growth of communication technologies and media culture responsible for transnationalization of cultures, for displacements and contradictions, and for moving urban designs of a multi-temporal and spatial heterogeneity therefore characterize urban scenarios from the mid-1990s to the present.

Figure 5. Urban Garden at 'Beco da Paz', Morro do Palácio. Photo Dinah Guimaraens 2017.

Framework

Urban Networks at Digital Plataform of MACquinho

The methodology of the project was carried out with the Urban Digital Platform of MACquinho, and it is based on a critical urban reading that elects the city as a laboratory and field of digital experimentation, through the analysis of localized experiences that carry the intention of changing public spaces from new architectural interventions. Focusing on the occupation of Brazilian megacities by groups of demonstrators organized through networks, the research emphasizes action on the microscale based on social practices and collective appropriations, drawing attention to the importance of bottom-up initiatives in urban landscape setting.

The tactic of the project focuses on the survey of a CONCRETE SPACE / CONTEXT defined by hollow occupations | emptiness as spaces that form an urban waste beneath viaducts, alleys, elevated streets, pillars, sheds, and iron fences. The focus of the research will cast its gaze along the networks that represent instigating examples of how population spontaneously transforms, sometimes transgressively, technical artifacts into active places for political-

cultural participation, and for playful-creative manifestations in urban everyday life with the creation of public gardens in the cities of Rio de Janeiro and Niterói.

The project prioritizes the public domain in specific scopes of urbanism as being composed by places where the exchange between different social groups becomes possible and where everyday life happens. It also emphasizes roughness as what is left of the past as concrete urban forms, built spaces and landscapes, and what remains of the process of suppression, accumulation, and superposition of things accumulated everywhere.

Figure 6. Architect Sophia Eder setting up a Green Wall. Photo Dinah Guimaraens 2017.

It highlights the methodological tools of participant observation both online and in person, held at MACquinho | Morro do Palácio in 2016-2017. To glimpse the new Brazilian urban participatory space, defined by the political-cultural performance of a new middle class articulated by urban vegetable roofs and green walls, the project adopts the methodological proposal of walking around (Careri 2013, pp. 7), or walking as a way of creating landscapes, urban interventions, or as an aesthetic practice. It will establish urban walking itineraries centered in places of sustainable occupation, trying to define which are the public spaces chosen to be traveled, occupied, interfered, reproduced in televised images, and disseminated through the internet.

The purpose of the project relates opening the debates with *favela* inhabitants around the validity of design and construction of prototypes of Green Walls and Indigenous Graphism at MACquinho by faculty members of the University Federal Fluminense/UFF, counting on the participation of more than 400 builders of Morro do Palácio in Niterói, Rio de Janeiro, Brazil.

Figure 7. Indigenous Graphism at MACquinho´s Music Studio. Photo Dinah Guimaraens 2017.

Conclusion

Green Walls (Urban Gardens) and Indigenous Graphism in Empty Spaces of Morro do Palácio

The project emphasizes the following theorical issues:

1) Cities as Adaptation between Private Rights and Public Responsibilities: Land Tenure in the *Favela*, Informal Housing and the Process of Gentrification.

2) Three-dimensional Mass of Buildings in the *Favela*: Hard Spaces versus Empty Spaces.

3) Scale of Buildings in the *Favela*, and in its Surroundings: Public Spaces versus Private Spaces of the Museum of Contemporary Arts- MAC, MACquinho and Morro do Palácio.

4) Environmental Sustainability: *Favela*, Lack of Urban Infrastructure and Urbanism.

Definying Innovative Urban Design Language in the *Favela*

In order of achieve originality of designing Green Walls and Indigenous Graphism in Morro do Palácio, the project prioritizes the quality and relevance of the knowledge it brings to *favela* inhabitants by generating social-economic value to its result products.

New Codifications of Democratic Public Spaces in the *Favela*

Revitalization of 'Beco da Paz' (Peace Alley), regaining its place as an active space for exchanges and meetings. There occured a transcultural dialogue with collective discussions that preceeded the project and had determined the main activities suggested by the inhabitants of Morro do Palácio, Niterói.

Concrete Space | Context:

Creation of a VOCABULARY OF EQUIPMENT IN THE EMPTINESS, with the capacity of absorbing diversity. Previously considered as the background, the new space became front in relation to the environment, created with the provision of a Green Wall and Indigenous Graphism at Wilma´s Bar.

The transcultural dialogue established between university professors and *favela* residents allowed houses to open balconies to the square, as the sidewalk turned a collective bed. The emptiness was delimited by self-constructions where previously existed a lack of meeting and leisure areas in Morro do Palácio, Niterói.

Trading | Opening

Adding natural equipment (Green Walls, Community Gardens and Prototypes of Bioclimatic Architecture) capable of activating the emptiness, based on uses suggested by residents of the nearby environment.

The methodology of Urban Design in the *Favela* ultimately includes the creation of a VOCABULARY OF EQUIPMENT IN THE EMPTINESS with the capacity of absorbing diversity by establishing experimental production of prototypes designed by architects, in collaboration with joint partners and builders of Morro do Palácio.

Figure 8. Green Wall and Indigenous Graphism filling in the emptiness. Photo Dinah Guimaraens 2017.

Txhyfeldja Fulni-ô, Jefferson, Sophia and students building the Green Wall. Photo Dinah Guimaraens 2017.

Relating the value of intangible heritage with innovative public university activities and counting on the participation of the Secretary of Technology, Niterói City Hall as well, the project has the actual objective of ensuring an inclusive education by promoting technical learning for construction opportunities to Morro do Palácio inhabitants. This ongoing joint transcultural proposal proposed by MACquinho, and the School of Architecture and Urbanism at University Federal Fluminense/UFF, focuses on academic interventions as relevant assets to explain and predict the behavior of territories and organizations located at Morro do Palácio by privileging the implementation of Green Walls (Urban Gardens) and Indigenous Graphism, allied to the production of bioclimatic architectural prototypes (bamboo, wood, clay, vegetable fibers etc). The working methodology of the group involved in the project revolves around a practical-theoretical seminar ministered at MACquinho Auditorium, as an academic activity of PROEX (Pro-Rectory of Extension) at University Federal Fluminense/UFF.

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LIVING MUSEUM : CULTURAL LANDSCAPE, INTANGIBLE HERITAGE AND REGIONAL BIOCLIMATIC ARCHITECTURE

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Introduction

Encouraging Nature and Design Along: Theoretical Concepts for Creating Living Museums

This paper is going to discuss the development of The Living Museum Project in Brazil and the role that such a project potentially plays in both the expression of Indigenous Knowledge and in community development. The project discussed in this paper, seeks to create a space for community memory as a tool for social empowerment. The development of this project has involved audio/visual and digital documentation, survey of local knowledge and research into existent paradigms for living museums.

The Living Museum Project is based upon theoretical visual anthropology, aiming to carry out cultural evaluation through the process of digital documentation. The use of visual documentation a vital support for cultural revitalization and helps to identify cultural traditions at risk of being lost in the near future. The project emphasizes, for example, the use of *embira* liana in Xingu longhouses ('ocas'), where natural resources become increasingly scarce due to the cultural local practices of not replanting the plant species used by craftsmen. Therefore, the project aims to identify and document those construction techniques which are in danger of extinction, as well as other cultural events to be preserved or revitalized through photographs, videos or digital DVDs.

To prioritize constructive cultural traditions to be revitalized, the project identified (and continues to identify) older members of the community, particularly those with Indigenous Knowledge and expertise, who may become future instructors of traditional arts practice. Elders in are of critical importance in the identification of plants and other local natural

resources, related to intangible heritage and to Indigenous Ways of Knowing.
The survey process of Indigenous knowledge also allows for a better understanding of shared knowledge; that is, the musical traditions, foods, dance and craft techniques that are held in common, between differing local Indigenous Communities. Together with existing informational resources including universities, archives, museums and cultural centers, this project supports a more holistic understanding of Indigenous Culture.
The research portion of The Living Museum Project, is concerned with the attrition of traditional cultural practices, the length of time this has been happening and the socio cultural significance of the loss of traditional practices, while simultaneously trying to see to it that Indigenous Knowledge and traditions are not ultimately lost. Again, to accomplish this, it is necessary to identify who still has understanding of and expertise in the traditions, language and practices of local Indigenous communities, in order to create creative opportunities for Indigenous heritage to be transmitted to succeeding generations.

Figure 1. Ritual of the sacred flute. Upper Xingu tradition as intangible cultural heritage. Photo Dinah Guimaraens 2014.

Museum of Origins: How to Be Contemporary Being "Primitive"

The desire to create a Living Museum—the concept of a living enactment of social memory and expression of Brazilian cultural heritage—is not entirely new. In 'Discurso aos Tupiniquins ou Nambás' (Address to Tupiniquins or Nambas 1975), the Brazilian

art critic Mário Pedrosa writes:

'In countries like ours, [resilient] although oppressed and [often critized as] underdeveloped at the level of contemporary history [we still strive] . . . when you say that art is primitive or popular is the same as saying that it is futuristic'.

Pedrosa's words suggest that there are differing perceptions of what art is deemed valuable and who decides what kind of artistic expression is valuable and what is not. Three years after Pedrosa's words, fire destroyed the Museum of Modern Art / MAM Rio (on July 08, 1978). This terrible event represented a privileged moment for rethinking the aesthetic and historical roles of the museological institution in Brazil.

Mário released, under the burnt pilotis of MAM-Rio, the Museum of Origins´ Manifesto, suggesting that the museum be divided into five modules: Indigenous Art, Virgin Art (Unconscious Art), Modern Art, Afro-Brazilian Art and Popular Art, as a historical alternative to the crisis experienced by the artistic avant-garde in late capitalism. The exhibition "Joy of Living, Joy of Creation" curated by Pedrosa after the fire, was designed to include a Yawalapiti longhouse (an 'oca') from Xingu. The 'oca' enacted as an expression that '--art is not an artificial thing but it comes from man, whatever the technology in which he lives. The technology prepares, but does not create anything, either yesterday or today . . . Art is not critical. The profession of the intellectual is to be revolutionary . . .' (Interview to Pasquim newspaper, in November 11, 1981).

Unfortunately, sometimes even the best of intentions falls short. The envisioned redesign of MAM-Rio suggests an appreciation for the interdependency of physical art and the process of creating art, in socio-cultural context, challenged dichotomous concepts of what is 'tangible' and what is 'intangible' . . . but did it actively promote and protect Indigenous culture and invite ongoing participation with Indigenous communities?

On its informational website page entitled 'What is Intangible Cultural Heritage', UNESCO writes: 'Cultural heritage does not end at monuments and collections of objects´. It also includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning the nature of the universe or the knowledge and skills to produce traditional crafts (Unesco). This concept of intangible heritage, the relationship between thought and action, suggests that eclectic architecture (sometimes referred to as *kitsch*, popular or vernacular architecture) is derived from a larger discursion about the relevance of a new global ethos; an ethos based upon cultural diversity, pluralism and multiculturalism.

Knowledge and cultural practices then are responsive to changing environmental conditions and cultural dialogue. For example, baroque-inspired architecture of Oscar Niemeyer's circular and spiral forms, eventually influenced the aesthetic of popular constructions of Rio de Janeiro suburbs and the Northeast of the country as well (Campello 2001). Such architecture expresses an aesthetic blended to the constructive principles of modern architecture of Niemeyer, which in turn incorporates baroque postures to the functionalism of Le Corbusier (Guimaraens & Cavalcanti 2006). Art and culture are not, therefore, created in creative isolation but are relationally dynamic. What impact then, might the presence, or absence, of Indigenous architecture and culture have upon urban environment, and vice-versa?

Figures 2-3. *Kitsch* architecture in Santa Cruz, Rio de Janeiro signs the popularity of Oscar Niemeyer in Brazil. Photos Lauro Cavalcanti 1978.

Museum Praxis: Indigenous Cultural Resilience

When heritage is viewed in relation to community wellbeing, its value is often reduced to economic development and tourism. Yet, cultural heritage also potentially actualizes as something essential to wellbeing in a more general, social sense. The Living Museum as it is currently envisioned, enacts as a collective re-actualization of the past, staged by museums in the present, encouraging a more sustainable future. One of the most important aspects of the development of the project was primarily determined (created and curated) by Indigenous ways of knowing. This process, this placing of non-Western ontology in the center of the creative process, challenges traditional Western ontological paradigms for project development and museum practice.

The separation of nature and culture in Western ontologies supports an impersonal, mechanized interpretation the natural world, potentially promoting attendant problems

of both environmental and urban degradation; for example, this perceived dichotomy between culture and nature is reflected in international heritage policies, such as Unesco's World Heritage Convention, which formally recognizes a separation of 'natural' landscapes from 'cultural' landscapes. The concept of cultural landscape adopted by Unesco in 1992 was incorporated as a new type of 'recognition of cultural goods' (in accordance with the 1972 Convention that established the World Heritage List). By 2012, world-renowned sites became formally interrelated to rural areas, traditional agricultural systems and other places of symbolic, religious and emotional significance; all with little or no support from Indigenous Knowledge Networks and Communities.

The recognition of the urban cultural landscape of Rio de Janeiro / Niterói, however, represents a new approach to cultural properties on the World Heritage List. The prototype of The Living Museum Project (temporary installation of 'ocas'/longhouses in an urban context) was envisioned as a multipurpose observatory space allowing for both traditional Indigenous ways of evaluation and scientific assessment of natural and environmental assets (registered by Unesco), thus contributing to the historical and socio-cultural rehabilitation of Guanabara Bay area. The essential value of the project was not only about the perpetuation of a traditional practice of 'intangible' culture; The Living Museum was intent to provide wellbeing to everyone involved in the creation and the use of the 'oca' (longhouse). The Living Museum was not manifest as a 'monument' to the past but rather as a dynamic expression of Indigenous art and social space in an urban landscape. It was an active aesthetic and spiritual intervention of Indigenous Brazilian cultural heritage.

Michael Herzfeld (2004) has shown how cultural intimacy and sociability engender local resistance to the monumentalization of social space and neoliberal processes of urban restructuring. Mindy Fullilove (2005) has charted the dynamic diversity of emotions, which contribute to social environment; how 'emotional ecosystems' galvanize group solidarity in urban environments (and the traumatic stress potentially brought on by urban renewal). Building on these notions of ontological security and Indigenous bioclimatic architecture (that is informed by natural environment, weather conditions and cultural traditions), The Living Museum in academic terms, explored how uses of the intangible heritage (cultural practices, music, dance, food and so on) are related to traditional building processes in living local museums. It also showed how The Living Museum practice may contribute to social sustainability by engendering

group resilience to multiscale processes of social displacement (resulting from environmental, developmental, or neoliberal contextualities).

Figure 4. Living Museum. Wood and bamboo structure from Uppper Xingu.
Photo Dinah Guimaraens 2014.

The Living Museum Project: Brazilian Indigenous Intangible Heritage

The Living Museum Prototype Project, was a civic engagement of urban Indians of Aldeia Maracanã and members of the Upper Xingu´s Aweti, Yawalapiti and Kamayurá. This collective was involved, from September to December 2014, around the construction of an 'oca' (longhouse) at the Campus of Praia Vermelha, University Federal Fluminense/UFF. The project was a transcultural and museological academic activity proposed by the School of Architecture and Urbanism. In accordance with the decree n. 3,551 of April 08, 2000, this project recorded practices from Brazilian cultural heritage, in compliance with the Registration Book of Knowledge of the Institute of Historical and Artistic Heritage-IPHAN, Ministry of Culture of Brazil, with respect to the typical ways of building Indigenous dwellings ('ocas' or longhouses) of Xingu, and the Amazonian and other coastal communities. These traditional constructions are exemplar of Indigenous building practices and dwellings of Brazil and provide a vital expression of Brazilian cultural heritage. The prototype of The Living Museum was aimed to record what are often termed 'intangible' forms of traditional practices and Brazilian cultural heritage (Guimaraens 2003).

Based on the concept of transcultural philosophy (Poulain 2001), The Living Museum Project, as a concept and a practice, past and present, explores the expression of Indigenous ways of

knowing, in relation to conventional Western approaches process of scientific research and the construction of knowledge. In the research approach for The Living Museum (in the prototype stage and currently), far from being an objectified subject of research, Indigenous living culture is perceived as a process; as a dynamic relationship, between multiple knowledge subject areas (what might be envisioned as regions of knowledge and expertise). Through these interdependencies, the interaction of these multiple ways of knowing and being (between Western and non-Western belief systems) a fuller, more complete expression of 'truth' emerges. It becomes possible to recognize the intrinsic humanity that supports a plurality of cultural and cognitive learning process in academic and in community contexts.

The purpose of the project however was not only to safeguard Indigenous culture and heritage but to also respond constructively to contemporaneous social events; to use traditions of the past to support community wellbeing in the present. The project happened in the wake of the abandonment by the federal authorities of the Museum of Indian/Funai, in order to make way for the new development of Maracanã Stadium, which was intended primarily to support the World Cup of 2014 and the Olympic Games of 2016. This remodeling of the Maracanã Stadium by the Odebrecht Construction Company and Governor Sérgio Cabral, when destroying an original art deco, had to be approved almost irregularly by the Institute of National Historic and Artistic Patrimony-IPHAN, Ministry of Culture of Brazil. This pharaonic operation of billions of dollars is currently the focus of the jet-laundering operation that fights the corruption of contractors and politicians in the country. While there were numerous reasons for the social and political street protests that erupted in Brazil starting in June 2013, social upheaval was provoked primarily by the removal, by government-mandated armed police, of local Indigenous leadership from the Indian/Funai Museum. These Indigenous leaders had occupied, for more than six years the Museum, in opposition to the Maracanã Soccer Stadium development. With the removal their representatives, the local Indigenous were essentially disenfranchised from due process. The victory of overwhelming forces of commercial enterprise, international construction marketers and corrupt strategic urban planning, all in support of 'great events', events deemed more important than Indigenous cultural heritage created there was a climate of extraordinary tension and social unrest in Rio.

The marginalization of the needs of Indigenous communities in favor of the development of Maracanã Soccer Stadium, raised important questions about the wellbeing of all Indigenous Brazilians living and working in urban environments. Data

from the Brazilian Institute of Geography and Statistics (IBGE), released in August 2012 showed that 324,834 persons of Indian/Indigenous heritage live in urban areas. There are in total, 896,917 members of Indigenous communities living in Brazil which are composed of 305 different ethnic groups that speak 274 languages (IBGE census 2010). This means that 36.2% of the Indigenous population of Brazil live in urban environments, yet there was, and is, very little formal support for, and understanding of the need of, this substantial cultural presence.

Figure 5. Indigenous Graphic Design. Maracanã Village (Aldeia Maracanã).
Photo Dinah Guimaraens 2012.

Lack of Social Justice: Participative Architecture at University

This lack of social justice inspired the Indigenous community of Rio de Janeiro and members of the University Federal Fluminense/UFF to create the prototype intervention; the 'oca'/longhouse installation. The success of that project has inspired the present educational project on bioclimatic architecture. The current project intends to establish collaborative practices between Indians of Aldeia Maracanã, Brazil, and professors and students of architecture, relating the efforts of Secretary of Culture of the State of Rio de Janeiro, aiming to establish a Cultural Center / Indigenous University at the house of the previous Museum of Indian/Funai located today, in ruins, on the site of the Maracanã Stadium.

A major goal of this transcultural project is to reveal how a Brazilian university can

achieve new pedagogical innovations in education, thus expressing the rich Brazilian multicultural context in a digital magazine. (This concept also conforms with the National Curriculum Guidelines for Education of Racial-Ethnic Relations and the Teaching of History and Afro-Brazilian and Indigenous Cultures, according the Brazilian Law n. 11,645 of October 03, 2008.) The value of intangible heritage (Unesco 2003) and vernacular architecture (architecture driven by local needs, out of local materials, associated with local cultural traditions) is a form of cultural practice that touches upon the following categories:

1) Registration of Knowledge (knowledge and ways of doing rooted in the daily lives of communities);

2) Registration of Celebrations (rituals and festivals that mark the collective experience);

3) Registration of Forms of Expression (literary, musical or plastic, scenic and recreational);

4) Registration of Places (markets, fairs, sanctuaries and collective cultural practices in squares).

As regards the cultural patrimony of Upper Xingu, for example, The Living Museum focuses on both category 1, consisting of the record of construction materials and knowledge (wood, bamboo, *embira* liana and vegetation) and category 3, musical demonstrations, visual and performing rituals (such as traditional ritual flute, played at the University Federal Fluminense/UFF in December 2014, on the opening of the longhouse (‘oca’) of Upper Xingu in Niterói/RJ).

Physical practices and traditions are not however the only medium of expression for The Living Museum. The Living Museum also incorporates interactive digital displays and models of architectural prototypes, along with live demonstrations of craft techniques of bioclimatic materials (wood, bamboo, adobe, palm fiber, palm leaves, and vegetable fibers) involved in the construction of longhouses (‘ocas’). The incorporation of virtual/digital elements into The Living Museum symbolizes a conceptual cultural exchange; a social virtual sharing of traditional techniques including Indigenous design (basketry, seeds crafts, ceramics, wood carvings, music and dance performances) and the use of medicinal herbs. Ideally in future, the physical environment of The Living Museum will be include a landscaped area with fruit trees and native healing plants. Again, The Living Museum is envisioned as a collaborative project involving Indigenous communities, professors and students of the University Federal Fluminense/UFF.

The Living Museum is a transcultural dialogue with Xingu cultures and urban Indians of the Maracanã Village and an international academic community. Indigenous construction processes have been supported by digital techniques of documentation.
The staff of the School of Architecture and Urbanism/UFF is also at present collaborating with MACquinho (the social educational project of Oscar Niemeyer at Morro do Palácio, an extension of the project of architecture of his famous Museum of Contemporary Art-MAC-Niterói), to develop new architectural concepts for The Living Museum. This project is entitled CAPES-Cofecub project n. 752/12 “The Transcultural Aesthetics in Latin American University” coordinated by Professor Dinah Guimaraens in University Federal Fluminense/UFF, and Professor Jacques Poulain in Université Paris 8-Saint Denis|Unesco.

Figure 6. Living Museum Design.
Photo Dinah Guimaraens 1998.

The Living Museum as a transnational narrative process, is a collective reconstruction of the Indigenous past. Ideally, it will perform a number of functions. It will:

1) make available to the national and international audiences the artisanal, musical and ritual intangible heritage of the Xingu cultures;
2) perform a Digital Exhibition emphasizing the indigenous construction techniques in wood, bamboo, and *embira* liana, with palm fiber coverage;
3) create a Website by sharing networks to disseminate traditional and constructive

cultural techniques, and establishing a digital database as well;

4) build practical and theoretical basis for the documentation of Constructive Intangible Practices of the Upper Xingu by the Department of Intangible Patrimony (DPI), the Institute of Historical and Artistic Heritage (IPHAN) and Unesco, exemplifying traditional celebrations, as well as educating tourists about the Indigenous culture and educating the public in how to avoid potentially negative impacts of cultural tourism in the region of the Xingu Park.

(All these activities will take place with the support of the Laboratory of Landscape and Place-LAPALU of the Graduate Program in Architecture and Urbanism-PPGAU/UFF.)

It is also an objective (now and in the future) of this transcultural, transnational project, to explore how the university can express pedagogical innovations in the Brazilian multicultural context. The relationship between Euro-Western social priorities and Indigenous social priorities during the development of this The Living Museum Project have raised many questions; questions the project has not yet fully answered but continues to be guided by, including:

1) How may the collective reconstruction of the Indigenous past in the present, support the development of social justice in relation to the future of the cultural landscape in Latin America?

2) How does the experience of Indigenous urban populations potentially contribute to social sustainability (or *sustainism*), including adaptability, cohesion and identity of Indigenous communities?

3) How the application of knowledge of the past is a critical factor in contemporary and future social challenges, specifically regarding the welfare of Brazilian Indigenous societies?

All of these questions enact as an ongoing inspiration to the project, concerning the role that The Living Museum will play in future and as an expression of communicative action in current museum praxis.

Figure 7. Living Museum Prototype. Campus da Praia Vermelha, Niterói, Rio de Janeiro. Photo Dinah Guimaraens 2014.

Conclusion: The Living Museum as Cultural Indigenous Revitalization

There are a number of things that can be learned from The Living Museum Project and the concept of a living museum as a dynamic, social narrative. In a general sense, this project is a part of the ongoing reconceptualization of social space, authority and the concept of transcultural philosophy proposed by Professor Jacques Poulain, (President of the Chair of Unesco's Philosophy of Culture and Institutions), the project opens a discussion; a dialogic of informal communication between Indigenous cultures and the academic university formal knowledge; to give rise to shared authority, mutual respect and the transcultural dialogue required by contemporary times (Poulain 2012). The current project focuses upon the concept of Cultural Landscape as a 'safeguarding the cultural and natural heritage of outstanding universal value', carrying out the application of Convention criteria defined in December 1992 by the World Heritage Committee, establishing three categories of cultural landscapes, as follows:

1) Landscapes designed, conceived and created by man, such as landscaping gardens;

2) Evolutionary landscapes and vineyards, rice fields etc, and

3) Associative landscapes of religious, artistic and cultural aspects as sacred or commemorative sites (Incollá 1999, pp. 11-12).

The Living Museum creates a new, hybrid and dynamic associative-yet-designed landscape, bringing rural practices of Xingu and Indigenous communities of Maracanã Village in Rio de Janeiro, into the urban contexts of Brazilian cities. This project documents artisanal construction processes of Upper Xingu, linking them to the technological innovation of bioclimatic architectural spaces of digital design, thus allowing participants (virtual or physical) to experience regional, life-affirming, creative activities, in a more global, transnarrative context.

This hybridization of the project, of the 'museum space' as both practical and virtual could be perceived as a 'fragmentary space', where cultural and political representations of relations established among different groups and social categories are 'staged'. Yet Lévy (1996) suggests that collective, social virtual space is a real space. The Living Museum allows the approximately 35,000 urban Indigenous that reside in Rio de Janeiro to interactively provide their perspective about the creative culture of complex urban society. The Living Museum Project derives from a participatory approach that allows members of Indigenous communities to join the museum (both online and offline) as healers, professors, and builders. It features digital interactivity and information about Indigenous practices, with live demonstrations of construction techniques, basketry, traditional cuisine, seed handcrafts, wood carvings, and music and dance performances. The cultural revitalization achieved through The Living Museum as museum praxis, involves increasing the opportunities for the expression of intangible heritage.

In traditional cultures the teaching process including members of different generations participating in the informal educational process, means more than simply creating handcrafted objects, if the material culture carries with it social and symbolic, and even spiritual meanings. The Living Museum Project created an opportunity for intergenerational teaching of construction techniques of longhouses (‘ocas’) and seems to show that this transmission of cultural values improves family cohesion. The activity of constructive craftsmanship and the cooperation of the Xinguan collective creative process appear to promote community wellbeing.

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FROM COMFORT TO HEALTH, FROM MECHANICAL-DOMINANT TO CONSTRUCTION-BASED BIOCLIMATIC ARCHITECTURE

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Abstract

Since ancient times to the present, the relationship between human physiology and the climate of the built environment has become the central agenda of ecological development. With the tremendous changes brought about by technological innovation, the architectures controlling the climate based on machinery and equipment continue to develop and improve, as well as the parameters judging the thermal comfort of the human body. However, is standards-based thermal comfort depending on the development of the machine and equipment equivalent to health? In the face of iatrogenic sick building syndrome such as air conditioners-related problems, more and more researches show that the climatic environment which slightly deviated from the exact comfort and controlled by non-mechanical means is healthier. In this regard, bioclimatic building which is based on construction, use structural, material and other strategies to manage the climate, creating new possibilities for a healthier environment.

Keywords

Physiology, Thermal Comfort, Environment Management, Bioclimatic Architecture, Chinese Rural Research

1 The Historical Tracing of Bioclimatic Architecture

1.1 Bioclimatic Architecture and Human Physiology

Bioclimatology mainly studies the impact of climatic environment on biology. In architecture, it involves the relationship among climate, architecture and people. How to make architecture as a spatial carrier of human life, as well as the external expression of human physiology, thus becoming one of the important means for people to adapt to the laws of climate change, has become the core of research on bioclimatic architecture. As human physiology has come into

focus, the thermal comfort generated by the interaction between the human body and the environment has become the starting point of bioclimatic analysis. The Danish scholar Fanger proposed a thermal comfort equation that establishes the relationship among human thermal comfort, environmental variables, clothing types, and activity levels, then quantitatively analyses the relationship among climate conditions, the thermal environment of architecture, and human thermal comfort. More and more relevant research methods have been continuously developed.

1.2 Architecture's Environmental Management from Physiological Perspective

Since ancient times, the comfort and health of human cannot be discussed out of the context of climate and environment. Since 400 BC, Hippocrates, the father of Greek medicine, first recorded the relationship between human physiology and climate. Then people realized that it was necessary to pay close attention to and study the climate environment closely related to physiology. Hippocrates pointed out that not only physical health, but also living habits, and even personality and hobby are closely linked with the climate. Vitruvius was the first to link physiology with the thermal environment of architecture, who believed that consideration of the human body helped coordinate the organization from material's selection to urban planning.

In the 19th century, with the rapid development of the city, a large number of people poured into the city which was over-burdened, causing crowding and pollution. The unhealthy status of people working and living in industrialized society has made environmental issues one of the most pressing problems. This requires not only industrial-related laws, but also equipment such as sanitation and ventilation to be updated immediately to meet the needs of industrial society. The external environment is contaminated by industrial waste and power generation equipment. The internal environment is filled with the foul air exhaled by people and the exhaust gas generated by the inefficient combustion of light sources. In ancient times, fire was the center of crowd. The stove is listed as one of the four elements of architecture by Semper, because in the long history of architecture, the stove has always been regarded as the center, for it not only brings the thermal comfort with physiology, but also symbolizes the joy of spirit in people's subconscious. In the mid-nineteenth century, as the demand for artificial lighting increased in industrial society, people gathered around table lamps instead of the fireplace. However, the lamps used at the time glowed with unburnt carbon particles in the smoke. The dirty light smudged the walls and ceilings, and also polluted the area under the ceiling. Until Edison invented the electric light, the clean light no longer brings about the problem of smoke pollution. This has also become a typical example of people using the power of mechanical equipment to create a healthy environment. During the first half of the 19th century, there were many modern studies on the relationship among comfort, physiology and architecture. The central research topic of scientists was to deal with the physiological reaction of air flow, which in turn prompted the development of a series of measuring instruments.

After the 20th century, the "Mechanical Age" came. The rapid advancement of science and technology has solved many physiological issues during environmental management. When the housing's volume becomes larger and the number of floor increases, decentralized heating using water pipes for heat radiation instead of central heating provides a comfortable thermal environment. After the appearance of high-rise and skyscrapers, the controllable mechanical

ventilation system becomes the necessity of human physiology. Especially at the Royal Victoria Hospital, whose modernity Reyner Banham emphasized but was neglected, the mechanical equipment combined with the plan not only promotes natural ventilation, but also cleans and heats the air, improving the hospital environment. Even more shocking is the emergence of electrical appliances such as fans and air conditioners. When people used oil lamps in the 19th century, the heating and ventilation problems were first consciously solved together, and the cost of efficiency was that the structure of the building had to be changed due to the need for air convection. The heat stimulated the air circulation, but the integration of ventilation and heating emerged only after the emergence of fan.

Modern architects are aware that the physical health of the human body is closely related to the built environment, or that the artificial climate created by architecture under the atmosphere is the external expression of physical health. Under the influence of this thinking, the development of architecture also has two new features. One is to try to completely control the building environment with the help of machinery (or even rely on it); the second is to love the modern elements like glass and light frame structure which symbolizes health and light with the help of technology. Aided with the rapid development of mechanical technologies, architect's ambitions for the environment management is evident from the term "control" they often use. For example, Reyner Banham repeatedly uses control-related vocabulary such as controlled mechanical ventilation, filtered air that is regulated by heaters and fans. In *The Architecture of the Well-tempered Environmental* he explained that *artificial climate* is a term that Carrier still uses after air conditioning has become prevalent. It shows that the nature of air is the composition of outdoor climate elements. People want to use equipment to make the air entering the room from the outside becomes completely controllable to form an artificial climate. Banham stated that Paul Scheerbart, a novelist who used his words to design architecture, linked ancient masonry buildings with germs and cold and complained about this terrible masonry culture as a prerequisite to his longing for glass architecture. Light-weight glass buildings can get plenty of sunlight, and pilotis is related to ventilation. Even the preference for minimalism and white is a proof of clean environment.

Reviewing the historical process of architectural environment management from the perspective of physiology, we can find that along with the development of social civilization, the external environment of human physiological health has faced more and more challenges. At the same time, people also learn to use mechanical strength to develop a kind of active environmental management. The forms and features of modern architecture are also influenced by this idea.

2 Mechanical-Dominant Strategy for Comfort

2.1 Comfort in the Machine Aesthetic Age

As Marcel Breuer put it in 1934: "*The origin of the Modern Movement was not technological, for technology had been developed for a long time before... What the new architecture did was to civilize technology.*" Some architects who emphasize civilization are trying to make people enjoy the aesthetics of the mechanical era while enjoying the comfort and convenience brought by machinery. In 1920s, the architects in Germany admiring the international style loved the white architecture. After people felt the power of machine, they were bent on

wanting the surrounding to be as bright as possible. But in fact, the glare of light made people uncomfortable, and pure white lighting can even cause some cases of neurasthenia.

At this time in Europe, there were no reasonable architectural forms to adapt to the development of machinery so as to help people explore the practical function of machinery to the maximum extent. Therefore, people cannot fully enjoy the convenience brought by mechanical equipment. But architects still yearn for this mechanical aesthetic. For example, the Bauhaus considers machinery as one of the aesthetic composition and completes design guided by geometrical principles as usual rather than considering how people use it. For example, by contrasting the design drawings with the photographs, Banham pointed out that the environmental management in the work of Gropius and Rietveld, such as lighting, neither considered people's comfort in space, nor really improved the built environment closely linked to physical health.

2.2 Comfort and Health under Mechanical Management

After mechanical equipment can provide indoor artificial climate with a constant temperature to people, people seem to have forgotten the adaptability of the human body in a changing environment. Since people can control artificial climates with the help of machinery, a stable and balanced microclimate represented by the PMV index (Predictive Mean Vote) = 0 has become the goal pursued by people. The constant temperature and humidity of the indoor environment has become a feature of "healthy, green" buildings. However, with the continuous emergence of sick building syndrome and iatrogenic issues such as “air conditioning disease” have urged people to rethink about the thermal environment. Is a stable and balanced artificial thermal environment really comfortable and healthy?

First of all, staying in a stable thermal environment for a long time makes people lose comfort both physically and psychologically. It is undeniable that the artificial climate brought about by machinery will initially attract us. As air conditioners appeared, cinemas and shopping malls have used coolness brought by air conditioners to attract people to enter and consume. But there is a basic difference between thermal perception and other senses. When we perceive that an object is cold or warm, it actually makes us colder or warmer. But when we see something red, it doesn’t get redder. Therefore, the thermal sensation is not neutral, and it is related to the state of body physiology at every moment. Being in a suitable range of temperature and humidity changes, people not only feel the thermal sense itself in the change, but also get the delight of life. For example, people walk under the shade of trees and alternately feel the warmth under the sun and the coolness under the shade. This brings exceptional comfort and joy in spring. Similarly, natural winds perceived by people are unbalanced and unstable. Gusts of wind repeatedly eliminate people's feelings of heat and bring pleasure. Studies have shown that natural wind is better for people than mechanical wind with the same temperature, humidity and average wind speed.

Second, a stable and balanced thermal environment caused many health problems. There are also many examples of how people like to switch between two different kinds of thermal sensations, such as enjoying a sauna in the winter, jumping into the sea from a beach under the hot sun, and so on. The reasons include that people in the conversion of these two thermal sensations feel the adaptability of their bodies to climate change, thus psychologically feel safe. The Chinese Center for Disease Control and Prevention conducted a survey of the population in East China and found that people who use air-conditioning have lower heat

tolerance than people who do not use air-conditioning. “Air-conditioning related disease”, that is an iatrogenic health issue, is causing people to reduce adaptability to climate changes. This problem has actually appeared in the records of an Italian traveller in the 18th century. He found that after the sauna, Finns like to feel the ice and snow out of the bathroom without clothes, which doesn’t make them ill or uncomfortable. On the contrary, if a stranger from a warm area is wrapped in thick fur, a breeze may make him sick. The adaptability of people's bodies to the climate needs to be cultivated in an unstable and unbalanced environment.

Third, excessive reliance on mechanical management increases energy consumption, which may have been avoided. Since ancient times, people have considered the thermal condition as a determinant of behavioral habits. After using machinery to keep our entire work and live environment in a unified and comfortable condition, the activities of different spaces that we previously located based on the thermal environment have become vague. They can happen throughout the entire building. The heating and cooling technologies aim to create a long-term thermal stability and equilibrium in the entire space, whose thermal environment can accommodate more activities than actually needed. To maintain unstable thermal energy in constant conditions, this poses many challenges for technology and energy consumption.

The mechanical-dominated environmental management brings a stable and “comfortable” environment, which is not real comfort, while it takes away the joy from the natural climate, and it also causes some health problems. At the same time, it blurs the location of activities in space and increases unwarranted energy consumption. Perhaps the solution is not just to focus on the development of better technologies, but rather to rethink from the perspective of physiology that how to create a healthy and delightful microclimate.

2.3 Machinery and Physiological Apparatus of the Human Body

We often associate the thermal environment of a space with human thermal sensation and thermal comfort. The human body should be the focus of our attention. Such an “internalized” environment is the goal of creating a pleasant thermal environment. However, apart from considering people's senses, we probably neglect the human body's influence on the spatial thermal environment. Since ancient times, people realized that besides the sun and fire, their body was also an important heat source, so the basic way of heating is to isolate the body from the outside world with clothes, blankets, and fur. In Eskimos’ igloo, ice films used to seal the small holes in the shell act as a radiation reflector, reducing the loss of heat from the body through radiation or conduction to the ground and walls. The traditional American house's love for the four-poster bed, according to Lisa Heschong, may be due to the memory of the colonial era. The four-poster bed is not warm itself, but the drawn curtain is gradually warmed by the heat radiated from the body. The warmth experience defines this particular space. In the ancient Roman baths, the human body as a physiological apparatus has a great influence on the thermal environment. Unlike the modern thermal comfort assessment model, which often assumes a single static person, a large number of people are moving at different times in the bath, and the physiological responses and adaptability brought by it are completely different from the single static model. Clothing, people's activities, and interactions with the people around all affect the bather's heat sense and the thermal environment of the baths.

In the early 20th, insulation technology expanded from steam pipes to architecture, but it was less aware that the human body was also part of the architecture 's thermal environment. Even in architecture where the thermal comfort is taken into consideration, the role of the

human body as a physiological apparatus for thermal radiation is neglected, and the feedback reinforcement system formed between the human body and the heating system is suspended.

3 Environmental Strategy and Thermal Comfort Analysis of Bioclimatic Architecture

3.1 Research on Environmental Management of Rural Architecture

Compared with urban architecture, rural architecture is more likely to reflect the impact of local climate and environment on architecture. As sheltering from regional climates remains a major function, rural architecture is usually built by local people who respond to the local climate with the traditional technologies and crafts. At the same time, due to the lack of architects in the construction of rural architecture, this self-organizing process is more able to reflect the relationship among human physiology, thermal sense and the built environment. Therefore, the study of the relationship between the environmental management strategies of rural architecture and the thermal comfort of human body has a significant role in exploring the further development of bioclimatic architecture.

The research was located in Shentan Village, Yiwu, Jinhua City, Zhejiang Province, China. Shentan Village, which have many historical rural buildings, is located in the central part of the eastern coastal province, with subtropical humid monsoon climate. The temperature in a year is comfortable and there are distinct wet and dry seasons. However, due to the large amount and days of precipitation in summer, cloudy and rainy weather occurs. Therefore, the local rural architecture uses brick and wood materials to prevent moisture.

Figure 1. Monthly average temperature of Shentan

From the monthly average temperature chart of Shentan, it can be seen that the monthly maximum temperature is 35°C in July, the lowest temperature is 3°C in January, and the average daily temperature difference is about 5-10°C. In most time, the dry-bulb temperature is not in the comfort zone. In winter, it is necessary to increase heat, and in summer it needs cooling and ventilation. In order to further analyse the thermal comfort of the human body, the factors considered are not only the dry-bulb temperature, but also the effects of humidity, wind speed, wind direction, ground reflection, human activity, and clothing, then adjustments can be made by MRT (Mean Radiant Temperature). By comparing the charts in or out of the sun, it can be seen that solar radiation has a significant effect on thermal comfort. The sun's direct radiation increases the number of days in the comfort zone during the year, but it also makes some people feel overheated. Taking into account that people can move in or out of the sun according to their needs, there are still nearly half of the year is not in the comfort zone. It requires the architecture to properly manage the environment.

After selecting the typical residentials in the Shentan Village and abstracting them into the model for PMV simulation analysis, it can be found that there is a clear difference in the thermal comfort brought about by envelopes of different orientations. Most of the dwellings in the village are close to the north-south direction, while some are slightly rotated from south to east, which is a kind of architectural layout in responses to the climate. For example, the dwelling's south-facing envelope has the largest amount of solar radiation captured in a year, making it comfortable in winter, but it feels overheated in summer. The function of traditional dwellings is related to the amount of solar radiation taken from each direction, and the patio increases southwards to obtain more sunshine.

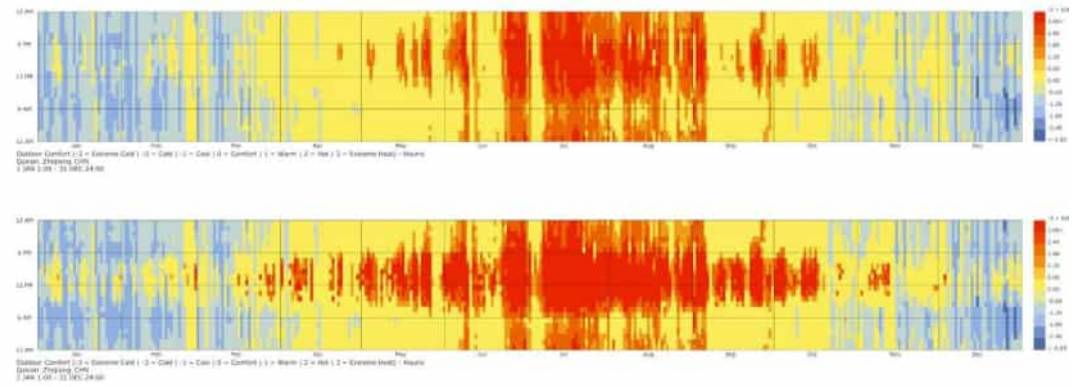

Figure 2. PMV in/out of the sun of Shentan

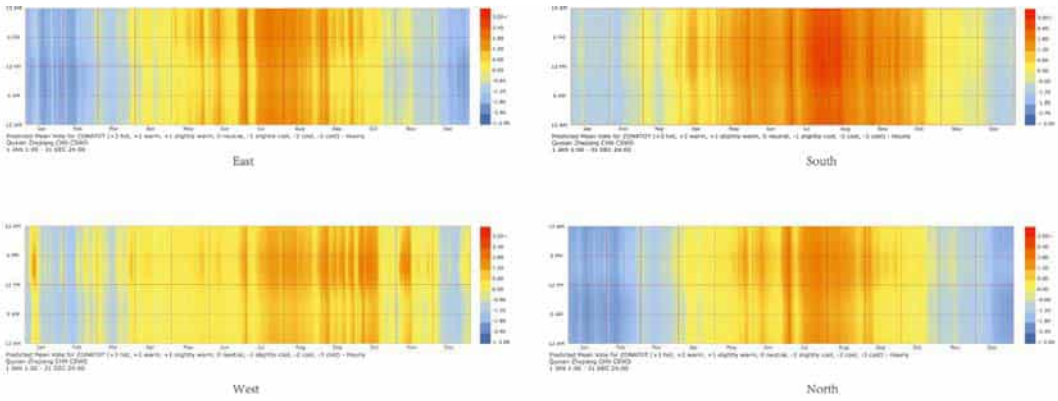

Figure 3. PMV from envelope of different orientations

3.2 Research-based Bioclimatic Environmental Strategy

The traditional dwellings in Shentan Village are built in a self-organized way. The methods of environmental management originate from the experience handed down through the historical process and the life experiences of the villagers, which have regional characteristics. The modern dwellings have installed heating and cooling equipment, but the strategy may be less locally targeted. By comparing and analysing traditional and modern dwellings in Shentan, we can draw some enlightenment for bioclimatic architecture in response to the environment.

3.2.1 Traditional Construction Methods and Materials

First of all, compare both the indoor and outdoor dry-bulb temperature in traditional and modern dwellings during one day, and it can be found that the indoor temperature of modern dwellings is generally lower than that of outdoor, mainly due to the similar trends as outdoor

temperature under the influence of heating facilities. The outdoor temperature of traditional dwellings changes more severely, while that of the indoor changes more gently. When the outdoor is colder in the morning, the indoor is warmer, which is related to the thermal storage performance of the envelope. The thermal performance of a single-layer monolithic wall is better than that of a multilayer modern wall. Although modern dwellings maintain higher temperatures, the mechanical equipment uses much energy. The material of the envelope structure should take into consideration the geographical characteristics and use local construction materials with good thermal properties.

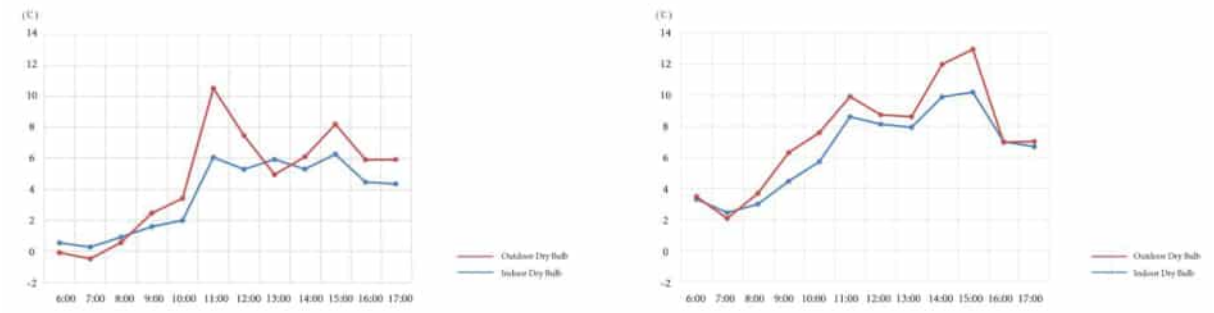

Figure 4. Temperature in/out of traditional and modern dwellings

Figure 5. Temperature of traditional and modern dwellings

3.2.2 Unstable Thermal Environment and Human Adaptability

Secondly, the indoor living rooms of traditional and modern dwellings were used to simulate thermal imaging and human comfort at different times of the day. Overall, modern indoor temperatures are generally higher than those of traditional halls. In addition, the thermal comfort of the modern indoor is relatively constant, which means that people have a more stable environment in the room during the day. Just as the distinction between the stable comfort and health of mechanical management has been mentioned above, the modern indoor environment may not be benefit to the human body's adaptability to environment changes. And it was observed that the temperature of the modern interior at 6:00 was generally higher than that of 9:00, which was due to the fact that residents were cooking and many people were gathering beside. This tells that other heat sources such as the stove, the human body itself, and especially the interaction among people, have a great impact on the thermal environment. As a physiology apparatus, the human body is a sensitive sensor to the

surrounding thermal environment, and is also a heat source. The acceptance and release of heat will have a fundamental impact on the indoor dynamic heat flow.

Figure 6. Temperature & PMV of traditional and modern dwellings

3.2.3 Thermal Environment and Human Activity Habits

Since ancient times, people have considered the thermal environment as a determinant of behavioral habits. By selecting the spatial nodes of modern and traditional houses in Shentan, and performing thermal imaging and human comfort analysis, we can find that the thermal environment of different spaces in traditional houses is quite different comparing to that of modern dwellings. The image at 9:00 shows that the outdoor area and the patio are in a hot state, followed by the main hall and the room on the first floor where most of the residents' activities happen. At 15:00, the temperature of the courtyard and the first floor room dropped, while the temperature in the second floor rose after receiving direct sunlight during the day.

After using machinery to keep our entire living environment in a unified state of comfort, the activities that we previously positioned based on the thermal environment have become vague, which can occur throughout the entire architecture. Excessive choices result in energy waste. If, like the traditional dwelling in Shentan, thermal environments' changes of different spaces in architecture are in line with the activities of people, it will be benefit to the real adaptation of the built environment to the villagers as well as to maximize energy use.

Figure 7. Temperature & PMV of different spaces at the same time

4 Conclusion

Whether it is in an architecture considered as the external expression of the human body or an environment managed by architecture, human physiology should be the focus of attention.

In history, people have obtained a lot of achievements in this exploration. In contemporary times, people have also constantly revised their previous ideas with critical opinions. Through the rethinking of human thermal comfort and the exploration of the relationship between comfort and health, contemporary architects should recognize that an artificial environment that relies on machinery is not the best option. Bioclimatic architecture, which links the autonomy of architecture with the energy flow, seeks strategies that bring real thermal comfort and health to the human body from the perspective of construction-based architecture. By investigating and analysing rural traditional dwellings that are more self-organizing, the enlightenment of the bioclimatic architecture 's response to environment is obtained. The relationship among human physiology, architecture and environment is a discourse that addresses contemporary human concerns, environmental issues, and energy crisis, which provides more possibilities for exploration of architectural design paradigms in the context of bioclimatology.

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TRANSFORMATION OF SEMI-PRIVATE AND SEMI-PUBLIC URBAN SPACES IN HOUSING UNITS IN THE CASE TURKEY

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Abstract

Urban settlement pattern of Turkey in 21th century includes two basic types of settlements with different characteristics. These are garden-city and satellite-city. The evolution of these two types is similar in the rest of the country. That urban settlement pattern has started to be designed and applied in settlement scale since the beginning of the twentieth century. As the type of master plan regulations that formed the settlements changed, the criteria effective in the design process changed as well. The design manner of single parcel scale included variations according to road width, maximum building height and backyard or courtyard size; withdraw distances from the parcel borders. Within this frame, the reasons of transformation of settlement and housing tradition may be stated as social realities with physical, conceptual and legal roots.

As a consequence of this understanding, 'satellite cities' or 'mass housing areas', which are the new names of modern settlements, have started to be produced rapidly at the borders of metropolitan cities. Together with this development, the building types that are suitable for mass production – 'spot and semidetached blocks' – were legalised. The approach of functional disintegration has found application ground in urban scale and housing unit scale. With relation to this disintegration, evening and daytime uses have been separated. The 'loosening' and 'disintegration' in social life has become legible in the physical structure of the built environment. The 'cities' started to present a fragmentary structure. This disintegration ended with the redefinition of public and private lives. The new public and private spaces did not possess the remains of old habits. They were reflections of the 'modern' living culture. Following these developments, modern settlement habits were interpreted as multi-floored apartments in Turkey's case.

Within the scope of work, Urban transformation process in Turkey and Standardized Housing Projects throughout the diverse Anatolia Region with different cultural, geographical and historical backgrounds which both trigger this ever growing problem, are to be examined in order to reveal the status of standardization in Turkey. In addition to that, a critical approach will be utilized towards the dynamics that encourage the facilitation of "standard housing" – "standard human" and spatial pattern or hierarchical order, which includes public-semipublic-semiprivate-private space relations, will be discussed.

Keywords: Semi Public, Semi Private, Housing, Turkey, Standardization

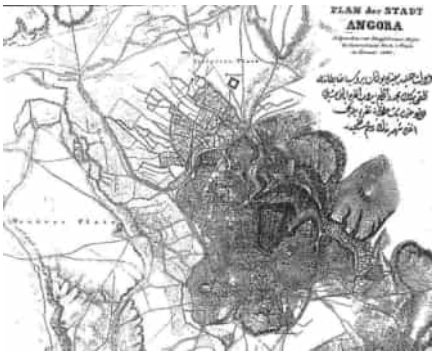
1. 21th Century Imported Architecture Language in Turkey

1.1. Fragmented Urban Texture

The process of modernity, which is rooted and developed in the Western world, mainly in Europe, accompanied with the realization of industrialization, has become a universal project that changed and transformed the economical and institutional structure of Ottoman Empire starting form 1840's. Thus, the 'modernization' and so called 'westernization' project which started off by the establishment of Turkish Republic in the second half of nineteenth century and found chances of wholistic practices and applications is actually a transformational project which constituted major changes and developments in urban environments and of urban housing designs and approaches. (Figures 1,2)

Figures 1-2. The westernization project which constituted major changes and developments in urban environments and of urban housing

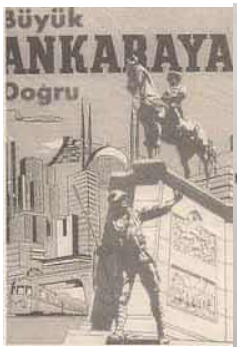
Until the nineteenth century, cities were interlaced spaces that had continuity, edges (borders) and mental rhythms within themselves. From the point of view of the urban spatial hierarchy, the main characteristic of the traditional cities or the pre-modern urban environments is existence of an organic interpenetration within various activity areas. For example, in traditional urban concept, there is the 'city center' where the political, religious and the trade activities are located. The dwellings used to surround the center of the urban settlements. There is a functional interdependency of various different activities and this required 'transition spaces' which either connects or separates different spatial qualities form each other. This is a different approach when compared to modern urban concept. The main characteristic involved in the urban principle of the twentieth century is 'zoning' among various functions. (Figures 3,4)

Figures 3 – 4. Twentieth century Ankara and Ankara city planning

This modern urban concept generated as a result of the industrialization process. Industrialization process brought social, cultural and spatial changes as well as economical transformations. Especially the rise of bureaucracy, professionalism, and consumption; the problems and changes of speed and scale are the main characteristics of the modern world view (Dowey, 1985). So; industralization caused city to have unhealthy living conditions. In order to overcome the problematic structure of industrial cities, the modern urban concept proposed to loosen up the tight urban pattern by both physically and functionally. The urban pattern is meant to be loosened, decomposed, raveled and is integrated again (Bilgin, 1999) within the principle of zoning. Such an understanding experienced in urban scale was reproduced in housing as well.

The first major effect of westernization or modernization project is the construction of new building complexes that respond to the new institutional structure and the public life that is proposed by the so-called 'new' modern world. This, in the meantime, stands for re-definition of public and private relationships. Within the modern living conditions, the private and public spaces are re-defined by the new ownership relationships. Along with the concept of 'zoning' that shapes the twentieth century urban spatial organization in general, public places and private places or spaces has diversified from the whole of urban structure and refined within this new spatial order. The settlement model, which started off with 'garden city' and transformed into the 'satellite city' model had caused the redefinition of public and private areas. (Figures 5,6,7)



Figures 5 – 6 – 7. New images and posters with modernization

Figures 8. Garden City model

Second of the transitions is the construction of a circulation network – such as roads, the urban transportation systems, various infra-structures which provides the transportation of people and the vehicles, the sewage, water and electricity as well as information and knowledge in order and without any disturbance. The distribution of such a technical system to the structure and consequently to the spatial organization of city means a conversion of the urban structure.This means the re-shaping of the urban pattern, which once was designed according to the pedestrian network. The street pattern, spatial hierarchy (private, semi-private and the public relations) the housing pattern relation was all formed by the pedestrian scale. Within the change of transformation system, which is based on the pedestrian system transformed to “highway system”, the scales and patterns are eventually transformed. This is a new design concept for settlement and housing unit scale.(Figures 8,9)

Figures 8 – 9. the change of transformation system

The third effect is the tendency for production of dwelling for the anonymous user, which is a fundamental transformation of production system and design criteria, which essentially changed the ontology of dwelling. The unit of housing scale whose user is defined had started to be mass-produced for an average modern man. As the scale and production style has developed, the housing unit and the new ways of modeling in their coming together have started to be developed. (Figures 10,11)

Figures 10 – 11. Production of dwelling

When those above mentioned effects are taken into consideration, as in the cases of modernizing societies where the growth of population is one of a basic problem, there exist various new approaches in housing typology that respond to demands of different social groups in different periods of time in Turkey as well. However, Turkey, confronting with industrial revolution later than the Developed Countries, tended to find solutions to problems of housing by models imported from West. Such models have carried new kinds problems related to their local context.

This paper mainly focuses on the settlement and housing models imported from West along with the local solutions developed during modernization process in Turkey. Characteristics of the new spatial pattern for housing environments proposed by the modern housing concept are already mentioned above as the three basic transformations. Those transformations are basically the redefinition of public and private spheres and their spatial reflections. Thus, this article, emphasizing basically on the private and public area relationships, proposes a multi-dimensional reading in order to understand the spatial organization and use of housing. Such an understanding aims to define and measure the spatial quality of the existing housing stock and will provide and illuminate the new housing projects.

With the rise of the modernization project in Europe; the world entered a transformation period. The social structure and the spatial organization of the Ottoman Empire and the Turkish Republic following it were all transformed. Some planning decisions were made to control the rapid growth. It is known that the industrial revolution caused this transformation and a new structure was formed in the social organization.

After the second half of the nineteenth century, the urban structure of the Ottoman cities started to be planned in a modernist framework. For this, the transformation had to be a programmed process and institutions akin to the Europe had to be established. The most important part of this formation was developing an urban planning project (Tekeli, 1999).

1930 Partial Planning Period: Importing of Modern Urban Housing Typologies
1930-1950 Early Period: Importing of Modern Garden-City Typologies
1950-1980 Urbanizing Period: Slums and Build-and-Sold Apartment Blocks
1980 – Liberal Period: Modern Satellite Cities (Mass Housing)

With the declaration of Tanzimat Period[1] in 1839, the urban space and the housing spatial organization have started changing in parallel with the institutional and physical planning decisions. These were made in the expanse of the modernization project. With the declaration of the Republic, all the decisions were finally made to establish a modern Turkey. New and modern, public and private relations were displayed in urban plans.

Depending on the periods, the decisions leading to the transformations of different severity and the “collective housing typologies” among the housing typologies developed accordingly have continued to destruct urbans with their imported solutions. Having disregarded and destructed mindlessly the local characteristics of Anatolian urbans comprising the geography

[1] Tanzimat period is the name of modernization period of Ottoman started with reading the manifest of tanzimat (Gülhane Hatt-I şerifi) in 1839. Tanzimat means arrangements, reforms and known as the Ottoman Reform in western languages.

of Turkey, such solution seeking, these “new settlements” commencing in 1980’s and then created with government assistance based on macro-scale have still been marketed despite the social collapse they caused and have gained recognition as the leading drive of the national economy.

1.2. Designed Space/Designed Object: “Modern” Turkish Residential Typologies

When the unit of housing started to be designed and produced as a “standard” unit in modern society, it was the threshold of an important change. This involves a distinction between the ‘settlement’ and ‘city’ concepts as well as ‘house’ and ‘home’ concepts. The meaning of the concept of ‘settlement’ does not involve a specific ‘place’ and stands for a partially planned structure lacking unity. It is mainly a self-sufficient design product. On the other hand, the concept of city is a unified whole and an organic structure where the parts are wholly integrated. Likewise, in the modern dwelling concept, the house, which is the physical product of dwelling, is liberated from the subject / user and it became a marketable product and a consumption object. Consequently, the two main concepts, house and home are separated conceptually. Home is the subject or user’s experiences, behaviors, feelings and mental world, and especially in the production and formation of modern housing, the role of user is eliminated. Thus, home and house became much more distinct from each other.

The idealized settlements of the 20th century and within the view of modern dwelling concept, the dwellers of city or homes are no more identified or determined subjects. Thus there starts a dissolution and distinction of dweller from his private space. The concept of “settlement’ or of ‘house’ started to define only the ‘physicality’ or the ‘objective properties’ and especially in academic fields “home” became the subject of human behavior researches.

“Home” and “house”, the two very integrated concepts, were handled apart from each other. Rational thinking of the modern age, regarded the house, which is the objective and physical product of the dwelling activity as the whole explanation of the dwelling act (Ersoy, 2002). (Figures 12,13)

Figures 12 -13. Dwellers life style were changing with the change of housing

Dovey (1978; 1985) indicates that a life expressed by “being at home”, in spatial, temporal and socio-cultural order can be thought as an individual’s way of existence in which one can find his own direction. For him, home is the most basic principle that determines our way of existence in space. It is a spatial order, which separates us from the outer world on which we cannot have a total control. Being at home is to know where we are. The order gained by this knowledge provides a trust and a control feeling, which distinguishes home from other places.

According to dialectic approach, all social systems are formed of personal and public opposition, which is also in balance or in equilibrium in various levels. The relation between the opposites, in its own form, continuously evolves as being a dynamic and variable process. The determination of this variation and direction of development is the short or long period variation of dynamism of inner-outer, political, economic, social and environmental facts.

In parallel with this point of view, Altman and Gauvin (1981) determine two specific ways of individuality/society dialectic to understand the man-home relations in various cultures. These are identity/communality and accessibility/inaccessibility.

Identity/Communality Dialectic: home reflects the uniqueness of the ones living in, the relation of individual and small groups with society (in an extended meaning, the relation with the culture that they are a component of) the borders and being limitless. In modern world, it is necessary to mention people afford to make their homes unique. At the same time, a rapid stereotype space designing process and conformity in social behavior areas take place.

Figure 14 -15. From traditional housing to modern housing

Accessibility/Inaccessibility Dialectic: this is about the verbal or nonverbal arrangements in the relations in between the ones living in the homes and the others outside the home. Home provides materials having the two sides of the openness /closeness dialectic. In many cultures being open to people and sharing the most private spaces, homes, with others, are accepted as a value that is respected. In addition to this, not being concerned with others

privacy, being able to put the necessary limits, being someone special and giving the right to be special is accepted as virtues. Homes represent the dynamism of this opposition in different cultures and the practices on how this dialectic is processed.

As a result, within the discourses of environmental psychology and phenomenology, the spatial hierarchy is a key concept in perception of home. The relationship of inside and outside, private and public or self and other is the main theme of human spatial experience. Besides, taking the privacy theory in regard (Altman.1977; 1993; Altman, I., M. M. Chemers, 1980), the confidential, personal, social and general remoteness coincide with the spatial hierarchy of private, semi-private, semi-public and public spaces. It should be noted that this couldn't be taken granted since the relationship between the private and public spaces show variations with respect to cultural, social and individual variations. Especially in the modern dwelling concept, the public and private borders are more determined and less emphasize is given to transition spaces.

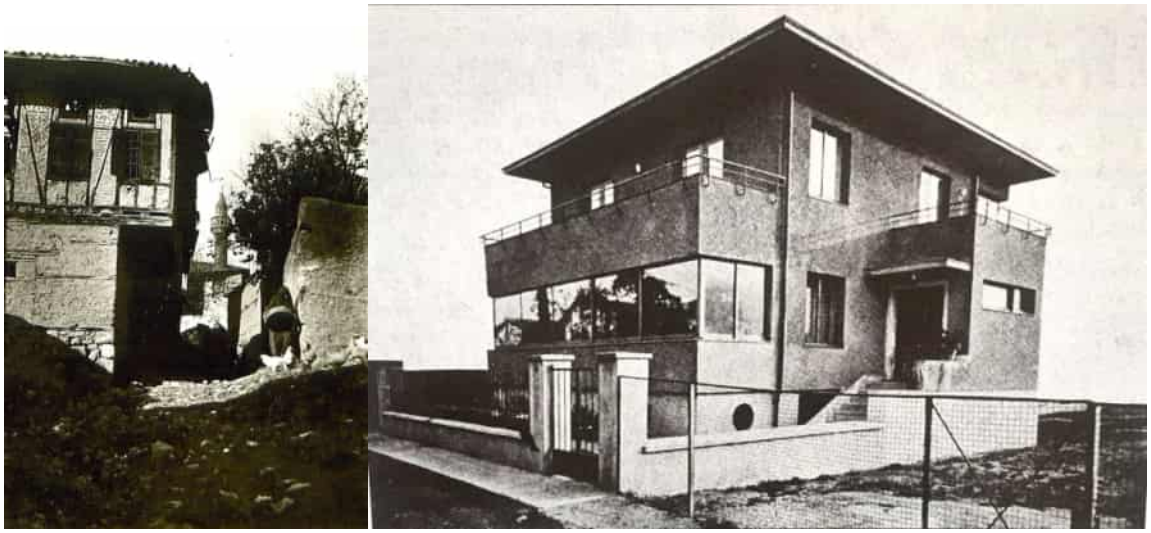


Figure 14 -15. hierarchy of private, semi-private, semi-public and public spaces are different between traditional and modern housing

For the collective housing projects having the greatest transforming power in formation of Turkish Urbans of 21st Century, the distinction between the residence and the house is disregarded. Solution seeking held objective solutions only has marketed the "unit spaces" which is the most significant input and is disjointed and independent from the spatial hierarchy comprising the social fabric as "ideal house". Yet, for the collective housing projects which is one of the greatest chances in the name of rise of urban quality, we would have had chance to achieve urbans quite different from this fabric comprising the actual urbans if they would have been designed on the urban design basis with the designs seeking for answer to such spatial problems, because the mass housing production gained momentum as from 1980's is one of the house presentation styles that many decisions are taken and applied about, in this period. The greatness of the house production number and gradually the scale and the quality formed by the inside and outside house uses, distinguishes this form of house presentation from the others.

1.3. The end of social diversity: Standard housing/standard human

Since 1980's, Neoliberalism has an effect on the political discourse in many countries. To that end, the private property rights, free market, free trade and role of private sector are foregrounded while the role of state has been degraded to create a corporate frame assuring and even facilitating the market forces and to maintain it. Neoliberalism has also lead to reconstruction of housing policies and redefinition of the role of the state in the housing sector. While its level differs from country to country, the intervention of the state on the housing sector has decreased through the neoliberal policies, the role of market processes and the private sector has been foregrounded in presentation of housing and operation of sector. Emphasis made on the market model has gained strength in line with increase of role of the private financial institutions in presentation of housing (Edgar et all, 2002). Even though the level of intervention of the state on the housing sector differs among the countries, the general tendency was towards leaving the role of the state as being the actor that furnishes houses directly and rather taking a role that will facilitate the operation of the sector.

It is emphasized that in 2000's, it is impossible to talk about a uniform neoliberalism, neoliberalism has found its expression depending on historical, political and geographical conditions (Peck, 2004) and timing, feed rate and effects of neoliberal policies vary from country to country (Forrest & Hirayama, 2009). O'Neill and Argent (2005) has highlighted that neoliberalism constitutes an agenda of probabilities for those who hold the power of realization of change. It is possible to observe an example of this point particularly in arrangements related to housing policies and housing sector in the period after 2002 in Turkey. Although Turkey has been deeply affected by the liberal economy policies since 1980's, along with the elections in 2002, a powerful governmental and politic environment that will facilitate carrying into effect the options offered by neoliberalism.

The new housing production has not been limited to the unused lands only, and it has been supported with the urban transformation projects realized in the historical urban fabric and in illegal housing areas. With many drafts prepared and the legal adjustments made since 2004, discussions on the urban transformation started to become agenda items. The urban transformation attempts that mention only renewal of illegal housing zones and worn out historical fabric in the beginning have been designed so as to include the disaster risk removal in the second period action plan of the government. In line with foundation of the Ministry of Environment and Urbanization in 2011 and with the legal arrangements made for transformation of buildings and areas posing disaster risk in 2012, the urban transformation has been made a nation-wide mobilization just same as housing production. Transformation works performed and to be performed in both illegal housing zones and in the disaster risk areas have been focused on demolishing and reconstruction – in high

density constructions in many case -, they are characterized to contribute increase of building stock volume.

Figure 16 -17. Demolishing of slums to urn-ban transformation projects

As reasons for the aforementioned new housing production and urban transformation applications, either in the government programs or in the emergency action plans or in the explanations of authorities of TOKİ and the Ministry of Environment and Urbanization, some social objectives such as providing the low-income groups with houses, increasing the living quality, developing disaster resistant housing areas, creating opportunities of new employment have been indicated. Relying on these objectives, legal regulations and implementations that pave the way for producing value through structuring inside the existing urban fabric, city-surroundings, in the agricultural lands and even in the forestry lands have been legalized. When viewed from this aspect, it is possible to say that the traces of neoliberalism in Turkey can easily be followed in the policies relevant to urban areas and in the housing policies.

In the period following 2002, there have been some negative outcomes of the facts that the state becomes a direct actor of the housing production through TOKİ in urban areas, that excessive housing production is made with economical and political expectations, and of the decisions on selection of location and urban value increases, that the urban and social needs in this process are not taken into consideration, and that the planning principles and environmental and esthetic values are not observed. (Figures 17,18)

Figures 17 – 18. 2000s, the change of housing production

Such huge collective housing settlements commencing in 1950's in Turkey and developing without relation in parallel to growth of urbans being disconnected from the local and from each other have reached to gradually increasing magnitude thanks to their typified designs resulting in breaking off all urbans from their environments. This magnitude has been re-questioned in line with redefinition of developing and physical borders of the areas that can be qualified as periphery under today's conditions. Such areas qualified as "inner-urban" have emerged as "incomplete areas" that cannot satisfy the requirements and demands of this new position not overlapping with their form and living styles as in the period they were periphery.

Another effect causing to this rapid transformation is the fact of that the country is located in a seismic belt. Due to being that the natural disasters play a dominant role, the buildings available in the existing built-up areas have been demolished without discussing first in detail on if they are historical artifacts and/or on the importance of the social and physical fabric they formed in the urban memory and without seeking solution accordingly, and consequently in compliance with the earthquake regulations 2007, it is headed for a standard production " which is reproduced/produced independent from its location/marketed by global world". Even though this case qualified as physical transformation has helped to the construction sector which is the leading sector in the country in a short term, it does not accord to social and cultural values and to the sustainability principles.

On the other hand, the concept "protection" in our country has been tried to ensure with the relevant regulation, but buildings have been tried to protect by means of laws as the protection consciousness, the basic concept of the protection, has not become established socially. To include the buildings of 20th Century into the scope of protection, they must have special qualifications such as being a work of a renowned architect, a representative of an architectural movement, and a part of a building series. In this context, a new genre emerges as the typologies of "reproduced ancient building" on a particular sense by ignoring the architectural legacy and without seeking protection ways that will assure urban integrity. In this manner, both the values comprising the local identities of urbans are lost and no data that will be an input to the newly designs to be created remains any more in the urbans that remained noncontextualized. The urban fabric internally emptied more day by day has been defined "urbans without identity and "new urban forms" have been suggested with the urban design projects developed on an urban scale under the name of urban development.

To remove this "incomplete" status, the practice to demolish and restructure has been implemented by today's urban strategies and "restructure by demolishing" is accepted as the single method. However, this irrevocable demolishing action may lead to highly significant social and urban breakups such as loss of urban memory, termination of production process of that location and interruption of sustainable development.

Although the design competitions that have gradually turned out to be a significant means of urban transformation are considered platforms which offer opportunities for exhibiting and discussing all alternative approaches, it is observed that the actual design fields have also ignored this significant transformation and kept up with conventional order. A majority of projects have been designed with "the idealized typologies of the standard global modern

living" by ignoring the lifestyle, social status and spatial habits of the existing user in the field". Considering that the major differentiations in the concepts of residence and house are belonging, neighborhood and social share, it is considered that these produced urban objects can hardly find the "standard ideal subject" it targeted.

Today, the definition of the urban transformation as accepted in the West reads "a comprehensive vision and action trying to find a permanent solution for the economical, physical and environmental conditions of a zone that provides solutions for urban issues and undergoes a change." To that end, there are chiefly three distinctive features of the urban transformation. Firstly, aiming to involve the actors who have the right to speak for the future of the said zone in cooperation with the native population and without changing the nature; secondly, including numerous targets and activities intersecting the basic functional responsibilities of the state depending on the special issues and potential of the zone; thirdly, requiring formation of functioning partnerships among the different communities of interest even though the process related corporate structures differ. This approach denies top down intervention without learning and recognizing first the contextual features of the intervention area.

Figures 19 – 20 - 21. The transformation of slums

Here, it is dwelt on that it is needed to seek paths how to protect the existing ones and how to produce without injuring identity values by talking about the issues of generation of a "new neighborhood" anew disregarding a settlement where an urban memory exists. The effects of spatial variables on the human behaviors which is a case on which many social

scientists work today have been ignored in the housing areas where many new houses have been produced at the very time. Even though the architect thinks that the physical environment cannot be dealt with independent from the human factor, she has to find out answers to some open questions and solutions to the issues in relation to the designs of primary interest. However, it is not thought that the designs created will not bring any solution to the real issues unless we do not seek for answers to the questions such as how the people make sense of the environment they live in and what kind of design they create in their minds in relation to the space. The studies headed "subject and object, residence and user satisfaction" must constitute inputs redirecting the design even the application is not started yet, rather than revealing the negations after everything is over.

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DECADE OF LOCAL IDENTITIES OF CITIES THROUGH URBAN ARCHITECTURE IN THE CASE OF TURKEY

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Abstract

As a subject matter of many researches on architecture, space is not only a physical shell in which individuals or societies engage in various activities but also a formation which contains various meanings and information depending on the cultures, lifestyles, changes in the social structures of the societies. It can be said that characteristics of societies exist in spatial systems and are reflected with the space and spatial organizations. Ultimately, each society will shape a unique spatial model that expresses itself. What is remarkable here is that the element which creates the difference between the cultures in the constructed environments consisting of similar elements such as house, street, squares, rooms, hallways and yards both on a scale of settlement and building is the principles in the organization and relations of these elements and meanings they express. In morphological studies which aim to analyze the spatial differences regarding the human-designed environments formalized in cross cultural studies both analytically and beyond perceptions, it is essential to put forward unique relational or configurational structures of the spatial systems.

Morphological characteristics of urban environments include physical constituents of urban space. These are basically related with "urban form" and "urban layout" (Carmona vd., 2003). "Urban layout" is defined by the sizes and forms of the city blocks and street patterns whereas "urban form" is defined by the positioning of the buildings in an urban settlement individually and according to each other. In this context, the components constituting urban form are the factors such as heights of the buildings, order of the structures, setback distances, building volumes. However, all of the city-wide plan changes made in Turkey have ignored the characteristics which form the morphological features of the urban environments and caused them to lose their quality and undergo a change.

In this context, this morphological transformation which gained speed in our country with 1965 property ownership law (Morphology concept of which dictionary meaning is form information, giving form information), is a concept which is followed by the modern architecture to overcome the consequences caused by the information crisis. What is modern/new has redefined the formation of ancient cities and caused especially architectural product to be alone and become a single case by cutting itself off the relations, context and a frame that will make it meaningful.

In the scope of this study, urban formation in Turkey, in other words, dissolution of the environment which defines the urban context as a result of the dissolution of the connection between the products that make a city such as structures/objects/houses will be discussed.

Keywords: Urban Structure, Design Concept, Local Identity, Housing, Turkey

1. Identity/Place/Space

When talking about identity, generally a certain continuity, an inclusive unity and self-knowledge are emphasized. Identity establishes a bond with the past and creates the future while connecting with the current world. It is the description of the search that appears during the social process of “who are we”, “who are our roots”. It does not only tell who we are but also who we are not as well as the way people describe themselves and society describes the individual.

Identity term comes from the “identitas” word which means “being the same, identical” in Latin and appears as a natural result of human as a social being and as a social phenomenon. It is described as the totality, diagnosis and identity of the conditions of being a specific person along with the signs, qualifications and features peculiar to human as a social being and identity is expressed as “the thing makes me different than any other person”.

Identity starts with knowledge; subject’s differentiating itself from the object and others. Identity is a social phenomenon and dynamic process which is shaped through interaction with the “other” and against the “other”. In another words, the identity is defined through the “other” and embodied through who or what the other is and who and what the other is not. As an otherness expression, it explains who we are not through the other.

In this context, the identity is the work of defining the qualities and classifying them based on the similarities and dissimilarities. However, an identity itself cannot represent a whole. Because, the universe and human life is a connected, unified whole where objects, events are connected to and affect each other.

In history of political thought, “identity” has been approached from different perspectives in terms of modernism and postmodernism. With modernism, human has become more than a being who is obliged and defined to obey god directly and has become a subject who carries out his own acts and deeds with his own mind thus being responsible for them and has been accepted as the “autonomous individual”.

The excessive importance placed on the human mind with modernism gave its place to postmodernism which started to appear in different disciplines in 1960s and “the truth” which is the magical term of this period. In modernism, the mind is the best road that can take humanity to the single, unchanging, universal “truth” whereas in postmodernism, it is accepted that truth is not absolute, everyone in the universe has its own truth none of which is “absolute, main, basic” and they are all equal thus the number of truths in the universe can be as many as eternity.

As the identities of people, societies, countries and institutions, the cities have identities as well. Cities are live organisms and get affected by and also affect their inhabitants. Distinctive role of identity defines and positions the cities and differentiates them from the others. Identity of the city, just like the personal identity, emerges through a constructing process and continues. Changing society and human relations requires this identity to be constantly redefined or created. In every period, the identities created by the society carry elements from the past, redefinitions of the past elements and completely new elements.

The identity of the cities is created by both social and physical structure such as the geography, topography, cultural level, architecture, traditions, lifestyle, economical structure of the city. These components are not independent from each other and their ways and

rates of affecting the city identity vary from one city to another and some specific features may be encountered more. These places where social and physical formation are discussed are generally characterized as “the space”.

Throughout the history, people have looked for an answer to what and/or where the notion of “space” is; many social scientists such as philosophers, sociologists, architectures, historians, anthropologists have affected each other with their different understanding of urban space they put forward and questioned the space, thought over space and fictionalized the space.

During the journey of conceptualizing of space, as an answer to the views which saw space as something existing not only as geometry, physical substance, a limit but also existing mentally, it is put forward that the space is created socially and society produces both physical and mental space.

For the readings of space put forward in architecture and social sciences, it can be said that they have single focus and see the spiral of space and society from only one side. Social scientists focus on the happenings in the space, day-to-day activities and social cases however they miss the effect of spatial formations on these. Similarly, architects box themselves between the physical qualities of the spatial formations and cannot explain the spatiality of the formation type of the societies. For this reason, society-space notion which stands somewhere interdisciplinary cannot be read through a single approach neither by the social scientists nor the architectures. This situation becomes a problem when a “ space” to be able to be read in both disciplines.

At this point, it is possible to say that one of the problems in architectural knowledge and application area is that space is perceived as a mere two dimension through a map and social and historical background is ignored. Both in project studies carried out in architecture schools and urban transformation projects applied in current fields, the intricate and folded structure of the space and society is not quite cared about. Development and improvement of social structure of the space as well as physical structure is regarded as a waste of time and money especially in profit oriented projects. Therefore, it is possible to say that almost in all the projects applied in urban spaces in Turkey, the social structure is being unrooted from the “space” and pattern where it is shaped and many people are removed from their places and their housing rights are being violated. In this sense, the distinction should be made that not every space is a “place”, “place” carries many more different, plural meanings especially in phenomenology and human geography literature.

In order to consider space as designing object, we need to examine not only the physical ones, but also the “place” which contains society-space in itself with all the historical, economic, political, social, mental, perceptual, empirical, visual, etc. layers. Accepting that not every space is a “place”, but “place” carries many more different, plural meanings especially in phenomenology and human geography literature than space should be noticed also in the scope of architecture and urban researches. Putting forward this difference and expanding the reading of space to understand a “place”, understanding the daily life and different ethnical-cultural-traditional differences and experiences as well as physical space can be said to carry great importance in the evolution of design in this direction by analyzing the individual and social behavior patterns.

2. Redefined Identity/Moving from Traditional to Global in Cities of Turkey

The dynamic and tense relation between the “space” and “place” have been discussed for many years. It is thought that space is a giant physical form that wraps around everything whereas “place” inside this space is more of specific locations carrying meanings rather than being an absolute form. Heidegger has made the distinction between space and place so long ago and questioned whether the physical space ensures a “place” for everything or not. However, speculations about space which increased after speaking of “the spirit of place”, breaking its homogeneous structure addressing its physical locations has caused it to evolve into a heterogeneous and layered formation after which the definition of “the identity of place” has become marketable and “relocatable” as a “local” identity”.

When we go deep into the local identity discussions in Turkey, it is seen that there is an environment created by the ones who digest its root and create a new value and the ones who make it meaningless, disjointed from its context. This subject matter which is one of the focus points of the identity discussions in architecture has come up with the question of “nationality-universality” many times in Turkey and it is observed that this “groundless” new comments are still increasingly produced. The reason for this is that the discussions in the field of design are being carried out in a limited ideological scope and the architectural tones come to the forefront with the association of “fanaticism-modernism” and “obscurantism-progressivism”.

Rapid spread of the “Modern Architecture” movement with the consumption society project and its causing an identity crisis which appeared with the human being gradually detached from the nature, their history, society they live in and from themselves mark the beginning of this formation. The changes which identity thought has gone through as a result of the epistemological and ethical crisis occurred in western civilization also constitute one of the main problems of postmodern argument today.(Hoffmann, 1980).

The fantasy of distances of place and time type (other geographies, far past or future) and fantastic searches falling far from the limits of thought have enabled the main escape from the reality. The most domain part of the movement has looked for the cure for the disease it diagnosed in reviving the long lost past; for some, going back to the exotic sources of the far geographies which modernism yet to reach and for others returning to the pre-modern sources was the “vernacular” solution. Because folklore has represented a resistance against a destructive development and cultural sustainability as opposed to the high tone which is closer to represent the material production of the culture, technical development thus progressive order.

It put forward the concept of “culture” as an alternative against the new world civilization whose destructive affects started to be felt. Thereby, the “civilization” term has been associated with the materialism and pragmatic rationality of the progressive order whereas “culture” term has been attributed an idealist meaning that contain sentimental values. Civilization has been dignified as a universal condition and gained status whereas culture has gradually earned a content limited with the local values and become idealized. On the other side, all these discussions are observed as the effort to reveal “new identity” which is idealized with the new century.

Figure 1-2: From the traditional to global

At first, advocates of the “civilized” thought glorified being “modern” which is an international ideology that removes geographical, religious, ethnical borders, the advocates of the “cultural” thoughts defended the traditional orders which modernism rapidly invaded and consumed. With the freedom and democracy ideals, this new face of architecture supported the emergence of nation awareness and a world civilization ideology based on the claim of “universal facts” and increased the stress on the notion of “from the traditional to global”.

As such, architecture throughout the history has staged political conflicts. With the emergence of idea of nation, the discussions of style in architecture have brought along the problem of national identity. It was only natural for a folk which newly began to build their nation to search for an identity by themselves that will symbolize and strengthen their national integrity. This search has continued with the selection of the images to best represent this or that wing of the aforementioned conflicts.

Modern Movement in the beginning of twentieth century wanted to dissolve these conflicts and reach a new synthesis. The reason for calling this synthesis “Modernist Tradition” lies on the fact that it is a term that contains the progressive spirit and the sustainability of the existing traditions and saves “modern” and “traditional” notions from being opposed to each other. On the other hand, those who defend that a modernist tradition can only be talked about in a paradoxical way are right.

In Turkey, the search for identity has continued with the discussion of “whether our identity should be national or universal”. In the Early Republic Period, the searches for national style did not bring a permanent solution to identity search. In a short time, with the victory of practice though not with a conscious search, the most indelicate local applications of international modernism have given today’s look to our cities.

For as long as Republic Period, the question of identity has revolved around the dilemmas such as east-west, national- universal, piety-secularism. The confusion resulting either from the geographical position between the east and west or the preferences of being devoted to Asia, Anatolia, Ottoman and Early Republic legacies have been the source of the hesitations which show up in various fields of cultural production.

In addition to being related to 'modern vernacular' construction culture which can be observed all around the world due to its genetic structure, information practice and general appearance, endemic processes have started to be mentioned peculiar to Turkey in terms of processes.

First "new identity" searches which was named as a period of "Early Republic Instability: Between National Movements and European Modernism" by Aydan Balamir have been supported by the founders of the Republic. It has been claimed that there is a strong sentimental relationship between the "new nation" and "modern architecture". This architecture correlates with the progressive ideals of the young nation which had undertaken a radical western "civilization change" project. Construction of a new capital provides all the possibilities to start the designed civilization change from scratch; the spaces and fitment of the city are seen as a more effective tool than the modern outfits in terms of being the indication and motor of civilization. In this perspective, Modern style housings produced in new cities of Turkey has been effective in the rapid spreading of a new western style life and visual appreciation culture in a western style.

Figure 3 – 4: Construction of a new capital

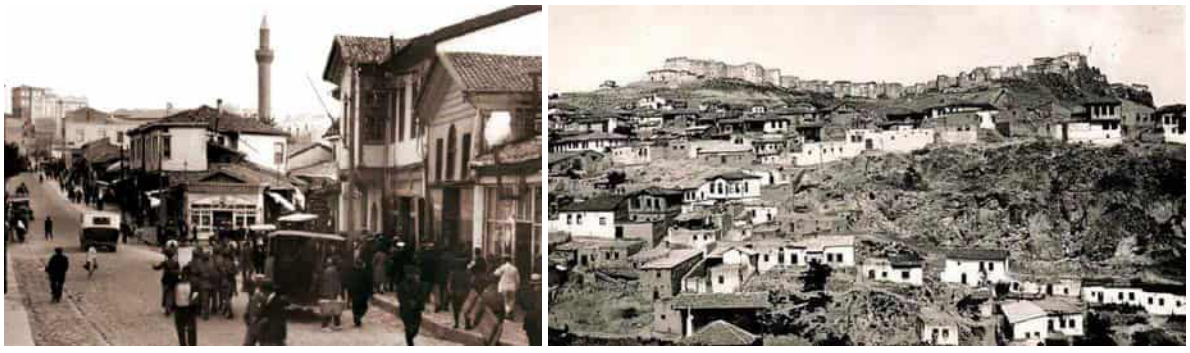
On the other hand, Eldem's approach called as "2nd National Style" was the adaption of Anatolian region architecture – or in a more specific way, wooden houses – to the modernist architecture manners. While "1st National Style" which was the adaptation of Classical Ottoman forms were perceived as obscurantism, architecture history and criticism has regarded adaption of regional architecture in a more tolerant way. (Figures 1,2)

Figure 5. Eldem's Taşlık Kahvesi - Figures 6. Eldem's The Faculty of Arts and Sciences

He dated the stages of Turkey architecture which develops every decade consecutively since the establishment of Republic in 1952 as follows: 1925, 1935, 1945 and 1952 – New Ottomanism, European avant-garde, New-Regionalism and American Modernism, respectively. The 50s when multi-party system was adopted, witnessed a change in the concept of 'West'; now the Americanizing period had started in architecture and life culture. (Figures 3) As well as the foreign aid flow from America to Turkey, the allies during the Cold War Period seeing the dream of being each a "little America" in Turkey shaped the direction of cultural identity and the matching architecture. Now with 50s, the production in private and public sectors will have the American Modernism lines.

Figure 7. illustration of Ankara Architecture History - Figure 8.

1950s witnessed "point and flat block" style buildings which were produced in accordance with the CIAM principles in the planned housing settlements as almost everywhere else after the 2nd World War. The select examples of such buildings were the qualified applications which had taken in the collective housing experience and modernist language of the west. However, what shaped the big cities were not the select examples of the high modernism. Housing problems arouse from the rapid urbanization due to migration from rural areas and capital insufficiency for new housing attempts caused direct occupation of the urban soils or unqualified development based on unearned income. The development of "slum cities" and zoned "apartment cities" were almost parallel.



Figures 9 -10. Slum Cities


Figures 10-11. Apartment Cities

Starting from the end of 60s, mosques centered in the unlicensed slums especially around the big cities where migrants from the rural were living thus as an indication of an unplanned growth of “the so called planned Turkey cities”, new, disorganized and non-foundational slum cities started to formed. As a result of the dense migration to cities, the moving population was positioned as “immigrant” and forced to face an identity problem. This problem has started to be describable through material problems of a population with an unidentified social class who have been overwhelmed and scattered inside the wheel of big cities more realistically than the sophisticated questions regarding cultural superstructure such as eastern-western, local-universal.



Figures 12-13-14. Slums areas and the transformation of slum to apartment blocks

There were primarily two diversifications of buildings produced in this period: blocks subject to same structuring conditions, built singularly on small lands; or large and small block clusters most of which were produced collectively on big lands in batches. First one of those two were closer to being a city pattern with their standard size and similar mass arrangements. If their architecture was elaborate, if their community facilities and landscaping were in place, and especially if they reached an urban-specific heterogeneousness with their grocery store-greengrocer-barber in time, the result would be positive in terms of urban life. Others, on the other hand, they were less talented to be a city; when their suburban morphology and social homogeneousness came together, calling these settlements not a “town” and certainly not a “city” but only a “compound” was indicating a problem about the urban identity to be faced later on.

Building stock which creates the visible identity of the towns – low rise and multi-storey apartment houses – were carrying a sustainable building craftsmanship as well as their architectural characters. Among the factors contributing this, seriousness of the contractor institution should be counted along with the well-raised architect, engineer and technical staff.

Democratic Party’s moving partially away from the statist agenda and paving the way for a liberal economy, an action started to be taken in every sector through private enterprises. Models developed by the small-size contractors in building sector put the production of town housings into a new track. Driving power of the production was the capital created by the small savings of future house owners and “fragmented ownership” which facilitated this – condominium legalized since 1965 – created a new social stratification along with the new urban life and building culture. Before, starting mostly with “sell from foundation” and moving to ‘build-and-sell’ model where the customer is completely anonymized, the relation between the architect-customer-contractor gradually ruptured. Before the condominium property law, apartment buildings were serving a source of honor for their owners and a favorable environment for the architect to show their abilities whereas the architectural services which were reduced to anonymized customer, unqualified contractor and license technicians revolutionized the building-life culture.

This dwelling production which is peculiar to Turkey has shown itself almost in every settlement without taking into consideration the historic fabric of the cities. Density increase which was frequently applied in the planning for zoned areas gave way to a mere practice blotting out early modern dwelling examples as well as traditional architecture. Most of the Anatolian cities lost their historic fabric in a total of half-century period starting from the 50s, gaining speed in the 70s and climbing up with the liberalism of the 80s. the country which was able to protect its cities from the destruction of the Second World War destroyed its historic cities with its own hand.

In this period where all the traces of multi-cultural fabric which the Turkey cities had, material, typology and marketed ideologies offered by the global world replaced the local fabric, street and similar criteria as a new designing input.

3. New Face of Turkey Cities / The State of not being able to Join the Pieces Together

The designing palette of “Global Architecture” which was marketed spread swiftly with the 2000s was consisted of innovative architecture languages created by “high technology” and the traditional languages which tried to create “high class” fantasy. A similar diversification can also be observed in the contemporary building practice of Turkey however, high technology end of the palette can also be seen mostly in the production as much as the other end.

The growth building industry showed in the past 20 years was in terms of the abundance of material rather than a radical innovation and experimentalism in the architecture technologies. Antiseptic-hermetic building practice which was widespread in the world have been naturalized by adapting into local conditions. A new vernacular was born with the façade system in various qualities covered on the reinforced concrete frame: ‘panel work architecture’. This practice that includes multi-storey buildings almost as tall as skyscrapers as well as small sized office buildings, showroom, supermarkets spread like a virus to every corner from the middle of the metropolitan to its eaves and countryside with this identity exercise built on the mass and surface plays and cause a new settlement language to be established which has nothing to do with the “local”. However, this language triggered the creation of an environment where incomprehensible, unattached city pieces stand together. Most of these buildings which offers a deceiving high technology image have become a demand of the market with the cliché solutions where in fact this “new building stock” produced in fact in a low technological profile, imported material and equipment is extravagantly used. This new vernacular which even became one of the dwelling options for the high income people is marketed with the “smart building” slogan. While the limits of the mind extends to comforts such as handling technical services from a remote, mind and ethical issues based on the sustainable consumption of the resources are not included in the designing inputs.

In this period, advertisings of the real estate industry included “privilege” being in the first place, small town publicness and revival of the feeling of belonging to somewhere. These emerging new solutions, ironically, constitute a new big part of the fragmented town fabric which is formed by the closed community settlement solutions living behind the “securely gated compounds” which is completely based on the loss of public spaces.

This way, this “new collective housing suggestions” has ended up with a loss of a very important opportunity despite the big capital invested in this fields due to lack of a system demanding a high level designing and application standard. This housing cluster designs associated either with modern or traditional which are built around the semi-public areas such as yard or side streets appear as “new and detached from its context, global marketing typologies” without including any of the discussions such as “local identity/context” and collective identity searched which were missing in the suburb settlements.

When these dwelling stocks produced in this variety since the 90s up to now are considered in an urban context; they create a “new fragmented fabric” built next to each other but independent of each other /without any context. On the other side, instead of this new fragmented and unassociated urban fragmentation detached from the context, understanding and reinterpreting the Anatolian housing tradition which form Turkey geography is considered as a new solution. If we want to redesign and transfer with a

New/Contemporary expression (instead of direct quoting, reproducing with our own terms), first of all it must be considered that we need to define construct characteristics which give identity to the traditional town fabric or in other words typological characteristic that this construct has created.

An important characteristic of traditional fabric in Anatolia, is that houses which are in fact independent of each other become united with garden walls when looked at from the street in a way that give impression of a adjacent pattern. This constant wall which gives positive space quality both to the street and the yard serves as a transition platform that interlocks the housing form with urban form. This typology enables the continuity of the platform to be cut on the upper storeys and houses to become in a singular order. This “urban wall” creates a flexible fabric; even though its physiognomy changes depending on the regional conditions and tectonic features, richness of its role in creating the fabric and urban space always stays the same.

It is clearly observed that state of being in a street which creates a sense of stability in terms of space, “being in your own street” cannot be achieved with the fragmented settlement plans in which apartment blocks of today are filling. “spatial hierarchy” in the traditional sense is formed depending on the cultural habits which also forms the social organization. Type is an abstraction and it is not possible to talk about a single “type” in Anatolia. It is the description of living habits in the space that were collected for years by the geographical, climatic, cultural diversification. Moreover, it appears as a very significant spatial factor that enables the formation of inside-outside, private-public dialects and created a bonding city-specific typology.

Figures 15 - 16. From traditional housing to standard apartment blocks

On the other side, in new collective dwelling settlements where zoning is not binding, dominant understanding of current dwelling market repeats its same groundless, block prototype. This understanding can be summarized as the familiar apartment blocks being as tall as possible and mostly being aligned on road schemes that mostly end up with movement chaos. Even in the education instructions where are expected to overcome market rules, it is highly thought-provoking that the students are repeating similar solutions for collective dwelling projects. In this case, the way to deal with the market conditions seem to be depending on the increase of out competency level, in other words refining our designing capabilities as well as forcing the limits of our authority.

What’s important is that it is necessary to increase the sensation richness and use values of the spaces by overcoming the typological poverty, to make subject invisible, in short, to prioritize fundamental elements of architecture rather than style concerns. In fact, many theorists say that architecture, in its essence, is related to “doing” more than anything.

However, aforesaid creativity does not mean creating something from scratch but rather re-creating which means “uncovering”, in other words, poiesis. Poiesis is at the center of the world and requires to give up on perceiving all the world as a body of usable objects, to learn to retrieve yourself, grasp the flow of nature and become a part of it rather than being its viewer. In this context, knowledge of doing is not a knowledge that can be attained merely with mind abstractions. It requires to see, listen, contact, preserve and become a part of it. However, the dominant “doing” type in the modern world is technology. The reality of the world is thought, produced, furnished, inspected through technique.

At the first half of the 20th century, type and style had been perceived as an obstacle to creativity rather than making creativity possible. In the architecture after 1980, this so called freedom (or unqualified independence) emerged when modernism disengaged from the moral rules have created its counter argument in a short time and production continues to repeat itself rapidly.

4. Concluding Remarks

Architectural identity argument of today does not revolve around an identity claim of a folk but around new orientations which emerged with the domestic and worldwide developments. We are being affected by the new option search of surrounding countries against the central as well as modernism questioning which is from one point is self-criticism of the west.

Besides the fact that Third World and Islam Countries are in the category which needs this questioning this most; and they also appear as countries where traditions are most strikingly interrupted and where the most unsuccessful examples modern architecture are dominant. However, along with this questioning, it is a very important discussion matter as to how declaring modernism as the scapegoat and blaming western civilization for the occupational failure in their naturally underdeveloped architecture practice creates an objective perspective when they are yet to solve their most basic problems. The production practice, ignoring the fact that it could not produce any thoughts but only imports from the West as the world is changing, - well no objection to imported thoughts when needed – but it could not produce any value by qualifying what it has imported, has been criticized academically while it has no return both legally and in the application phase.

As Ricoeur strikingly mentioned, ‘single world civilization’ which spread into every corner of the world completely destroying local characters is not something anyone approves of. On the other hand, while searching for ways of escape against the destructive affects of a stereotyped world culture, producing local diversifications of Kitsch’m which is so called traditional that develops based on the fashion and market values but in fact is also an international practice is presented as solution. Both carrying features from the past and cathing up with the age at the same time is reconciliation problem that requires great care and skills. In our days where strategies that reconciliation between the opposite world views are esteemed, the approach which Frampton (1983) re-described under the name of ‘Critical Regionalism’ proposes an architecture that internalizes the local qualities and redefines them with contemporary terms rather than directly quoting from the tradition.

He also points at an inevitable dilemma of the modern society (especially developing societies which entered the modernization process by force): on the one hand entering the

progress race at the cost of destroying generally cultural resources; on the other hand protecting cultural resources at the cost of stopping the progress. He searches for an answer to the question of are there any ways to prevent the negative affects of both option as much as possible, in other words 'being modern and sticking to tradition at the same; both being inside the universal civilization and also keeping the national culture alive?'.

In current order, it is possible to talk about an urban identity to be gained through "establishing a language" by unifying the style in urban areas against the question of what different style searched may bring other than a superficial image. However, structuring of the apartment buildings in a fragment order and in different times is even an obstacle to this. For this reason, the positive aspects of the tradition of 'perimeter blocks' that are in adjacent order which form the historic fabric of western cities can be indicated. Adjacent order in the scale of urban island not only requires the integrity in one size but also provides opportunity to the outer spaces defined in either along the street or avenue or along the backyard and yard.

Perimeter block typology's regaining high importance in the city designs is a clear protest against the "object buildings" notion that ended up with the reversal of shale ground relation in the form of cities which is one of the most criticized aspects of modern architecture today. Transition to singular block tradition surrounded by an undefined space from the building tradition shaped to surround a defined space is seen as one of the most unforgivable mistakes of the modern architecture (Dennis, 1986; Ingersoll, 1989). It is clear that Turkey cities are being built based on this notion and traditional settlements are being repeated in anyway at the cost of completely rejecting the building-space relations.

Although we share the same view on a city basis, when it comes to dwelling settlements, it becomes hard to remain neutral against the failure of singular block applications in Turkey in terms of environment quality. In Turkey, there have been very few attempts for zoning order which enables a design on an urban island scale except for few examples from the First National Architecture Period (for example, Kemalettin Bey's apartment buildings in İstanbul and Ankara in perimeter block order). Whereas, adjacent order was quiet popular before today's singular blocks became the only model and could create an urban identity on street scale. Towns of İstanbul having different land sensations such as Akaretler, Kadıköy, Şişli can be given as examples.

Figures 17 - 18. Street view from Akaretler /İstanbul

If we want to present Anatolian dwelling tradition with a contemporary expression (restating with our own words rather than directly quoting), first of all we need to define the fictional qualifications that give identity to traditional urban fabric. An important feature of

traditional fabric is that the houses which are in fact independent of each other unite with garden walls in a way that will give the impression of an adjacent order when looked from the street. This constant wall which gives positive space quality both to the street and the yard serves as a transition platform that interlocks the housing form with urban form. Without forgetting that street fabric is apart of the urban identity, it is necessary to be aware of the values of the "local identity" elements, in other words, values of the cities that grown piece by piece by overgrowing today., the necessity to examine "the place" which also includes society-space with the its historic, economic, political, social, intellectual, perceptual, empirical, visual, etc. layers to understand the physical rather than thinking of urban space as a design object should be thought.

In this context, keeping the fictional qualities of traditional dwelling order alive brings together the necessity to abandon the current law and legislations and resort to new arrangements in order for the searches that can keep the traditions in 'picturesque' details to be included in the settled urban order. In new collective dwelling settlement where zoning is not binding, it is imperative to pass over dominant understanding of current dwelling market, away from the "market demands this" notion and go towards a design understanding where "ethics and morals" are prioritized.

Figures 19 – 20 - 21. In Ankara, the transformation of traditional dwelling

Figures 22 – 23 - 24. In Mardin, the transformation of traditional dwelling

Figures 25 – 26. In Safranbolu, the transformation of traditional dwelling

Figures 27 – 28. In Nevşehir, the transformation of traditional dwelling

Even in the education institutions where is expected to overcome market rules, it is highly thought-provoking that the students are repeating similar solutions for collective dwelling projects. In this case, the way to deal with the market conditions seem to be depending on the increase of out competency level, in other words refining our designing capabilities as well as forcing the limits of our authority.

It is not that important whether our apartment buildings which are mostly diversifications of some cliché plan schemes carry things from the past or evokes the future. As long as apartment order can handle more vital problems, it should not be considered harmful to leave the preference of style to personal taste. What's important is to increase the sensation richness and use values of the spaces by overcoming the typological poverty, in short, to prioritize fundamental elements of architecture rather than style concerns in which case, there is no any reason not to achieve a good architecture with multi-Storey order.

In fact, although it is not necessary to find a "good "model to be reconciliated upon as a nation (as it is not possible), it is expected from a good architecture product either not to ignore its cultural context in the beginning or to be strong enough to create its own context (and an unprecedented new age identity).

The thesis is of the opinion to learn from the alternative program's mistakes rather than tossing the modernist project aside. On the other hand, as mentioned in the beginning of the article, the mistakes of the thesis which described historic progress through a linear progress model thus assuming that there is no way to escape from modernism is apparent. In fact, radical modernism has already diagnosed this mistake itself and delivered that the indicator of modernism can only be the free will. With Baudelaire, the idea of seeing modernism as a compulsory condition has already lost its validity.

Bearing in mind that identity is described as "the thing that makes me unlike anyone", it is urgently needed to reviewed the relation of the design environment produced today which promises "independent of ground" "new identity".

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THE PLACE OF ANCIENT KNOWLEDGE IN THE DYNAMISM OF BODY-SPACE

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Abstract

In the places where life quality of the society is high, the relation between the conventional and contemporary has always caused tension. Being innovative and adopting technology has been regarded as an indispensable condition of development. At this point, the question of what interpreting the ancient knowledge which forms the content of conventional as a world of meanings rather than interpreting it as "old" can produce constitutes the content of this article. When considered from this aspect, ancient knowledge can be re-interpreted with each period's data. Wade Davis in his book called The Wayfinders focuses on the importance of ancient wisdom in the modern world. He talks about ancient knowledge as archaic voices which have lost its functions today. He also suggests that each of these archaic voices can be regarded as advise for today's contemporary practices. In fact, he reminds us that ancient knowledge can develop alternative ways in guiding people both spiritually and experimentally.

Space, on the other hand, is an experience area which can argue this situation. Each style of production creates unique spaces. Moreover, what gives production and consumption relations social assets is the spatial formations. Space lives and sustains life, produces and is produced. With these facts, we come across with the production of space concept of Henry Lefebvre. According to Lefebvre, "space is never an empty, given basis on the contrary it is something that always produces with social practices. From this aspect, space is both the social production process itself and its prerequisite. According to this approach, culture is the result which is produced by this process. Production relations carry its own conflicts into the production process of the space. Therefore, Lefebvre states that space has a history engraved in the space. It is possible to discover ancient knowledge from this history over space and analyze it in today's design practices. In this article, relation types of the body with the space production type through these analyses will be discussed.

Keywords: Ancient Knowledge, Cultural Heritage, Body- Space, Production of Space

-*Ancient :* Something without a beginning, old, eternal-

Ancient knowledge is originally hidden in the nature. It incorporates even artefacts and turns them into today's archeology when the time comes. This archeology becomes our biggest bond with the earth we are standing on to interpret the present and establish the sense of belonging. There is no politics in the cycle of nature. Likewise, social or economic balances are not changed by the nature. Its own cycle is in motion. Human, by his nature, is a part of it. However, thinking human separate from can be the biggest future danger. Thinking as a whole requires caring and owning the ancient knowledge received from it. Thus, it can be understood that sheltering as a basic motive is an attempt of human to create a defined space in the nature. With this perspective, it can be said that search for creating existence between the ancient knowledge and nature started with sheltering practice.

As the most common building type of all time with various cognitive meanings, "home" is a kind of building that is much more than a structure that brings together stone, bricks and other materials but it is a kind that constitutes the intersection of the society with a private space belonging to a family and individual. Each production style produces peculiar spaces. Moreover, what adds social values to production relations is the spatial formations. Space lives and maintains life, produces and is produced. We come across with these facts with the concept of production of space of Henry Lefebre. [1] According to Lefebre, "space is never an empty, given basis on the contrary it is something that always produces with social practices. From this aspect, space is both the social production process itself and its prerequisite. According to this approach, culture is the result which is produced by this process. Production relations carry its own conflicts into the production process of the space. Therefore, Lefebre states that space has a history engraved in the space. This situation does not cause a disconnection from the technologies and relation types of the time but it can create alternative and substantial aspects to these relations. If we need to read the space through historical layers of the space, cities as the representatives of modernism can be a means of study. Paul Virilio sees this addiction as an important factor in our development as a human and existence as a cultural being and he claims that being more independent from the earth, being detached from the gravity is the end of the human as we know it.[2]

Home describes spaces which belongs to individuals and families that they use for living, working, sleeping and nutrition and maintain their private lives. In addition to this, traditional style of home which consisted of a series of common rooms and separate sleeping spaces have gone through some radical changes in the last century and the opportunity to express oneself with the design of the house has created a new experimental field for architecture. Changes in the social order also affect this experimental environment. Architects today design houses for many different kinds of users. Families with one parent, couples without children, large families with more than one generation, etc. There has been a rapid progression in especially computer and construction technologies in the last fifty years in parallel with the social changes and more and more opportunities come out each day for the users it provided service to. In this process, there is a double interaction environment. First one is the sheltering habits that come from a couple of generations ago – maybe even older-. The other one is the new living habits that appeared with the attempt to keep up with the modern world practices.

Wade Davis, in his book called The Wayfinders, focuses on the importance of ancient wisdom in the modern world. He talks about ancient knowledge as archaic voices which have lost their functions today. He also suggests that these archaic voices can be regarded as advises for today's contemporary practices. In fact, he reminds us that ancient knowledge can develop alternative ways in guiding people both spiritually and experimentally. Attempt to survive in new life practices can be culturally and identically defined as long as it does not move away from the historic layer which makes human meaningful. [3]

Heidegger says that "being there (dassesin) is the same as existing". A being is only possible in a being space; as sheltering is a requirement for human to exist, earth is required for human as well. We should see the earth not only as a link underneath our feet that protects us from disappearing in the space but as the first shelter of our existence. Heidegger also claims that existence is related with the history of the earth and it becomes darker with the disruption of the earth, standardization of human and simplicity that is becoming widespread. [4]

Change of the body and the interaction with the environment it is in through the factors of time and speed puts forwards the fact of re-questioning the relation between this two. Space, use, multi directional relation between the user and space carry great significance at this point. Basic motive between body and space is sheltering. –sheltering-home-housing Housing which is the equivalent of sheltering in today's world is designed as an equivalent for all kind of requirements of the body. The most critical issue in housing design is the free bodily actions of the users and the use of the space in line with the decisions the body will make as a result of these actions. [5]

Home of which first examples were built with contextual data and seen as a need can find different ranges today. The reason of this can be body's defining itself as an individual and the attempt of taking up a position of living as an individual. Individual is now the side of the space which asks the questions of what, where, how. It can decide on the style of the "housing" with the knowledge of its requirements. The dynamism of the user inside the space and its harmony with the space is explained with individual behavior. Behavior-adaptation theories question the dual status of adaptation between the space and user. Behavioral differences during this dynamism and adaptation process are also related with the connection between the environment and behavior [6]

When we talk about housing, we actually start to think about the activities the user carries out. The user has physical counters that change through the cycle of life. Space maintains its stable status however these physical demands and changes transform the space as well. Activities constituting this variable structure are mostly shaped culturally and socially. Some housing schemes are created a result of this interaction. These schemes have turned into a universal Knowles inside a social structure. For this reason, while environment tries to establish a bond with the user physically, it actually locks on the schemes and patterns created before in the mind of the user. [7]

Rapoport states that physical elements do not only produce visual and cultural categories but they also create a meaning when they are matched with the user schemes. Now in the 21st century, most of the population live in the cities and shaped by the

sheltering culture the city offers. Thus, home is not user-oriented rather it is produced with the architectural identities transformed in the intersection of the city and its modernization [8]. According to Maslow user categorizes its needs as physiological, security, sense of belonging and self-realization. What is important here is that user needs do not only have physical contents but they also include subjective qualities such as self-realization. [9] [10]

Today's cities which are detached from their traditional contexts also host the space of modernism. However, the context and scope of how the cities which are shaped with this attitude shape the life is critical. As Robert Park, city population scientist, says "city is the most successful attempt of human in rebuilding the earth mostly in a way he desires. However, if the city is the world human created, it is also the world he is obliged to live from now on. This way, by building the city human indirectly has recreated itself without any open explicit perception as to the nature of his duty." [11]

People who are surrounded by things like socio-economic balances, global relations, disappearance of languages, technological developments, population explosions, migration are also having problems due to for example cultural deprivation, climate change, inorganic food. Especially the urban profile detaches their binds from the knowledge coming from their roots while reconstructing themselves. Aldo Leopold said that "There are two emotional dangers of owning a farm. First one is that people need to cultivate a garden to protect themselves from the danger. For the avoidance of confusion, this should be preferably done in a place where there is no supermarket around. The second thing is that people need to place a good piece of oak log on the iron furnace and burn it to protect themselves from the danger. And he would better do this in a place where there is no heater around and let it heat his bones while blowing snow of February hits the trees outside. If someone cuts, crumbles and stacks his own oak tree to a corner and thinks about the meaning of this while doing it, he will now remember where the heat is coming from and acquire many rich knowledge however this knowledge is not granted to those who spend the weekend lying next to the heater in the city." [12]

Throughout the process of development, humanity has tried to understand the life cycle. This situation can be thought to be caused by the search of making a connection with the others. While fictionalizing the environment surrounding himself singularly, he is after interpreting all kind of bodies. From this point of view, ancient knowledge serves as a guidance. With the awareness of this importance, the future can be more enriched.

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URBAN AGGLOMERATION AS A SOCIAL DISASTER AND MIGRATION TO RURAL SPACE

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Abstract

Cities are shaped through the influence of dominant ideology, historical layers, micro-political strategies, large-scale transnational companies. Cities are assumed to be constructed by planners and architectures. In reality, the dynamics which shape the city in a forward-looking way are the behaviors, experiences of the residents and the effect reflected as a result of their relations with each other. Although this interaction may give positive results it can also create negative effects. Crime, noise, epidemics, unqualified housing, being deprived of green and earth, high cost of living, traffic, decrease of purchasing power… Buying a castle in a rural part of European continent can be much cheaper than buying a flat in New York or London. However, people have continued to migrate to cities facing all these costs against the opportunities big cities provide. This chain development process is called 'urban agglomeration'. As a benefit of this agglomeration, social opportunities have increased and a city culture produced by public spaces has been created. Although there are positive aspects as above, the challenge in reaching these positive aspects create the negative aspects. In most part of the world, urbanization does not develop in a healthy and qualified way and the 'agglomeration' quality differ from one city to another. Unqualified 'agglomeration' drives ten millions of people to slums which are deprived of basic utilities such as electricity, clean water and internet. Therefore, although population explosions in the cities are designed and foreseen, they generate important questions and problems about the future of the cities. Many people migrate due to wars, economic fluctuations, political reasons as well as these problems. 'Agglomeration' can be encountered in other ways in addition to cities' own processes. In addition to all these reasons, the change in the means of production and development also changes the direction of migration orientation. Migrations which are mostly considered as from rural-to city and from city-to city now can be developed from city to rural as a result of 'agglomeration'. Especially the relations the migration from city to rural will build in terms of sense of belonging will constitute the subject matter of this article. It is believed that the reasons creating this type of migration is not only the urban life habits of the individual but also the desire to create an intimacy and contact with the nature. This situation will be discussed through examples that create their

physical space in the nature by migrating to rural areas but sustain their urban life practices in terms of means of production and communication.

Keywords: Urban Agglomeration, Migration, Rural, Body- Space, Production Of Space

Design chooses to understand disciplines through human nature. Whereas design approach which thinks over the space argues human body through its experience and dynamism. Body is faced with the current world that it was born into. Each action taken to know its surroundings serves as a base for its next move. It turns the experiences gained over itself into knowledge. It can both produce its own product and also feed from an existence of an environment acquired traditionally. It also intervenes with its own space during this acquisition process. At this point, it can be seen that the space the body produces through itself is a result of the dynamism and interaction. Existence of environment and natural conditions or desires of the body define the borders of this space and cause structural correlatives. The return of comprehension and cognition of this world can be reflected upon the totality of the space. For this reason, spatial borders actually appear as the results of the experience.[1]

In this case, understanding the body and building a living space require a plural encounter. This situation turns the human into a being that needs to be read through qualities rather than as a quantitative value. Quality space, on the other hand, requires many different perspectives to be considered altogether. Each factor that we are born into and shapes the life cycle becomes significant. Most of the environments born into are cities and a significant rate of the world population is shaped by the urban life practices thus the body space relation needs to be discussed over urbanity. However, cities host the bodies more in a subject position rather than an object as the impressive element of the space. [2]

In this case, the party that makes the production of the space is the city which turned into a subject and the managing power. Accordingly, the objectified power of today is the politics of economy of this environment and is certainly not enough to comprehend the relation between the space and body. On the contrary, it is necessary to understand human structure within the resultant of layers such as social, cultural, historical. The life can be quality and subjective only within the context of effects of each of the titles above. Understanding and discussing this multi-layered relations network do not seem possible in the empirical structure of today. Doğan Kuban relates this empirical structure with having two unforeseen dimensions in the relation between the urban environment and human. He evaluates these two dimensions as “human and its behaviors” and “politics and its affects”. He thinks that the basic problem arises from the complex nature of the megapolis which became an equivalent of contemporary city and 21st century and its chaotic growth and the fact that we cannot comprehend its problems. If we were to analyze this plural structure in terms of human settlements, we come across with the term of ekistics. “Human settlements” term almost corresponds to “human life” term. These two terms shape each

other. Consequently, with all of its components, true ekistics structure environment defines a comprehensive thesis and research field which discusses the historical development of all the actors which are parts of the physical structure, social and political laws and the transformation and even the inter sections of their relations. Wide repertoire of ekistics concept covers urban planning and social planning as well as building design and includes regional planning, geography, geology, agriculture, human psychology, anthropology, sociology, culture, ecology and even aesthetic fields. When the interactions between the human groups, humans and politics are examined, these relations can define the ekistics theory as the combination of human science, technology and art." [3]

The reduced status of this plural structure is explained by İhsan Bilgin in today's life practices as below; "Lately, we are witnessing that the subject matter concerning our professions are separated into 3 different sectors that cannot be related with each other: first sector deals with the practical social context where constructed environment production takes place (development plan law and applications, illegal housing, unearned income and plunder, land mafia, etc.): second sector deals with the specific status of architecture within this social context (customer relations, fees, occupational ethics, application problems, etc.); and the third sector deals with the attitudes and occupational formation which the architect may adopt during the formation practice of the physical environment (architectural movements, aesthetic values, preferences regarding technology and material, education, etc.). If these sectors which are separated from each other succeeded in solving the problems they expressed themselves within their own lanes, or if they succeeded in developing a clear and coherent discourse that does not turn back to where it starts and close on itself, there would not have been any problem left. However, just the opposite is happening; first one reaches to a pitch-black environment in which it is impossible to act properly; second reaches to an occupation that is not understood and is victimized and the third reaches to a relativism that justifies the attitudes altogether; they go back to where they start, and rediscover their acceptance of the beginning through a short cut at the end and cause a short circuit." [4]

The period of 20th century had intended to direct the destiny of the cities in various ways. Considering the body as an object as a center becomes harder when thought over the space and looked especially through a city and the body becomes objectified. However, 21st century practices see this object as a programmable structure and shape the living spaces accordingly with the existing of rapid developing technologies. In this context, it is required to understand the space through cities. Because, spatial structure produced with traditional context seem to have lost its effect. Observation field of this situation is the urban spaces. Now the cities are shaped within the context of design material and relations with the effect of globalization. This type of configuration is generally repressed by capitalism and relatedly by economic and political powers. What's "new" now is a product of understanding style directed by the global market; not a product of design. However, although there is an intention to develop altitude that prioritizes humanism, the application practices of the countries does not seem to accept these approaches.

Global Approach

In 1978, Unites Nations Center of Human Settlements (UNCHS) was founded. Since two third of the world population was living the rural areas when it was founded, urbanization and problems related to urbanization had not reached yet the importance it has today. As a result of the Habitat-II Conference held in İstanbul in 1996, "İstanbul Declaration" was accepted with the "Habitat Agenda" one of the basic documents of UN-HABITAT[5]. With these documents, governments guaranteed to provide proper housing opportunities and develop sustainable human settlements to all the citizens. With half of the population starting tol ive in the cities between 1997 and 2001 caused for UN-HABITAT to be revived and strengthen again. 5 years after the Habitat-II Conference, "Cities and Other Human Settlements Declarations in the New Millennium" known as "İstanbul+5" was accepted in 2001 and UN-HABITAT was given a continuous responsibility and support by the UN General Assembly in terms of the execution of "Habitat Agenda" [6]. Later, it was turned into a "program" under the UN and was named as "United Nations Human Settlements Program". Mission of UN Habitat Organization is to promote development in sustainable social and environmental human settlements and housing opportunities with quality life standards for everyone. In line with the Habitat program, United Nations considered 1990 as the beginning and set 8 "Millennium Targets" for 2015. Two of these targets are remarkable; [7]

- 7. Ensure environmental sustainability
- 8. Develop a global partnership for development

These articles may seem to support especially the transformation of societies into a more sustainable environment however, through quantitative values in the light of 8th article, it only sets the basis that will shape globalization through quantitative values. Moreover, another issue discussed within the scope of 7th article is the quality housing conditions. United Nations considers providing sufficient housing for everyone as a responsibility of nation states. The reason for laying such a responsibility on nation states is that sufficient housing is accepted as a human right. Housing problem constitutes the discussion basis of architecture environment in various periods as an agenda. In today's Turkey, housing problem is tried to be solved with TOKİ which is an urban transformation and social housing production project. If we were to look at it through examples in Turkey, a social housing typology occurred in the way of a housing type that is state funded, detached from its context and applied everywhere. Although this formation is called social housing, they are merely piles of mass. [8]

Therefore, the issue becomes a context problem from a Turkey-specific perspectıve. Human and communities which were turned into a quantitative value through population are seen as adequate factors in fulfilling the survival conditions in terms of spatial equivalent. In this way Toki becomes settlements that receive negative criticism both academically and socially. Toki is a social housing and urban transformation project. However, it has become a

formation where the cities and their sub parts, spatial contexts are transformed into practice of fulfilling quantity outside of their characteristics. Now in Turkey, projects as the repetitions of production types are developed to find solution to housing problems in all the cities.

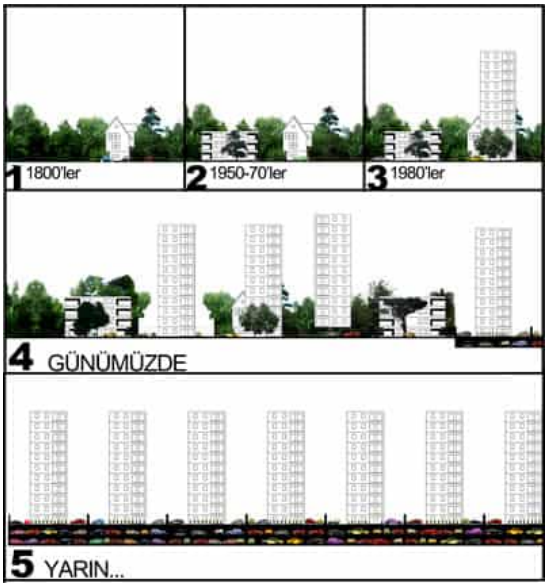

Figure 1. Caddebostan-urban transformation [9]

Toki, specific to Turkey, a program aims at quality life standards in line with these targets is a clear example of this and seems to support urban transformation studies. (TOKI which received the Best Real Estate Project from the Royal Family of Spain also received another award from the United nations Human Settlements Program. Accordingly, as a result of the evaluation meeting of “Best Applications” carried out both by UN HABITAT and Dubai Municipality, Erzincan Carsı Neighborhood Slum Transformation Projects carried out by TOKI received an award). [10]

Figure 2. Bursa - Kocaeli – Erzincan / Some Cities From Different Regions In Turkey

Evaluation of human through quantitative values makes them objects. This situation is generally seen as the effect of globalization. Doğan Kuban discusses this situation through two unforeseen dimensions in the relation between the urban environment and human. First one of these dimensions is human and its behaviors and the second is the effect of politics. Common result of these observation is that economy puts forward only statistical

generalizations and in some cases provides assumptions. At this point, it is clear that what makes human objectified is the political and economic balances. As a positive example, the architect Alejandro Aravena in Chile was in search of a new production where social housing construction developed a participant attitude and home owners were included. [11]

Figure 3. **Alejandro Aravena**- *Iquique Project / Chili*

In the statement made by Elemental, architecture office of Alejandro Aravena, it is said that; "Out of 3 million people living in the cities, 1 million is below the poverty line. By the year of 2030, the number of people living in the cities will have reached 5 million and the number of people below poverty line will increase to 2 million. That means that by spending 10 thousand dollars each week for every family, we can build houses for 1 million people. When the restrictions regarding housing are taken into consideration, it becomes clear that people should combine their own resources and building capabilities with the government and sector resources in order to solve this problem. For this reason, we wanted to set up an open system and activate proper channels where everyone can feel as a part of the solution rather than the problem."

This project, as an evidence showing that state fund can turn into quality life spaces with design approach, evaluates the two-dimensional situation that Kuban is mentioning together. Economic resources provided by the state becomes a tool in the context of space design.

Configuration of future cities in this integrity makes life of quality and also has become a necessity. Aravena expresses this perspective in the interview made with Icon Magazine January 2009 issue as below; "The biggest challenge of today should be to bring the elements which are not architectural – poverty, less discrimination in the cities, less violence- under the umbrella of architecture through the method of designing and planning about which we have specific knowledge.". This way, space configuration can stay loyal to the production condition which is through body-space dynamism. Accordingly, a design approach has been produced which uses all the elements together. Otherwise, space design will be nothing more than spaces produced to support cities' growth to become megacities monopolized by global balances. [12]

Effect Of Urban Agglomeration

Change of location has been seen in human masses for various reasons throughout the history. Two of the most crowded 3 cities of the world BC 7000 is in today's Jordan and Anatolia. Çatalhöyük's population at the time was only 1000 people. After a thousand years in BC 6000, Çatalhöyük's population increased exactly 3 times more and reached 3000. For the next 8 thousand years, there have been only few cities with the population over 1000 people. However, majority of humans continued to live in rural areas. With the industrial revolution in the 19th century, migration concept had become a dominant situation. In the mid-19th century, the population of London was over 2 million whereas in the 20th century, population of London was over 5 million and 20th century completely triggered a move to the cities. However, 21st century has been completely different from all the processes so far. The biggest mass migrations of the human history started and urban masses occurred. Today there are only 8 in Pakistan 8, 12 in Mexica and 100 "million" cities in China. According to United Nations, if the migration to city proceeds at today's speed, in 2050, 70 percent of the world population will be living in cities. [13] In 1927, 75,8% of the population in Turkey used to live in the rural areas and only 24,2% was living in the cities whereas now the situation is completely reversed and in Turkey with 78 million population, with a drastic change, 92.1% of the population is living in the cities .[14]

Table 1 . Urban Agglomerations

Rank	Name	English Name	Country	Population
1	Guangzhou	Canton	China	45,600,000
2	Tōkyō	Tokyo	Japan	39,900,000
3	Jakarta	Jakarta	Indonesia	30,300,000
.....				
10	New York	New York	USA	22,200,000
11	São Paulo	São Paulo	Brazil	22,100,000
12	Beijing	Beijing	China	20,000,000
.....				
23	İstanbul	Istanbul	Turkey	14,800,000
24	Tehrān	Tehran	Iran	14,700,000
25	London	London	UK	14,600,000

Cities are shaped by the effects of dominant ideology, historical layer, micro-political strategies and large scale multinational companies. However, a space or a settlement that is designed and physically produced continues to be constructed and shaped by the effect of numerous human relations that are becoming infinite and daily life practices of the individuals. In fact, the dynamics that shape cities prospectively are the effects reflecting as a result of the behaviors of the inhabitants, their experiences and their relations with each other. This interaction may create positive affects as well as negative ones. For example, crime, noise, contagious diseases, unqualified structuring, deprivation of green and earth, high cost of living, traffic, decrease of buying power… Buying a castle in the rural parts of European continent may be much cheaper than buying an apartment flat in New York or London. However people continued to migrate to cities due to the opportunities big cities offer despite these costs. This chain progress period is called “urban agglomeration”. As an advantage of this agglomeration, social opportunities increased and an urban culture produced by the public spaces is formed. Although there are such positive aspects, the difficulty of reaching these positive aspects bring out the negative aspects. (such as the public space definition undergoing a capitalist transformation). In addition, many people migrate due to wars, economical fluctuations, political reasons, etc. ‘Agglomeration’ can appear in many ways in addition to cities’ own processes.

Why Social Disaster?

In most parts of the world, urbanization is not happening in a healthy and qualified way. ‘Agglomeration’ in London, Paris or Berlin is too different from the ‘agglomeration’ in the biggest urban agglomerations such as in Mumbai, Mexico City, New Delhi, Shanghai, Calcutta, Karachi, Cairo, Manila, Lagos, Jakarta. Unqualified ‘agglomeration’ in the second class directs people to giant slums deprived of basic utilities such as electricity, clean water and internet. Accordingly, even though population explosion in the cities are planned and foreseen, it brings out important questions and problems about the future of the cities. “Architecture for humanity” researches describes the field of social disaster as the human made disasters (wars, migration, hunger, homelessness, etc.). Lifestyles occurring as a result of Urban Agglomerations and their negative effects; slum settlements growing in line with the development rate of the cities, homelessness problems or multi-storey unqualified housing units, etc. can be seen as social disasters in this sense.

In countries such as Brazil and Mexico where urbanization is regarded as a tool for economic growth, slums are expending and unemployment embraces the sub class who moved recently. All this quality housing right is not only a problem of the part who needs social housing needs. Multi-storey blocks, settlements such as simulation satellite cities can create a negative effect for those who have financial possibilities and deprive them of quality housing right. Lack of land and population increase is inevitable for metropolitans. As a result, the spaces produced generally tend to be vertical. A life profile which creates the connection with nature through landscaping placed between the floors of the skyscrapers

started to be dominant. Human which is an organic body as a part of the nature, experiences nature that is the reason of its existences in an artificial way. Moreover, it also marginalizes various layers which constitute the cities. Now urban design approach has become complex structures such as housing/mall-sports activities-workplace which develop within the same settlement. Other layers of the cities are far from being perceivable for the large masses who live in this complexes. [15]

Figure 4. From the book of Jale Erzen- called Three Habitus; "I imagine a house from where I can go down to a mall with an elevator." [16]

On the other hand, China does not find metropolitan environment satisfactory and support the transition to megapoles from metropolitans and regards it as something positive for the development of the country. It tries to find this approach with a formula of creating "local consumer". Those who live in the rural areas in China are self-sufficient to a great extent and can produce from the earth and live sufficiently in terms of infrastructure.

The government, who speeds up rapid urbanization and the radical transition from production to consumption despite this self-sufficient position, believes that numerous opportunities may come up for construction companies, transportation, public services and device producers." A section of government research institute, Vice President of World Economy and Political Institute Li Xiangyang says that "If the half of China's population starts to consume, the growth is inevitable." "Now they are living in the rural areas where they do not consume.". [17]

Figure 5. China- Being

In an article published in New York Times about this formula, it is stated that: While China was going through all these processes, both Pritzker award winner Wang Shut and Lu Wenyu undertook the renovation Project of Wencun village. Importance of this move is that while the cities are being shaped through global values, this Project can be a proof for showing that rural areas can still be produced through agricultural approaches over local contexts. Later on, in the light of these data, Wang and Lu searched for a method that can protect the existing values without rebuilding the past. With this understanding, they revived these fields in their headquarters in Hangzhou, Amateur Architecture Studio and designed buildings that are based on the traditional forms. With this, they think that they can save the new generation from feeling dependent on the cities and attract them to the rural regions.

Figure 6. Wencun village renovation-China

The team used the architectural language that is the same with the old buildings which are made with with bamboo, earth and natural stone in 14 dwellings with 3 or 4 storeys which they designed for the addition to be made in the West side of the village. All of these buildings are constructed with local materials in a traditional style however with an understanding that can catch the modernist feeling. The dwellings include sections such as retro worshipping spaces, warehouse for farming equipment, workshop, living room. This new environment they produced turned the old space which migrated to cities into a contemporary living style.

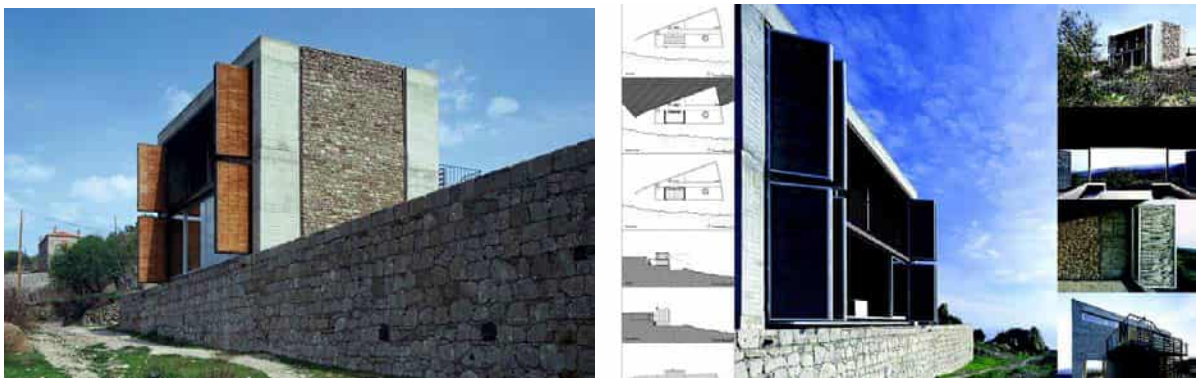

Figure 7. B2 House- By Han Tumertekin

B2 House which is an example of the design produced with this approach was designed to be used by two brothers called Selman and Suha bilal. Summer house which was designed by Khan Tumertekin was rewarded with Aga Han Architecture Award in 2004.

In the comments of the jury of Aga Han, it is said that: `B2 House was rewarded due to its design that materializes the feeling created by goodness and perfectness. Building is a new and unique design that respects the surrounding houses and landscape and is a part of the society it is in. With its aesthetic and elegant design, the house is now standing on its own however in the future'. New houses with the same approach but in a bigger scale can be added to this area.` [18]

Figure 8. Neighbours of Büyükhusun Village- B2 House

The jury was proven right and the Buyukhusun village where B2 House was built now started to be called B2 village. Other inhabitants of the villages were influenced by the building and examples that is in line with its context but also can offer a contemporary living environment have increased. B2 House is a role model for the new formation of the Village`s local typology. This example shows that the rural areas can host today`s contemporary living styles. Having contemporary life and space styles not in the cities alone but also in the rural areas encouraged the local community to go back to their roots.

While cities create problems, the quality of life in the rural areas are changing. Although rural areas were associated with deprivation, we can see in the developing countries that services of the cities are now reaching to rural areas as well. Especially the use of internet

which make people free of a place, can trigger the sense of belonging to somewhere. Internet provides people with many opportunities of the city without physically being in the city. Even a person living in the toughest geographic conditions can be a part of the `agglomeration` if that person has internet connection. Today in many countries, those who are living in the villages, towns and counties can order the products produced in the city via internet. Moreover, they can share their opinions with the world and exchange information. They can even find education opportunities on the internet. For this reason, countryside can experience many opportunities just like a city profile both socio-culturally and socio-economically. That means that countryside can experience the opportunities of city life altogether. [19]

Migration from the countryside to cities until the beginning of the 21st century has today started as migration to countryside especially in the developed western countries even though it is yet on an individual scale. Many people leave the negative living conditions of the cities and prefer the natural environments where they think to be more of quality and the countryside where they can experience it. And all at the same time living as if they are still in the city with the internet access... This movement spreads to other countries as more companies tend towards online commerce (First e-commerce was done by a farmer in Virginia who was producing flowers). Fischler put forward the `legend of returning to nature` as an opposite view to the tendency of urbanizing. [20]This is an opposite view to the human view who manages and controls the nature. Returning to the nature view reflects a deep yearning for nature and past. And yearning for nature and past is supplemental to the urban life. Urban people prefer countryside to get away from the feeling of fatigue of urban life [21]

All these new migration movements are the field of study of sociology and anthropology. As a result, it lays the ground for making research on the relation to be built with the space in terms of sense of belonging on the mind. Accordingly, as well as sociology and anthropology, it is a field of study for architecture whose main concern is space. New movement of migration from the cities to countryside creates many fields of study such as processes where urban profiles gain access to countryside knowledge, types of existence in a spatial meaning during this phase. As an alternative to urban based style of 21st century space design, it can now produce an environment in the countryside as well.

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APPLICATION OF TRADITIONAL COMPONENTS IN RURAL LANDSCAPE DESIGN FROM THE PERSPECTIVE OF MANCHU CULTURAL SUSTAINABILITY

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Abstract

The culture and art of the minorities have always been part of the treasures of China. The culture of the minorities is of great importance to the prosperity of national rural culture, especially in the course of promoting a comprehensive rural renaissance. This paper summarises sustainable design thinking, namely, rurality, melodramaticality and symbolisation, of Manchu culture in rural landscape renovation through the introduction of historical culture, religious faith, traditional residence, dress culture and other aspects of Manchu culture and their application in the rural landscape. Core values of development and utilisation of national cultural elements are sustainable conservation methods for folk culture. Moreover, national elements, including unique symbol, colour, character and custom, among others, of a nation should be fully utilised in landscape design and reflect the spirituality and aesthetic culture of the nation from all aspects.

Keywords

Cultural Sustainability, Manchu Culture, Rural Cultural Landscape

1 Introduction

Different nationalities have different cultural settings where different cultural types are generated. As an important component of Chinese national cultures, Manchu culture is materially and spiritually wealthy, consolidated by Manchu and the ancestors through the long-term practice of knowing and transforming. Furthermore, the Manchu ruled during the Qing dynasty in China, thereby causing the impact of Manchu culture to stretch far beyond other minority cultures. The charismatic form of Manchu folk culture still persists today. The application of the elements of Manchu culture in the rural landscape is an important means of manifesting rural regional cultural characteristics and displaying the national personalities of the Manchu nationality and is also necessary for the sustainable development of minority culture.

1.1. Rural cultural landscape and cultural sustainability

1.1.1. Rural cultural landscape

Rural cultural landscape refers to a carrier with cultural significance and is able to give expression to regional characteristics and cultural factors, including history within a region, villagers' manners and customs and religious faith. Rural cultural landscape is divided into two categories, namely, tangible and intangible cultural landscapes. Tangible culture in rural cultural landscape is mainly represented in the natural landscape, residential architecture, road landscape and villager clothing, among others. Intangible culture in rural landscape is mainly reflected in rural historical and cultural landscape, religious faith, application of character, literature and art, among others. Abundant rural national cultures and folk customs are the main contents of national and rural cultural landscape.

The rural cultural landscape of a national minority is a type of national cultural landscape that exists in a specific territorial scope. It is formed in the context of a particular ethnic culture and still stands to become the carrier that records the history of human activities in minority villages and inherits the national culture. Its significant feature is to conserve a wealth of historical landscapes in material form and traditional customs in nonmaterial form, and it jointly forms a relatively complete national cultural landscape system with a dependent landscape environment and landscape intention formed by the comprehensive perception of people.

1.1.2. Cultural sustainability

The 5,000-year history of Chinese civilisation has proven that rural sustainable development is based on cultural foundation. Social structure, economic system, lifestyle and cultural tradition of Chinese traditional villages are integrated. However, sustainable development of villages can be realised only if rural construction is raised to the level of cultural revival and rural cultural vitality is activated. The existence of the Chinese national culture in home villages is reflected in traditional classic, folk custom, lifestyle and idyllic scenery. The value of home villages serves as the recipe and prescription for the treatment of urban disease. Thus, the development of rural industry will be unfolded by focusing on the urban spiritual crisis. Furthermore, culture is given the highest value in villages.

Gy Ruda proposed that the renaissance of nature, human and architectural environment can be achieved only by rural sustainable development and a healthy rural life. The protection of the settlement landscape is mainly related in the following aspects: ① harmony between nature and the architectural environment; ② historical style and features, traditional appearance, folk life, art and daily custom landscape; ③ values of the local community or nationality; and ④ character and structure of the whole village. The protection of the national and rural cultural landscape should be comprehensively established in the long history and integrality of a rural landscape, localism and environmental coordination of architecture and typicality of cultural inheritance, among others. Among them, cultural inheritance and protection are the keys to rural sustainable development.

1.1.3 Manchu culture

Manchu culture is a long-lived and mixed culture. An absolute connection exists among various cultural elements. Manchu culture can be divided into two categories, namely, intangible and tangible culture. History, language and characters, literature and arts, religious faiths, customs and traditional festivals of Manchu nationality are all part of intangible culture. Residential buildings, clothing, diets, production instruments and vehicles are part of tangible culture.

2. Manchu Nonmaterial Culture and its Application in Rural Landscape

2.1 Manchu character

Manchu ancients applied the graphic text of shamanism to record information. Archaeological experts found shaman myths and legends recorded on shaman fishing nets. Fishing nets were used as warning labels or for recording shaman divine songs in early times, and in rural landscape design, fishing nets can be used for shaman religious activities in villages. Firstly, as decorative elements, annotations for shaman totems and graphic patterns make the landscape interesting. Secondly, as graphic text, fishing nets are easy to understand. Partial, simple, indicative information in rural landscape can take fishing nets as the subject for information expression and, supplemented by other characters, identifiers can be made. Thirdly, as a simple pattern element, fishing nets can be integrated into paving design (as shown in Fig. 1).

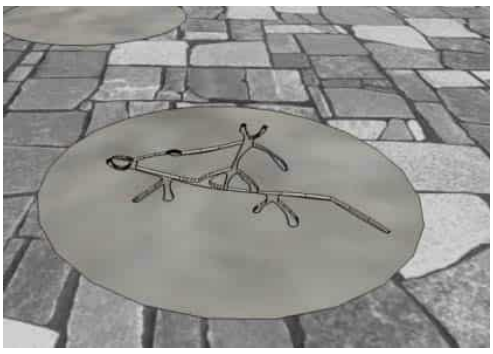

Fig. 1 Application presentation of Shaman characters Fig. 2 ‘Fu’ character in Manchu script

Nurhachi ordered the creation of the Manchu script in 1599. Based on Mongolian literature, the old Manchu script without circles and dots was created. Two kinds of characters, namely, Manchu and Han scripts, are still preserved on existing plaques in the Palace Museum. The

character pattern and writing mode of Manchu script are relatively special, and as a cultural element full of Manchu characteristics, Manchu script can be applied in sign design, text decoration and other aspects (as shown in Fig. 2).

2.2 Application of Manchu totem

Primitive men used an animal or plant as a clan emblem; the animal or plant was worshipped as a clan totem. The totem culture of the Manchu nationality has a variety of characteristics and is related to shamanism, the polytheistic faith of Manchus. The totem landscape represents the national soul and can thus act as the centre of landscape composition. The most obvious totem element in the landscape is the totem pole national pattern, which is engraved on a pole to symbolise clan ancestors. A total of 35 Manchu totem poles are displayed in Manchu folk custom villages in Shenyang Meteorite Mountain (as shown in Fig. 3). The gyrfalcon is the most representative among the Manchu totems. The gyrfalcon is a kind of falcon that represents the small defeating a big, inflexible will and valour, and it is the art embodiment of the Manchu national spirit. A relief landscape wall uses the gyrfalcon as the core to foil and render Manchu culture, and an iconic landscape is formed (as shown in Fig. 4).

Fig. 3 Totem pole

Fig. 4 Gyrfalcon relief landscape wall

2.3 Manchu literature and art and their application

Manchu literature and art have numerous varieties and are represented by *Manchu ulabun*, a part of Manchu written literature. Performances venue for novels and writings about anecdotes and trivial matters can be regarded as a Manchu literary element in designing rural landscape due to the unique manifestation mode of *Manchu ulabun*. Moreover, *Manchu ulabun* tends to have relatively thorough story systems. These story systems can be used as elements in designing landscape nodes. A landscape wall acts as an exhibition. The functionality of a performance venue can also be combined and integrated with these stories in the design of nodes. Examples of these nodes are children's activity areas.

Manchu art has varying manifestations, including papercuts, embroidery, drawing and small octagonal drums. Manchu folk artisans express various elements in Manchu culture in the form of papercuts, from which we can understand various Manchu cultural elements, including their natural living environment, religious faith, lifestyle, customs and traditional customs for weddings and funerals.

Manchu papercuts express numerous subjects that cover almost every aspect of Manchu life. Thus, diverse patterns of rural landscape are found in Manchu papercutting. As a vignette, papercutting can be applied to landscapes, including residences and landscape walls. It can also act as an ornament of landscape sculpture and communal facility.

Fig. 5 Application of Manchu papercutting in landscape

3. Manchu material culture and its application in rural cultural landscape

3.1 Manchu traditional residence

Manchu residences in the north of China mainly use a load-bearing wooden frame structure and are filled in with stone, brick or rammed earth as walls. Architectural elements include a gabled roof, a stepped gable wall and a tower foundation. The building is decorated. For example, carved bricks are placed on ridges, and auspicious patterns are engraved on stone seats and peristeles. Ordinary dwellings were usually three-section compounds in the early days. Axisymmetrical quadrangle dwellings as a form of Manchu residential architecture were gradually formed in the Qing dynasty. In the early stage, Jurchen innovated the fire wall, fire pit and chimney outside the buildings. The chimney became the ‘Hulan chimney’ with Manchu features.

Fig. 6 Hulan chimney

The Manchu nationality has a custom of offering sacrifices to heaven. A Solon pole is set up for enshrining and worshipping ravens and magpies. Manchus show great respect for the Solon pole, and the tradition goes down to the late Qing dynasty in other regions, including the northeast of China and Beijing.

Fig. 7 Solon pole in residence

Fig. 8 Manchu residential landscape

The Manchu traditional residence is an important component of the rural landscape culture. The characteristic elements of the Manchu traditional residence are a Solon pole, a Hulan chimney, a heated brick bed and window paper. Original decoration, such as tiling and carved stone seat with patterns, in a Manchu traditional residence needs to be preserved in new construction or renovation. The characteristics of the Manchu traditional residence should be emphasised, and attention should be paid to the harmony between the residence and the surrounding natural environment.

3.2 Manchu cooking culture

The working process and site of Manchu traditional diets, which includes the use of tools such as kollergang and stone mill, can act as elements of dietary culture in the Manchu rural landscape. The custom of butchering pigs is practiced in Manchu villages. Places are specially designated for butchering pigs in the village. Butchering pigs is a significant event in the village. Tools and places for butchering pigs can be preserved and designed to be symbols of the Manchu dietary culture in the rural landscape.

Fig. 9 Landscape sculpture of soft beancurd production and stone mill

3.3 Application of Manchu clothing culture

Not only clothing but also ornaments, musical instruments and other ornamental elements are part of the culture. The most intuitive representation of clothing in the rural landscape is villager clothing. As an active landscape element, villagers are an important part of the rural landscape. Manchu male clothing includes arrow clothing, mandarin jacket and wula. The female clothing includes cheongsam, waistcoat and flag shoes. Embroidery is usually designed on Manchu clothing, and Manchu women embroider dermatoglyphic patterns with auspicious meanings on clothing items. Auspicious flowers and plants embroidered on pillow ends, legends and other elements of Manchu clothing culture can be extracted, purified and integrated into rural landscape design. Manchus value the colour white, and white and royal purple are mainly used in Manchu clothing. Colours became increasingly rich due to the influence of Han culture, which came after the period of the Manchus.

Fig. 10 Manchu traditional costume and wedding clothes

4. Sustainable design thinking of the Manchu rural cultural landscape

4.1 Rurality

Farming culture is the background of Chinese culture and the core of rural landscape culture. The farming culture landscape is mainly built in two ways. Some typical scenes, such as a threshing floor for wheat, stone mill and kollergang in daily life in Manchu villages, can be purified and concentrated. A flute on the back of a cow, cock bark, a river in front of the house and a street market are all embellishments of farming life.

4.2 Melodramaticality

Melodramaticality involves organising the landscape sequence to tell a story of minority culture. Revolving around the theme of Manchu culture, participation, intellectual–cultural orientation, amusement and other characteristics of comprehensive leisure activities can be intensified in designing the Manchu rural cultural landscape. The following are all part of the Manchu cultural landscape: production scenes of Manchu artware; rural farming scenes, such as fishing, hunting, gathering, seeding and reaping; processing scenes featuring delicious food; Manchu sacrifice and musical scenes; and playgrounds for Manchu traditional sports and entertainment, such as riding and shooting, camel hopping, sledging, ankle bone shooting and hawk-and-chicken.

4.3 Symbolisation

In the development course of Manchu history, language, character, music, dance, graph and symbol are important forms for people to express their various ideas, religious beliefs and emotions. These forms have been conventional sign indicators throughout people's long existence and practice. During those years, original graphs have been a constant visual sign and graphic art symbols with national geographic characteristics, distinct features and implications. These symbols function as links that connect the modern and the traditional through modern design. For example, a Solon pole is abstracted as a landscape lamp moulding; the 'Chinese knot' as a folk custom widget, a birdcage, and sugar-coated haws on a stick and other Manchu symbols are used to design dustbins, seats and road nameplates, respectively. Image reconstruction of building elevation can be conducted, and the art form of cucoloris with Manchu residential characters can be adopted to heighten the atmosphere. Innovative models are formed through duplication, combination and grafting of the symbols of Manchu cultural elements.

Fig. 11 Chimney-like structure symbolising the entrance to a village

Fig. 12 Manchu character as a landscape pattern

5.Conclusion

The significant development and utilisation of national cultural elements require the sustainable conservation of folk culture. National elements, including unique symbols, colours, characters and customs, should be fully utilised in landscape design that represents the spiritual and aesthetic culture of the nation in all aspects. The vulnerability of minority culture has drawn the attention of local and foreign researchers in recent years. Culture as an ecological concept not only refers to the protection of tangible and intangible local culture but also the inheritance of national history, an indelible component of the local historical context, traces of human civilisation and an indispensable link with mankind.

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WHAT IS THE BETTER COMPROMISE BETWEEN ENERGY SAVINGS AND INVESTMENT IN ENERGY REHABILITATION?

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Abstract

Many people about 4 millions in France are in energy precariousness and 3 millions housings are energivorous. The previous studies have shown the energetic rehabilitation have a high cost for the households. Today, rehabilitate its dwelling requires to invest thirty to forty years of energy before obtain savings. Three levers allow to improve the comfort and to realise savings but sometimes with a big investment. This study aims to determine the minimum investment generating maximum savings to improve household comfort and decrease energy spendings. This article lists the different solutions, their costs and the savings. It proposes a final table allowing to the user, in function to his housing, the dwelling energy label and the possible investment, to know generated energy savings and the investment period. It also gives the list of behaviours to adopt to both decrease spendings and maintain its comfort.

Keywords

Energy savings, rehabilitation, heritage, economy, efficiency.

1. Introduction

The housing crisis in France seems to be unchanged for several years. First, there is a lack of decent housings and secondly, a lot of people are in energy precariousness. The state would like to decrease energy expenditure of the poorest households by its new measures. For many years, the government and associations encourage people to invest in new low energy housing or rehabilitate their housing on account of the high consumption of energy and the increasing of energy cost. These measures are conditional subventions. Despite financial incentives to promote energy renovation and to built new low energy dwellings, the housing situation in France in 2017 remains always critical. The construction of new low energy buildings increase but remains insufficient and the lack of space contributes to urban concentration and generates urban warming. That is why it is urgent to renovate ancient buildings. Patrimonial buildings have a big potential which must be preserved. The government objective to renovate 500000 dwellings per year from 2012 to 2017, is not reached. Currently, 3 millions of housings remain vacant and unhealthy. A lot of them are energivorous and have a strong impact on the household budget [1]. The government aims to renovate 26 millions of housings which 60% built before 1974 with the goal to reach a

energy low consumption in the next thirty years. In 2013, only 350000 dwellings are renovated, whose cost of energy renovation amounted to 12 billion euros for households and 650 million euros for the state, four times lower than in 2008 [2]. In 2017, only 130000 housings have been renovated. What are the reasons for such a decline?

The various studies carried on show that to decrease energy spendings, it is necessary to act on three levers. These levers act on reducing needs, generating savings. The first two are relative to the building and its constructive typology. We talk about active energy efficiency. The first one was the subject of a first study to identify the insulation needs of vernacular buildings representing a significant budget for the user. However, this initial expense reduces the energy bill. The second lever is the improvement of the technical equipment of the building and it management. This important item has to be take account in function of proposed rehabilitation and different uses. This implicitly plays on the third lever which is the user's behaviour, called passive energy efficiency. These rehabilitations have an initial cost. What investments are needed to reduce needs and generate savings? To encourage households in energy improvement of housing, the french government has set up a new energy policy. They benefit from subsidies in exchange for improve their dwelling and reach energy performance. Finally, what is the real cost for households, for taxpayers and for the french government?

This study aims to determine the minimum investment generating maximum savings to improve household comfort and decrease energy spendings. By determining the different energy works and their costs related to the different levers and to the reaching energy label, this study focused on evaluate their costs and the generated savings. Then, this article presents the different solutions of energy rehabilitation, their costs and the associated savings. It proposes tables allowing to the user, in function to his housing, the dwelling energy label, energy works and the possible investment, to know generated energy savings and the investment period. It also gives the list of behaviours to adopt to both decrease spendings and maintain its comfort.

2. Reasons for declining investment in energy rehabilitation

2.1. Government policy changes

At each change of government, a new energy policy is set up. From 2008 to 2017, various measures have been proposed, aimed at improving the comfort of its occupants and reducing energy expenditure especially for the less well-off households, in energy precariousness [3]. Various subsidies and tax credit are « offered » by agencies from Anah[1], energy suppliers and the government but often subject to conditions and decreasing each year [4]. To benefit from this, people are forcing to new costly rules (new and increasingly expensive rules). For example, they have to make an energetic diagnostic, and reach higher energetic performance for their housing [3]. And since 2016, to benefit from energy transition tax credit, it is necessary to call upon a professional environmental guarantor recognized to perform housing energy improvement works [5]. This new qualification forces people to use qualified companies, which increases the cost of energy works. In addition,

[1] Anah: National Agency for home Improvement

only two categories of people are targeted, owners doing work for their principal residence and owners renting their homes.
On the one hand, increasingly investment and contraints, and on the other hand, a decreasing of subsidies don't facilitate the revival of energy rehabilitation. In addition, for some households, aids are poorly understood and changing policies lose some of them [6]. In 2017, 80,720 homes were renovated, + 15% compared to 2016, and 21,800 jobs created for an amount of 650 million euros of aids. We are far from the 500,000 renovated homes and 75,000 jobs created per year, aimed by successive governments [5] and which should cost the state 12 billion euros over 5 years [7]. One of the reasons is that low-income households can not invest in improving their habitat even at the risk of some people being forced not to heat up. Energy expenditure on household energy is on average around 2300 euros per year and per household in 2006, knowing that a lot of people earn less than 800 euros a month [8]. A household is generally considered to be in a situation of energy poverty if its housing energy budget exceeds 10% of its income [9]. According to the National Observatory of Energy Poverty, 5.1 million households (12 million individuals) are in energy precariousness, of which 87% are in the private sector and devote 15% of their incomes to energy expenditure [9].
According to a survey in 2017, 40% of French households would be interested in energy renovation works [6]. The reason is mainly to realise energy savings and therefore a decrease for the heating bill in the long term. What hinders them? It is obviously the cost of works for 78% of cases. They reach 10 000 euros on average, decreased by 17% thanks to subsidies [10]. In this article, we wonder about the type of works realised for 10,000 euros [10], and especially the energy savings that this work can generate. It is not the measures in reflection announced by the Minister of Energy Transition that will help the recovery. He would propose the establishment of a heavy tax for those not performing rehabilitation, as a bonus-malus [11]. Then another proposal would be to share the heating costs between the owners, who will have already invested a lot, and the tenants. Is this the right solution knowing that today rents are for a large number framed and that we rely on homeowners to renovate and rent their homes that are crucial defects? Who will rent his home in these conditions? Let us incite positively and not by repression.

2.2. A variable primary energy cost

As we have seen before, the government's incentives and all energy rehabilitation campaigns were based on, on the one hand, a probably decreased fossil energy and on the other hand a surge in the cost of energy during of the last fifteen years. Even though the increase in the cost of electricity, gas and fuel is important for households, it has not doubled or even tripled as expected in 2011 (Figure 1). If we compare the cost of forecasting primary energy between 2011 and 2018, at real cost, the price of gas and fuel decreases and stabilises. The price of electricity increases slightly. Since the oil shock in 1973, the cost of primary energy has increased considerably. But in recent years, they have not grown in a gradual and dramatic way as planned. We can see that with each new energy policy and new regulation putting in place to reduce expenditure due to the energy increasing, the cost of primary energy falls (Figure 1). As in 1982, 1988, 2000, 2005, 2009 and 2012, the cost of primary energy declines, putting people in doubt and not encouraging them to renovate and especially to invest. We assume that each thermal regulation induces less primary energy consumption, so the price decreases.

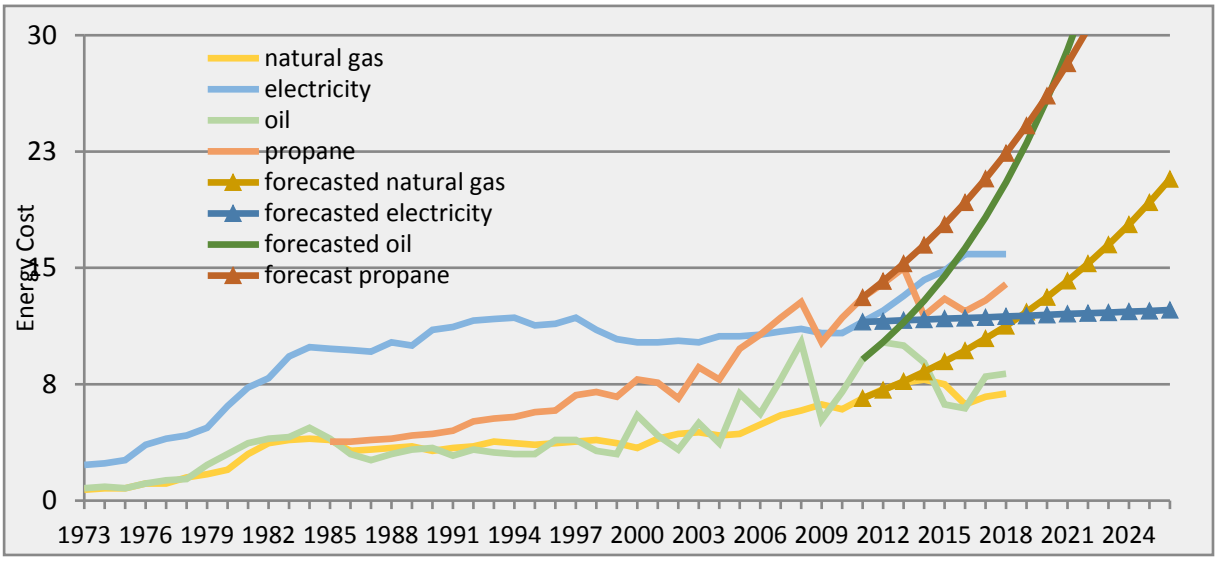

Figure1: evolution and forecast of energy price in France (euros per kWh)

During those last 40 years, electricity price has increased more than 50%. That does not encourage people to invest in wind power and photovoltaics. In 2017, energy costs are still weighing on household budgets with electricity prices increasing more and more. Even though the price of fossil energy (gas, fuel) has decreased in the last 5 years, spendings remain always high and its consumption is also contrary to sustainable development. Despite this, in France the most used energy for heating remains electricity (32.1%), followed closely by fuel (28.8%) and gas (24.8%). This is probably due to the fact that the heaters like heating pump are more efficients and have received subsidies during their implementation. Moreover, many housings are heating with electrical appliances which investment is cheap. But the announcement of increasing in price of electricity and the subsidies decreasing caused the drop in the number of installation of the heating pumps. Similarly, people are more reluctant to undertake rehabilitation work. Is this due to a much smaller increase in primary energy than expected? Is this due to the cost of rehabilitation works? This is the main objective of this article. It aims to determine the real cost of rehabilitation and solutions to reduce energy costs.

2.3. High cost of energy rehabilitation and high performance

Previous studies have shown that the cost of rehabilitation is a big investment. It is for a dwelling of 100 m² on the order of 10,000 to 30,000 euros [12] depending on the works done. This investment is not possible for households in a precariousness situation and even for low incomes. We will then see if this investment can be amortised quickly and finally generate savings. The enterprises and fournisseurs always talk about savings that you could realised if you replace your boiler and your bulbs. But no one tells you the investment that this represents and how long it will be amortised.

At the same time, new measures to improve more housings increase investment and add to household budgets. In fact, to benefit from government and agency subsidies, housing rehabilitation must achieve an energy performance that is always higher than the thermal regulation of ancient buildings. Indeed, this creates a high investment cost for the owners

and, therefore, an additional cost for the tenants. This targeted performance necessarily has an additional cost, but how much savings does it generate? When a housing is labeled G, it is more expensive to achieve the energy label C than the energy label D but the savings are they proportional to the expenditure? After the first energy shock, the various regulations only increased the requirements, therefore the costs of the works and the fact the investment costs. This of course reduces energy costs. What is the investment cost? What savings do households make? Are the subsidies sufficient and relevant? Are all these standards, which continue to be more demanding, certainly improving comfort and reducing spendings, an obstacle to renovation and do not go against what households needs? The next part aims to determine the final cost of households energy rehabilitation based on the type of rehabilitation works and the final savings reached.

3. Results: investment and savings

It aims initially to make an inventory of high energy consuming housings and define the reasons for such additional costs in the works of energy rehabilitation. It also seeks to present the actual savings by households compared to the initial investment, in the short term and long term? It is also based on accurate examples and concerned only individual homes, that account for about 10 millions of housing stock.

3.1. First lever: insulation and double glasses

The first lever on which households can act, is the insulation of the envelope of their housing (walls, roof, ground) and the change of their windows. As Ademe[2] points out, the sources of heat loss in houses built before the first oil shock and the first thermal regulations, are mainly roof (25 to 30%), walls (20 to 25%) and windows (10 to 15%) [13]. In this study, housing is naturally ventilated and we will not consider ventilation losses. We have taken for example, two types of house of 100 m², building before 1970, situated (located) in Strasbourg, North-east of France, first without rehabilitation.

This study demonstrated a first point, the losses depended on the configuration of the building, its orientation, its compactness and building materials. The figures 2a and 2b show that the losses can be very important depending on developed surface and used materials.

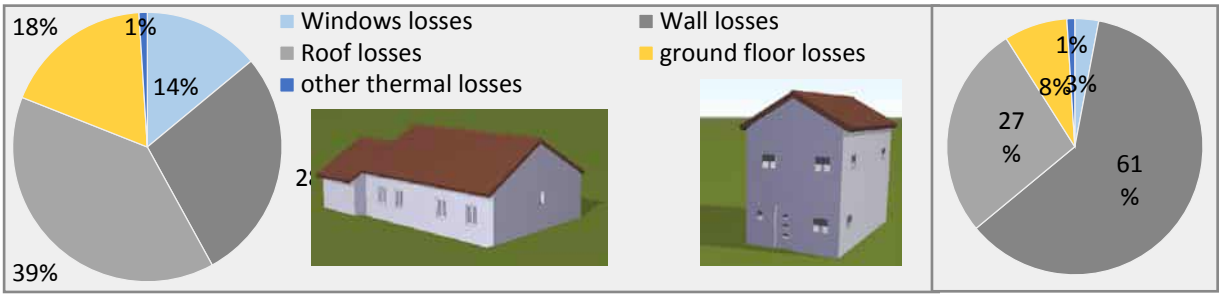

Figure 2 a and b: Energetic Losses

[2] Ademe: Agencie for Environment and Energy Management

In the first case, the roof area is larger than the living area, resulting in significant losses through the roof (39%) (Figure 2a). In addition, the walls are stone with a thermal resistance of 0.95 $m^2.K.W^{-1}$, decreasing losses through the walls contrary to concrete walls. It will therefore be preferable in this case to isolate the roof. In the second case, the compact house has a smaller roof area for the same living area as before. In addition, the wall surface is greater with a concrete material with a thermal resistance of only 0.1 $m^2.K.W^{-1}$, thus generating significant losses through the walls (61%) (Figure 2 b). In this case, insulating walls will generate more savings. We will see later the savings that these rehabilitations can generate.

The Archiwizard software allows to simulate energy needs in function of different types of walls, roofs for each scenario. It gives us the energy needs and so we could calculate the energy spendings. The table 1 below explains the difference between energy needs, invoiced consumption and DPE1 consumption, depending on primary energy and type of boiler.

	Global efficiency of boiler	Consumption DPE kwh/m2.year	Consumption fact €	Needs kWh
Archiwizard				30000
ancient boiler gas	0,7	357	3064,30	42857
gas	1,0	250	2145,00	30000
pellets	0,7	357	2374,30	42857
heat pump	2,9	222	1643,80	10345

Table 1: Energy consumption and needs for a given housing

First, by changing the different materials and insulating the house, we simulate the spendings. The needs given by Archiwizard are correlated with the data provided by the

	Energetic works	No insulated	Windows 4000 to 8000 invest	Roof insulation 3500 to 10000	Wall insulation 6000 to 14000	Roof/wall /windows 15000 to 35000
cinderblock >1950 to 1970	Label/ kwh	Label E 330/ F 345	Label E/ 323 337	Label E/ 284 293	Label D/ 225 230	Label C/ 154 1
	Energy needs (kwh)	35000 to 42000	36000 to 40500	32000 to 35000	25000 to 27000	17000 to 1970
	Savings (€)		50 to 150	350 to 1000	800 to 2300	1400 to 3400
	amortization (year)		25 to 150	4 to 22	6 to 13	10 to 20
stone <1949	Label/ kwh	Label E/ 239 to 245	Label E/ 229 to 235	Label D/ 180 to 190	Label D/ 206 to 222	Label C/ 138 t 145
	Energy needs (kwh)	27000 to 29000	25697 to 27600	21316 to 22000	23091 to 26700	15495 to 1700
	Savings (€)		80 to 250	400 to 1000	200 to 600	800 to 2000
	amortization (year)		20 to 100	4 to 20	12 to 50	8 to 40

Ademe [8]. Then, for each rehabilitation works, we have evaluated their costs and compared the investment to the realised savings.

Table 2: Savings after envelope rehabilitation

The table 2 shows the energy needs of non insulated housing and realised savings in kW.h after energetic rehabilitation works. The costs take account different energy (gas, oil, electricity, propane) and rehabilitated in function of existing-RT. The thermal resistance of

the roof, the stone wall and the cinderblock wall is respectively about 0,22, 0,95, and 0,1 $m^2.K.W^{-1}$. In these conditions, for a housing of 100 m² habitable, and 110 à 120 SHON RT, the total energy needs are about 27000 to 42000 kW.h per year. By insulating the roof with 18 cm of rock wool insufflated with thermal resistance of 4,51 $m^2.K.W^{-1}$, the energy needs decrease and reach 21000 to 35000 kW.h/year . However this energy economy has cost an investment of €3500 to 5000. The amortisation is between 5 to 22 years. That depends on the used energy. If used primary energy is propane gas, energy spendings were very important and so the amortisation is quickly.

Most of the time, the change of windows does not make it possible to obtain one level of energetic label with only 10 kW.h/m².year of gain. Furthermore, it generates a very high investment which unfortunately is difficult to amortise it. However, demand has doubled since 2014 because it represents an accessible investment (about €1000 per window) with easy implementation and facilitated by many subsidies. The insulation of the roof saves from 50 to 60 $kW.h.m^{-2}$ and the insulation of the walls saves from 20 to 120 $kW.h.m^{-2}$ depending on the material used initially and earn one level of energetic label. The insulation of the entire envelope saves two levels of labels and saves from 120 to 200 kW.h/m².year.

The results show the higher the initial bill is, the faster the works will be amortised. It is due on the one hand to the primary energy used and therefore the heating mode becomes a priority, and on the other hand to the initial energetic label depending on the construction materials. In function of configuration of housing, compact or not, the energy spendings and investments are different and we were able to determine a relationship between investment and savings. The first works of rehabilitation is the insulation of roof, then the walls. The table shows the cost of investment to reach each level of energetic label and savings which are generated.

These results are given for renovations following the existing-RT. The thermal resistances are lower than those requested to benefit from state and energy agency subsidies. Those subsidies are an help to not neglect, but the investment is more important and the subsidies depending on so many criteria, that short-term profitability is to be verified and is the subject of another paper, not presented right here in details. The energy spendings calculation of several houses allows to compare savings between an insulation according to the existing-RT and the thermal requirements to obtain subsidies gave for houses located in Toulouse as in Strasbourg. Those savings are of 700 kW.h/year of savings with values between 600 and 900 kW.h/year . This corresponds to a gain of 5 to 8 kW.h/m².year and a saving for houses of 100 m² about €40 to 70 per year depending on the primary energy used. The expense is from €2000 to 3000 but it allows to obtain 30% of subsidies on the supply only. This represents €2000 to 2500 of tax credit for the entire bill. The amortisation of fifteen to twenty years initial allows to obtain gain 2 years.

3.2. Improvement of technical equipment

Another of levers is the replacement of thermal equipment like the boiler. As for the receivers, they are rarely replaced. Sometimes fortunately, because in terms of performance, nothing can replace cast iron radiators that are now very expensive to buy. Several scenarios were made by replacing on the one hand only the boiler ie by focusing solely on it performance and on the other hand, with insulate the housing too. In this part, only the impact of the boiler on the savings to be realised is studied. The various studies

were conducted considering a house of 100 m², with a ceiling height of 2.50 m high and a set temperature set at 19°C.

This made it possible to determine the minimum power of the boiler to take into account. Only for heating, the minimum boiler power is 12 kW. For a mixed boiler, ie heating plus domestic hot water, the required power is between 20 and 25 kW. Energy cost calculations were made from the cost of primary energy in 2018 in France (Gas 0,0715; Propane 0,1395; Electricity: 0,1589; Pellets: 0,0554; 0il: 0,0819 (€/kW.h)). For the same house and insulation works that do not change, several technical equipment solutions have been considered. Price studies gave the cost of replacing the following boilers (heat pump between €8000 to 15000, pellets between €5000 to 12000 and gas or oil boiler between €3000 to 5000). By changing the type of boiler, we improve the overall efficiency of the technical equipment. Global efficiencies of ancient boiler are about 0,6 to 0,7 while the new ones are about 0,9 to 1. Heat pump efficiency is about 2,9 and pellets efficiency is about 0,7. The table 3 shows the invoiced energy consumption and savings, with changing the boiler and primary energy for an initial needs of 25000 kW.h/year.

	Boiler before/ after	Consumption before €	Consumption after €	Savings €	Amortization years
before insulation	Gas or Oil/ Pellets or heat pump	2500 to 3000	1400 to 2000	600 to 1500	8 to 17
	Propane/ Pellets or heat pump	4500 to 5000	1400 to 2000	2000 to 2500	2 to 6
	Gas or oil/ Gas or oil	2500 to 3000	1750 to 2000	750 to 900	4 to 7
after insulation	Gas or Oil/ Pellets or heat pump	700 to 1000	400 to 700	200 to 450	23 to 54
	Propane/ Pellets or heat pump	1800 to 2000	500 to 700	1000 to 1300	5 to 12
	Gas or oil/ Gas or oil	1500 to 1750	1000 to 1250	450 to 530	7 to 11

Table 3: Savings and rentability by changing boiler

First, more costly primary energy as propane and initial technical equipment are, shorter the amortisation is. Furthermore, the amortisation of boiler is long when the energy needs are weaker. The table 3 shows the changing of efficiency boiler save €750 to 900. But as we explained in table 1, the energy label is different according to both the primary energy used and the type of boiler. We can win one energy level for €900 won and €5000 spent.

In ancient housing, heating represents 80 to 90% of energy spendings and hot water 8 to 15 %. It is preferable to first decrease heating spendings. The domestic hot water expenditure for a family of 4 persons is around 1500 to 2000 kWh/year which cost depends on the type of hot water production. The table 4 focuses solely on the impact of the change in hot water production on the final bill.

ECS	investment min/ max €	before/ after efficiency EH	Invoice before €	Invoice after €	Savings €	Amortization min/ max year	Tax credit €
Electrical Heater / EH	500/1000	0,5/ 0,7	510	363	147	3/ 6	0
EH/ solar	5000/8000	0,5/ 0,8	510	160	350	14/ 22	1200
EH/ Thermo	3000/5000	0,5/ 1,9	510	134	376	8/ 13	1000
Gas/ solar	5000/8000	0,7/0,8	165	80	85	>60	1200

Table 4: Savings and amortisation of changing hot water

With only a 50% utilisation, the solar water heater always has a very high cost for low-income households that does not facilitate its implementation. The realised savings don't allow a rapid amortisation. For the investment to be profitable and amortised over 7 years, it would require an maximum expense of the order of 1000 euros. Today yet, the supply and installation of a solar water heater is about €6000 to 8000. Tax credits do not provide enough support to make it profitable in the short term.

3.3. Changing behaviour

Thermal regulation imposes minimal performances both to reduce energy expenditure, which is a step forward but expensive, and to improve the comfort of the occupants. But she forgot an important point: the behaviour of households. In addition, each person has different needs that must be considered. Everyone must learn to live with their home, especially if it is ancient building and be better trained. We are not all equal before the temperatures and each kW.h spent have to be controlled. Depending on the type of heating, electric or central, certainly the behaviour will have to be different. It will be necessary to follow the consumption of his home to avoid over-consumption of kW.h that no one does not need. In addition, the ancient building having materials with high inertia, these buildings can provide some comfort at lower cost. This study looked at the cost that can be worth 1°C of temperature in more or less and therefore the savings that can cause the decrease of 1°C of indoor temperature. For the previously presented houses, different temperature scenarios were simulated, retaining the same configuration and materials with an initial label E and F. A decrease of temperature of 1°C above 20°C allows to economise 3000 kWh per year for a housing with label E, F. That corresponds to 30 kW.h.m^{-2}/year per degree of temperature. In these cases, there is no investment and spendings above €150 per year for housing with label E, F. A decrease of temperature of 1°C above 20°C allows to economise 1000 kW.h per year for a housing with label B. That corresponds to 10 kW.h.m^{-2}/year per degree of temperature. In these cases, there is no investment and spendings above 50 euros per year for housing with label B. More the energy label is close to A, less the degree of temperature in addition or in less will be impacting on the bill. With initial heating spendings around €1000 to 1500, the lowering of interior temperature about 18°C to 19°C the day and 16°C the night in winter, allows to have savings of €300 to 400 per year. That allows to reach one level of energy label without investment.

Monitor the temperature at home, benefit from solar input through windows, avoid large temperature differences by opening and closing shutters and windows in function of external temperature variations due to the season, are both citizen gesture and energy savings.

4. Conclusion

This article shows the rehabilitation of individual homes built before 1970, which are energivorous, represents an important investment for low-income owners who only benefitting from tax credit. In order to save money, households must invest on average the equivalent of 20 to 30 years of energy. If the housing is very energivorous and the used primary energy very expensive, the energetic rehabilitation allows to make quickly savings.

Vernacular building has specific particularities. It can not rehabilitate as those built in 1970-1980. In each case, a diagnostic is necessary to determine priority works. Concerning vernacular building, that is preferable to insulate roof, depending on building configuration. A contrary, concerning homes of 70-80 years, wall insulation is a priority. The windows changing is an important investment with a difficult amortisation.

The realised savings mainly depend on used primary energy. The gas is the most used energy in individual homes. Homes heating with propane have good reasons to change on the one hand, their boiler allowing to reach one level of energy label and have important savings, and on the other hand, change primary energy to have both citizen and economical gesture. The problem is that people who could save €2000 by insulate their home, don't have enough money either to heat themselves or to invest €35000. In this case, the investment allows them to reach comfort, without both spend or save more. Even with a zero rate loan, they have to wait 30 years to save money.

Insulate your dwelling, replace the boiler by one more performing and change primary energy allow to economise. Even if total works are expensive and longer to amortise it, with strainer housing, it is not economical to replace the old boiler by one more performing because the realised savings have absorbed by the poor condition of the envelope. Hot water expenses are very low compared to those of heating. So the change of it, is not a priority with a prohibitive cost of solar hot water system, given few savings. The last lever on which households can act and which saves money is the behavior towards their home, that is to say, know your house well, rehabilitate safely and intelligently, use it properly and control your expenses. This allows to economise without investment and win one level of energy label.

Finally, this study shows roof insulation allows to reach up to one level of energy label, wall insulation up to two levels and total works up to three levels, depending on building conception and used primary energy. To each level, the savings are between €400 to 1000 in function of energy with an investment between €3500 and 15000. For a large number of households, subsidies represent only 5,5% of works cost. We well understand the owners unwillingness to invest in energetic rehabilitation.

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A CLIMATE RESPONSIVE DOUBLE-SKIN FAÇADE PROTOTYPE FOR LIGHTWEIGHT PREFABRICATED BUILDINGS IN TWO CLIMATIC ZONES OF CHINA

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Abstract

Lightweight prefabricated buildings (LPBs) have spread widely in China for their advantages in mass production and economical efficiency. However, the lack of climate responsiveness also leads to poor indoor comfort and energy efficiency. Aiming to improve LPBs' building performance, a climate responsive double-skin façade (DSF) prototype with corresponding operating modes was proposed in this study firstly. Secondly, the DSF prototype were further practiced in two lightweight prefabricated platforms locating in Guiyang and Beijing in China, belonging to the Moderate Zone and Cold Zone respectively. In order to verify the thermal and energy performance of this DSF prototype in different operating modes, field measurements were successfully conducted in both summer and winter on two platforms. Finally, through comparing and analysing carefully, the seasonal optimal operating strategies of this climate responsive DSF prototype were concluded, which succeeds to enhance the climate responsiveness for LPBs in two climatic zones in China.

Keywords

Lightweight prefabricated building; Double-skin façade; Prototype; Climatic zone; China;

1 Introduction

Lightweight prefabricated buildings (LPBs) normally refer to building systems assembled on-site with light structural and envelope components, which are prefabricated off-site. Due to the advantages in mass production, space flexibility, fast construction, recyclable use, lower cost with higher quality, LPBs have gradually attracted extensive social concern and swiftly spread to every corner in China serving as temporary buildings, like post-disaster housing, office and dormitory in construction sites. Among them, the portable house and container house are the two best-known types (Fig.1). However, despite the wide existence in China, these systems have rare change even locating in different climatic zones, leading to poorer thermal and energy performance. Yan Wang et al. [1] carried out seasonal measurements

for a portable house in the Hot Summer & Cold Winter Zone of China and showed severe discomfort in summer and winter, suggesting passive design like natural ventilation and solar shading should be adopted to improve LPB's climate responsiveness.

Among passive design and building technologies, the double-skin façades (DSFs) have been proven effective to improve both thermal and energy performance under different climatic backgrounds, such as hot-dominated, cold-dominated or even mixed climate [2-5]. Besides, the lightweight DSF system is also a typical kind of industrial building products, which makes it suitable to LPBs in nature. However, the experimental studies combining both DSF and LPB are still in blank, especially in the context of China. For this article, a climate responsive DSF prototype for LPBs was proposed and practiced on two real-scale experimental platforms in two climatic zones of China. Different operating modes for this DSF prototype were further presented and verified through a series of filed measurements in summer and winter.

Figure 1. Two typical types of LPBs: portable house and container house

2 Climate responsive DSF prototype

2.1 Structure of DSF prototype

Based on the tectonic features for both LBPs and DSFs, the climate responsive DSF prototype is designed, as shown in Fig.2. The prototype is divided into three parts: the internal wall, the external skin and the intermediated cavity. In general, the internal wall refers to one façade of LPBs, which has already guaranteed the basic functions like insulation, waterproofness and air-tightness. The window-wall ratio should be carefully designed according to climate and function. As to the operable glazed windows (OGWs), the tilt-turn windows with higher insulating performance are recommended, which can adjust and control climatic energy (light, wind or heat) in a much wider range.

The external skin can be regarded as a protector covering the whole DSF, which constructive complexity and physical properties can be relatively reduced to enhance cost performance. The air entrances (AENs) or air exits (AEXs) will also be placed on the skin surface, aiming to arrange the indoor and cavity airflow.

The height and depth of air cavity are required to be larger than 3m and 0.4m respectively, aiming to promote cavity ventilation while guaranteeing insulation performance. In addition, considering most LPBs are low-rise buildings assembled with independent modules, the air cavity is also divided into modules by vertical and horizontal baffles. If necessary, the sun-

shading devices, insect screening and mechanical ventilation devices can be further installed within the cavity.

2.2 Operating modes for DSF prototype

The climate responsiveness of DSF mainly relies on different configurations of operable parts such as windows, air vents, shading blinds, baffles, etc. These configurations can be further concluded into several "operating modes" to solve specific climatic problems. Based on the design of the DSF prototype, four basic operating modes are proposed (Fig.2). For the first mode, the AENs, AEXs and OGWs are closed, acting as a thermal buffer (TB) to enhance insulation. In the second mode, the AENs and AEXs are opened while the OGWs remain sealed to encourage cavity ventilation (CV). In the third mode, the AENs and OGWs are opened but the AEXs are shut, aiming to promote interior ventilation (IV). The last mode is just opposite to the CV mode, in which the AENs and AEXs are closed but the OGWs are opened, encouraging the air convection (AC) between the cavity and indoor space. It's worth noting that, due to the OGWs are tilt-turn windows, the IV (AC) mode is further extended to IV1 (AC1) and IV2 (AC2) modes with OGWs swung inward at bottom and to the side respectively, indicating two ventilation (convection) rates or capacities.

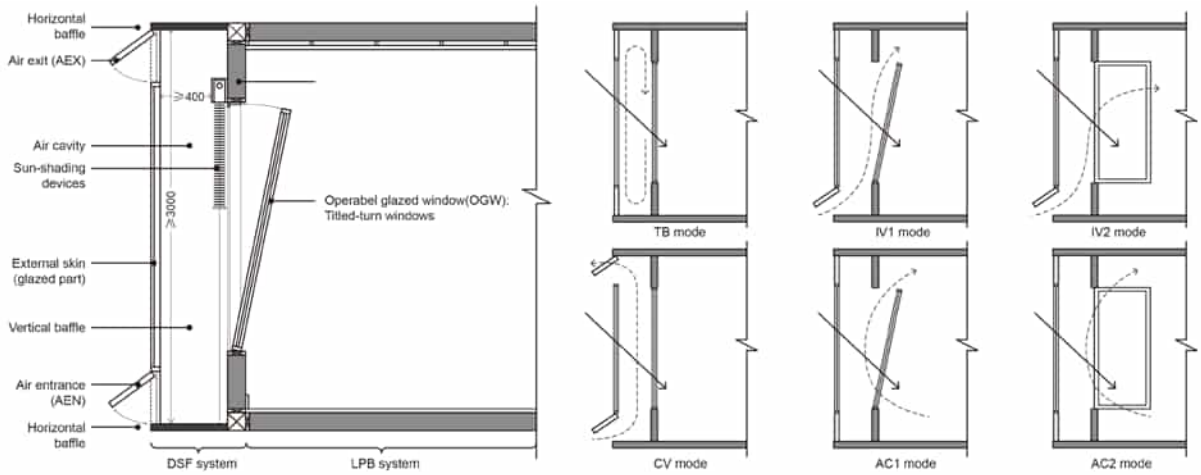

Figure 2. Structure and operating modes for the DSF prototype

2.3 Climate backgrounds

China covers vast territory with various climatic types, which can be mainly classified into five climatic zones, including the Severe Cold Zone, Cold Zone, Hot Summer & Cold Winter Zone, Hot Summer & Warm Winter Zone, and Moderate Zone (Fig.3). In this study, the DSF prototype was discussed in Cold Zone and Moderate Zone. Firstly, the climate in Moderate Zone is far milder than the others, which can be regarded as the "**simplest**" climate for the DSF prototype. Secondly, unlike buildings in Severe Cold Zone or Hot Summer & Warm Winter Zone facing only one-season problem (extreme coldness or overheat), those in Cold Zone and Hot Summer & Cold Winter Zone struggle with an ambivalent challenge both in summer and winter. Thirdly, considering the higher annual energy bill and heating demand in winter, the Cold Zone is finally selected as the "**hardest**" climatic background for DSF prototype. Two cities, Guiyang and Beijing, are selected to present the Moderate Zone and the Cold Zone respectively to build the platforms.

Besides, Guiyang and Beijing happen to locate in two solar energy resource zones, in which the solar radiation intensity varies remarkably (Fig.3). The seasonal radiation accumulation in Guiyang is almost the lowest among all Chinese cities, while that of Beijing is stronger than many cities. Therefore, from the simplest to the hardest climates, from weak to strong solar radiation levels, the climate responsiveness of DSF prototype will be fully examined.

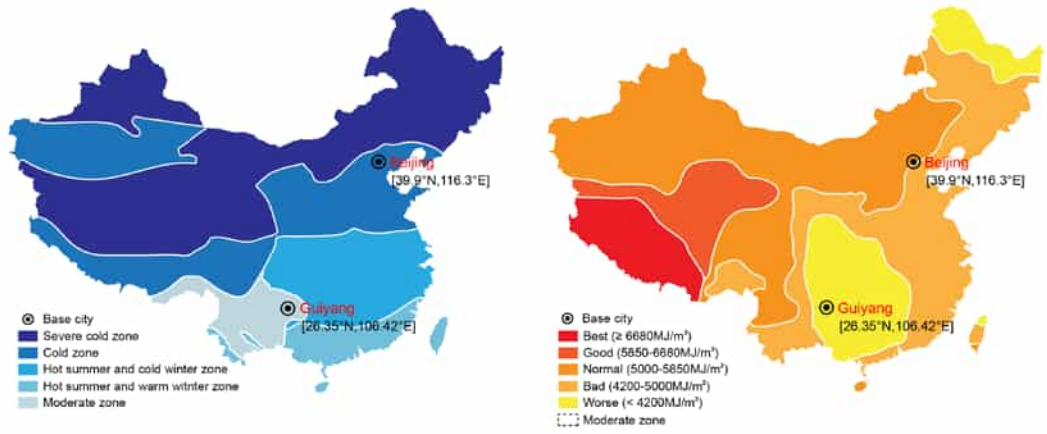

Figure 3. Five climatic zones and zoning for solar energy resource in China

3 Application to two experimental platforms

3.1 Experimental platform in Moderate Zone

The experimental platform in Moderate Zone was finished in Jun. 2015, called THE Studio (Fig. 4&6). This building is not only the start-up case in Guian Innovation Park in southwest China, but also a demonstrated NZEB (Nearly Zero Energy Building) with the BREEAM 3-star certificate. The first floor of THE Studio serves as a reception and exhibition for the whole park while the second floor provides office and meeting rooms. Aiming to finish within six months, two lightweight prefabricated systems were introduced: the light steel container system at the first floor and the light timer system at the second floor [6].

In order to enhance indoor comfort of lightweight system, the DSF system is used at the first floor. Considering the mild climate, the external skin of DSF adopts a single-glazed facade as a protective layer. AEXs on top and AENs at the bottom are also set to encourage cavity ventilation. The internal layer is a light steel wall, assembled by the metal skinned sandwich panels with rock wool. The OGWs are tilt-turn windows, aiming to control the total incoming of light and wind. The intermediate air cavity is set 3.95m high and 0.45m deep to provide adequate thermal pressure for ventilation. A perforating mental mesh above AENs serves as a maintenance deck, without interfering the airflow and introducing insects. Considering the solar radiation is weak, sun-shading device is not involved in this study. To supply fresh air, an earth-air tunnel system was further introduced building. It's worth noting that its vertical ventilation ducts are integrated within the air cavity, which not only save indoor space for LPBs, but also serve as vertical baffle to form a series of box-window DSFs.

3.2 Experimental platform in Cold Zone

The experimental platform in Cold Zone completed in Jan. 2017, the CSC Center, is a NZEB with BREEAM 5-star and LEED platinum certificates. The building is composed of three individual boxes sharing the same building prototype, serving as reception, exhibition house and fitness room respectively for the local community. The prefabricated timber system is adopted to shorten the whole construction process. Aiming to improve the comprehensive building performance, many passive design and active technologies are also employed, particularly for the envelope system. Among them, the same DSF prototype with THE Studio is applied on the south façade of exhibition house (Fig. 5&6). However, some modifications have been made according to the local climate characteristics.

The transparent external skin is divided into two parts. The lower part uses double-glazed facade with Low-E coating, leading better insulation. Based on the rich solar energy resource, the upper skin integrated with solar photovoltaic glass can produce power to reduce reliance on grid. A group of opaque sliding windows acting as AENs is placed at the skin bottom. The internal layer refers to the light timber wall filled with PU insulation. The OGWs are still tilt-turn windows but with better thermal properties. The air cavity is 5.5m high and 0.41m deep, sharing a same ventilating maintenance deck with THE Studio. In order to control the strong sunlight, an electronic sun-shading blind is further set between external skin and OGWs.

Figure 4. Application of DSF prototype on first floor of THE Studio

Figure 5. Application of DSF prototype on exhibition house of CSC Center

3.3 Operating strategies of DSFs in two platforms

According to the climate factors of Moderate Zone and Cold Zone, different operating modes are assumed from the initial phase of design. For THE studio in mild climate with relatively low solar radiation, the CV mode and IV2 mode are recommended in summer for reducing diurnal heat gain but improving night cooling effect, while the DSF in TB mode is designated to provide thermal insulation in the whole winter day. As to the CSC Center in Cold Zone with strong solar radiation, the CV mode and IV mode are also pre-set for summer condition as THE Studio. However, the AC mode is chose to gain more solar heat during sunny daytime and then the TB mode will be activated at night.

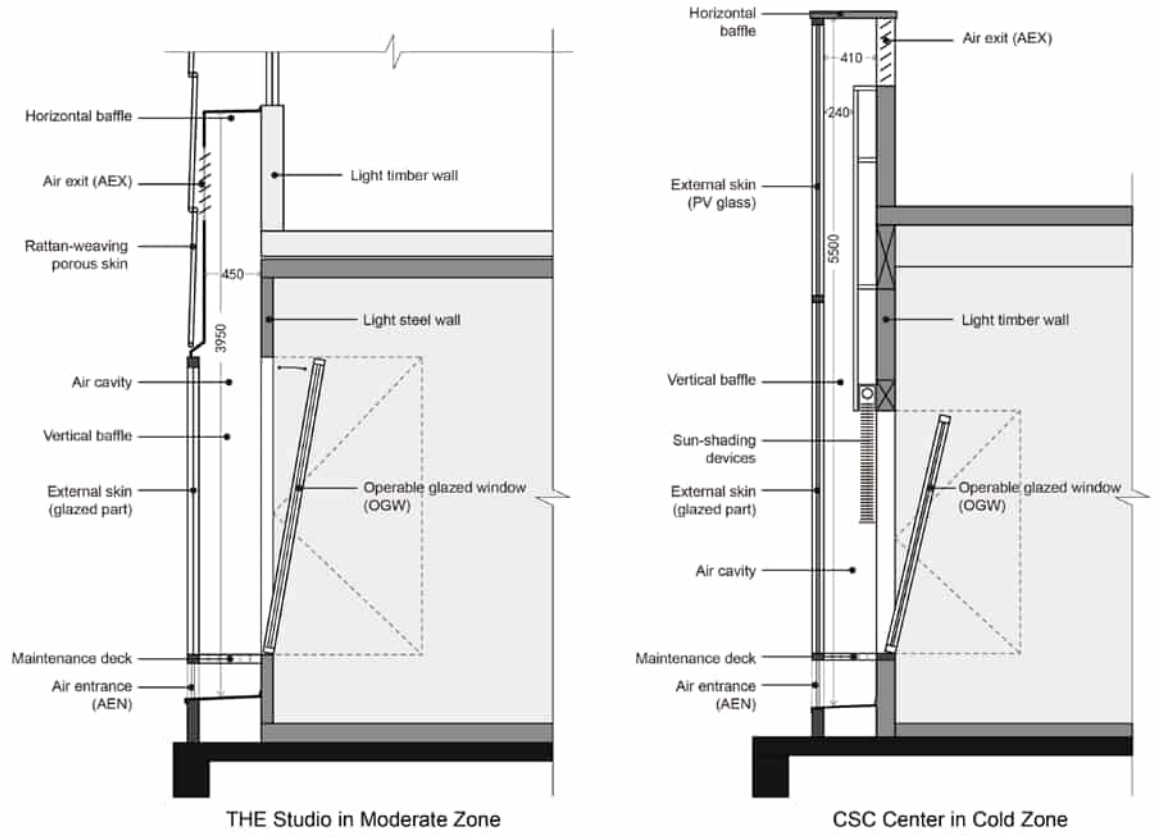

Figure 6. Structures of DSFs in tow experimental platforms

4 Field measurements and verification

4.1 Field measurements in Moderate Zone

The field measurements in THE Studio in Moderate Zone were carried out both in summer and winter. A south room with DSF was selected to measure in different operating modes.

In summer, the TB and IV2 modes are firstly compared in a two-day measurement. As shown in Fig. 7, once the DSF is shifted into the IV2 mode, the room temperature would swiftly approaches to the outdoors no matter whether positive or negative. It indicates that the IV2 mode does encourage ventilation, and that the night ventilation is good for thermal comfort but the daytime ventilation aggravates indoor discomfort by introducing hot air. Secondly, when comparing the data of a period from 8:00 to 15:30 for each day, it can be found that

although the outdoor temperature increase largely in the second day, the room temperature can still remain within the “comfort zone” (24-28°C). It can be attributed to the hybrid mode combining IV2 at night and TB mode in the daytime, which can positively capture and conserve night cooling energy to counterbalance daytime heat gain.

Although the local solar radiation is weak, the “green house effect” in air cavity still works. Therefore, TB mode is further compared with CV mode in a two-day period of summer. As shown in Fig. 8, despite the average outdoor temperature rises 2°C in the second day, the average room temperature in CV mode only increases by 0.7°C, remaining in the “comfort zone” as the first day. Besides, the cavity temperature in CV mode is also much closer to the outdoor temperature when compared with the TB mode, meaning that parts of accumulated solar heat in air cavity can be removed through cavity ventilation.

To sum up, in summer with low solar radiation, the best operating strategy of DSF prototype is a hybrid mode combining the CV mode in the daytime with the IV2 mode at night.

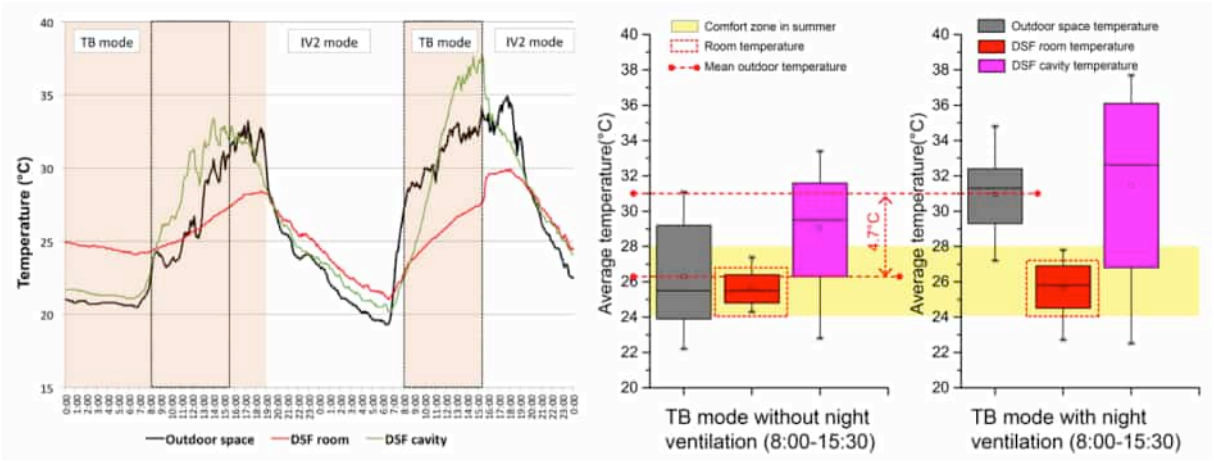

Figure 7. Temperature data of DSF in the TB and IV2 modes in summer

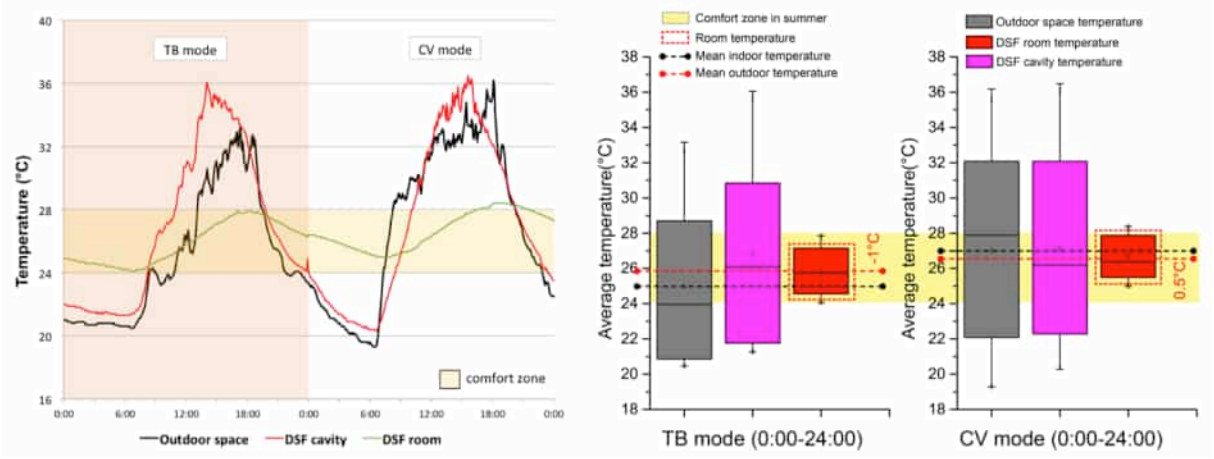

Figure 8. Temperature data of DSF in the TB and CV modes in summer

In winter condition, four operating modes of DSF system including TB, IV1, AC2 and CV mode were measured, as shown in Fig. 9. It is worth noting that these modes are only activated for a fixed period from 9:00 to 17:00 in each day, which is the same to the working hours in THE Studio. In order to compare their thermal performance more visually and horizontally, the D-values of outdoor and indoor temperature of each mode are calculated and shown in Fig. 10. The D-values in TB mode stay higher than in other three modes with a higher average of at

least 1°C, which means that the TB mode owns the best insulating performance in winter. Due to the weak ventilation in air cavity and the limited connection to the outer space, the thermal performance of the CV mode lies just behind the TB mode. However, as a result of introducing cold air into air cavities and indoor space, the insulating performance in the IV1 mode is proven much poorer. Due to the very weak solar radiation in winter, the AC mode with single glazed skin doesn't increase daily heat gain, but even causes extra heat loss for the whole day due to its poor thermal properties. Consequently, the TB mode

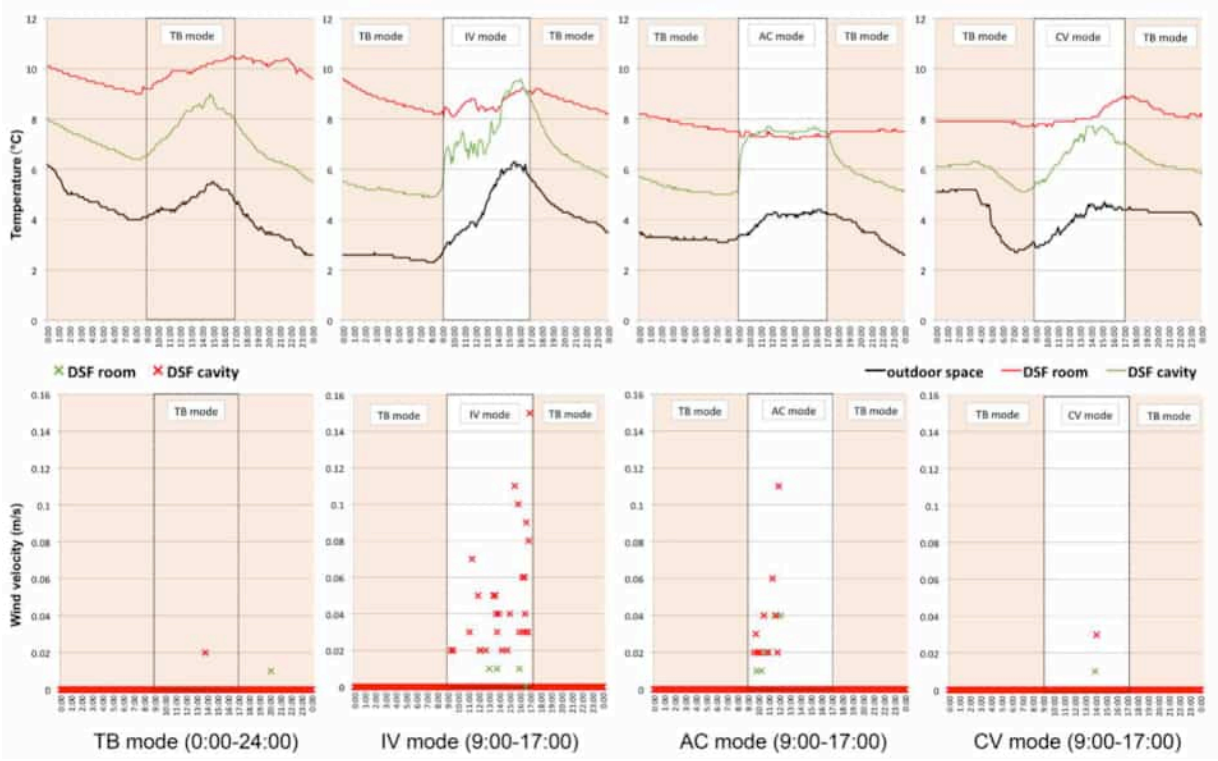

Figure 9. Temperature and wind velocity data of DSF in four operating mode in winter

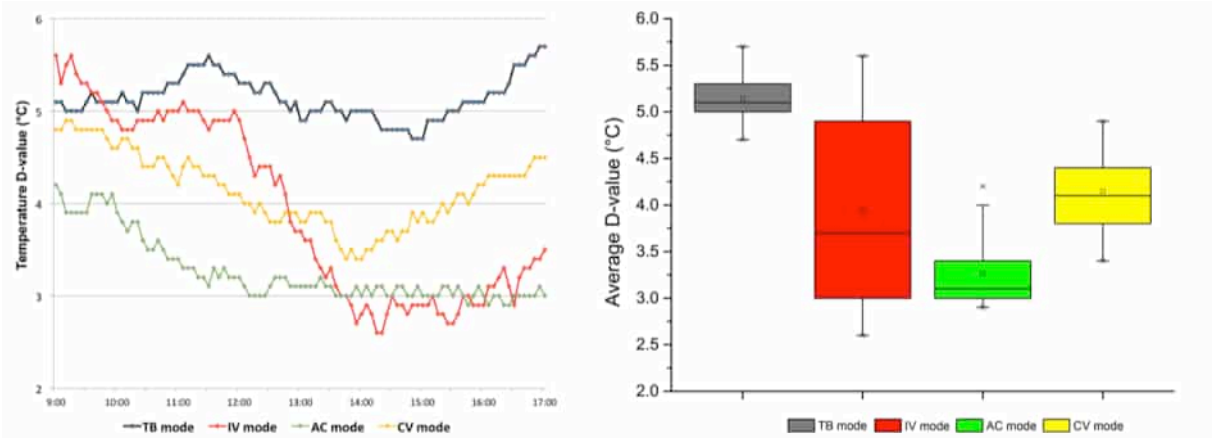

Figure 10. D-values of DSF in four operating mode in winter

4.2 Field measurements in Cold Zone

The field measurements for CSC Center in Cold Zone were also conducted both in summer and winter. The exhibition house with DSF system was select as measuring room.

In summer, the TB, CV and IV2 modes were measured in a three-day measurement, as shown in Fig. 11. It's observed that the outdoor temperature in Beijing fluctuates obviously, which is quite high in the daytime but falls to an acceptable level at night, indicating that the DSF should both reduce diurnal overheat while promoting night free cooling by ventilation. Therefore, the temperature D-values of indoor and outdoor space should also be discussed in day and night scenarios. In other words, a large D-value can indicate a better insulating performance in the daytime, but also refer to a poorer cooling effect at night. For the daytime scenarios, the D-value accumulation in the CV mode is larger than those in the TB and IV2 modes, which account for 95.5% and 68.6% respectively. It means that the cavity ventilation only slightly improved the daytime indoor comfort, and that the daytime interior ventilation does aggravated indoor discomfort by introducing hot air inside. As to the night scenarios, the D-value accumulation in the IV mode is extremely small, which means the night ventilation is truly encouraged to cool down the room. The night D-value accumulation in the CV mode only accounts for 61.9% of that in the TB mode, and the cavity temperatures of CV mode are also much closer to the outdoor temperature, which means cavity ventilation also help to cool the indoor space. Therefore, in hot summer day of Cold Zone, the optimal operating mode of DSF prototype for LPBs is also a combination of the daytime CV mode and the IV2 mode at night.

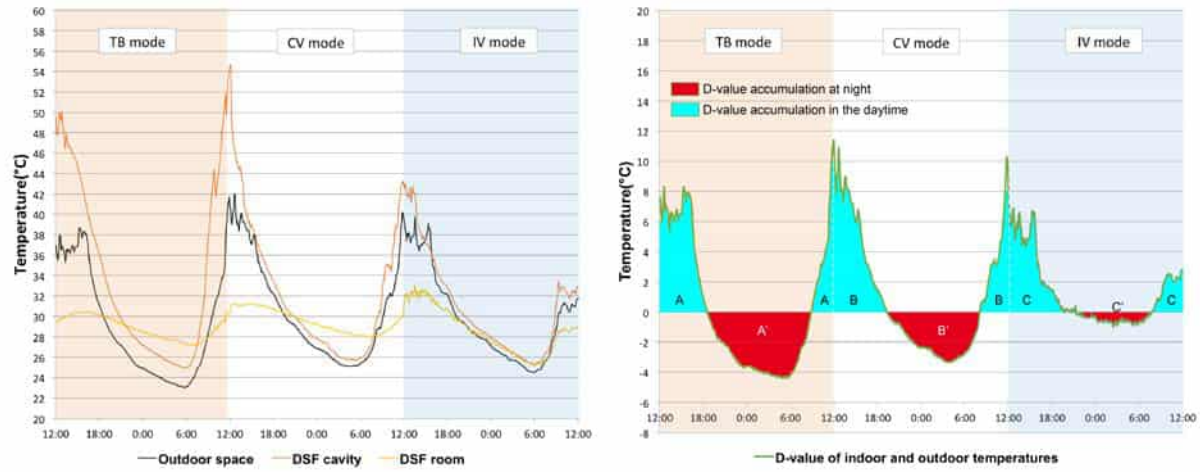

Figure 11. Temperature data of DSF in the TB, CV and IV modes in summer

In winter, the TB and AC (AC1 & AC2) modes were measured, as shown in Fig. 12. It's worth noting that these modes were only activated for a fixed period from 9:00 to 18:00 in each day. In numbers of studies, the TB mode is the only choice to enhance insulating performance in winter. However, in this study, even though the air cavity temperature could reach over 40°C, the indoor comfort doesn't improve remarkably, meaning the accumulated heat gain in cavity has been wasted. In order to use the cavity hot air, both AC1 and AC2 are proposed to encourage heat exchange between indoor and outdoor space via the opened windows. It's observed that in the AC1 mode with OGWs swung inward at bottom, the air movement in both cavity and room largely enhances due to the "stack effect" and the D-values also increase significantly as well, comparing with the TB mode. When the DSF is shifted to AC2 mode, the air speed is slowed down but the sunlight in sunny day can arrive the indoor space by penetrating only the external skin, still leading to higher D-values than the AC1 mode. Nevertheless, if the solar radiation intensity is not strong enough, the TB mode providing a sealed cavity as thermal buffer will still be better than other modes.

In order to further examine the energy performance in TB and AC2 mode in sunny days, a two-day monitoring were carried out. The room temperature is set about 20°C by activating an electric radiator from 9:00 to 18:00 for per day. As shown in Fig. 13, the hourly and total energy consumption data are collected and the AC2 mode is proved more energy-efficient, using around 11% less heating energy than the TB mode. Therefore, in sunny day of winter, the AC2 mode is better than the TB mode.

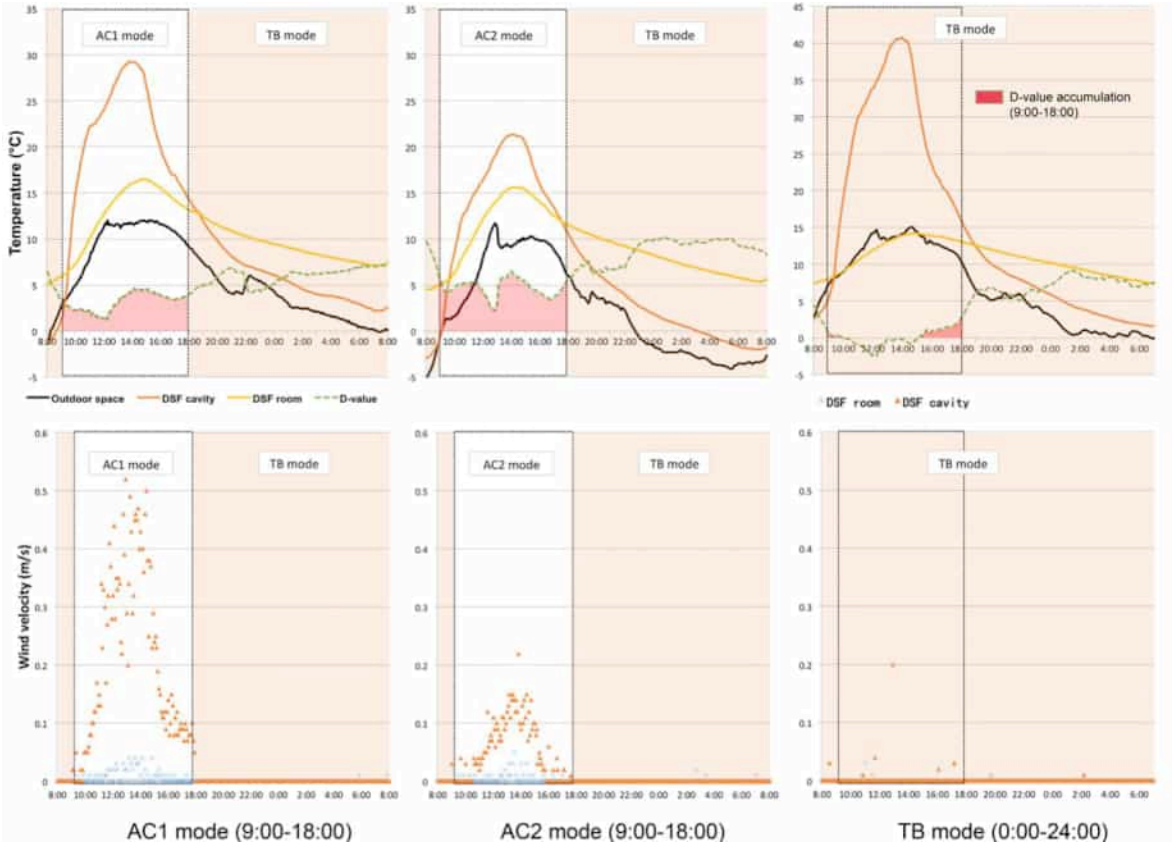

Figure 12. Temperature and wind velocity data in TB, AC1 and AC2 modes in winter

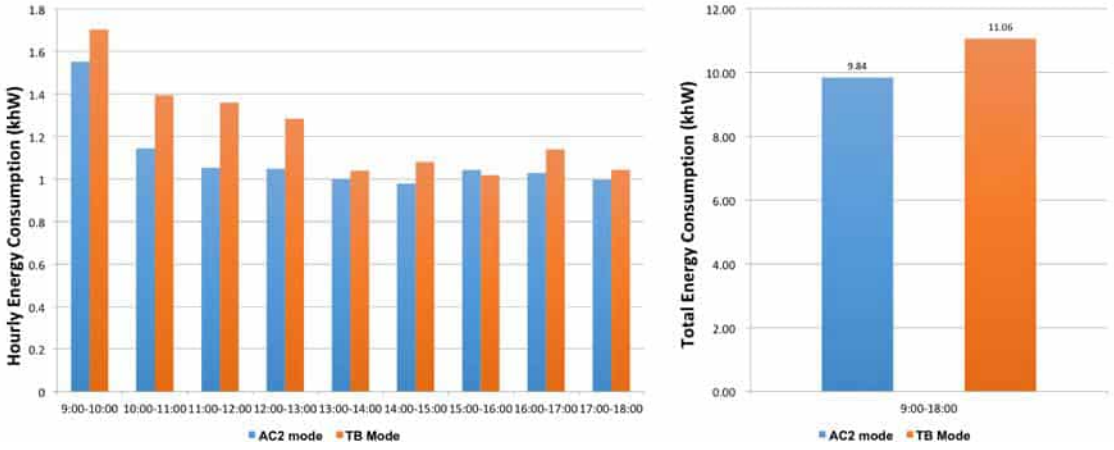

Figure 13. Hourly and total energy consumption in TB and AC2 modes in winter

5 Conclusion

Despite the wide existence of LPBs in China, their lack of climate responsiveness has led to poor thermal comfort and energy performance. In this study, a DSF prototype with different operating modes for LPBs is firstly proposed. This prototype is further applied on two newly-built prefabricated buildings locating in Moderate Zone and Cold Zone respectively, serving as experimental platforms. In order to verify the thermal and energy performance of the DSF prototype under different operation modes, a series of field measurements are successfully conducted both in summer and winter. In Moderate Zone with weak solar radiation, the optimal operating strategy in mild summer turns out to be a combination of daytime CV mode and night IV2 mode, while that in winter is the TB mode. In Cold Zone with relatively strong solar radiation, the best mode for DSF prototype in hot summer is a hybrid of daytime CV mode and night IV2 mode as well, but that in winter will depend on the solar radiation intensity. If the solar energy is strong enough, the daytime AC2 mode with the TB mode at night can provide better energy performance and indoor comfort. Otherwise in cloudy or snow days, the TB mode with thermal buffer will be better. Therefore, by delicate design and careful operation, the DSF prototype proposed does improve the climate responsiveness for LPBs in two typical climatic zones of China.

Acknowledgements

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Challenges Of Applying EnerPHit Standard To The UK High-Rise Social Housing

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Abstract

Residential tower blocks, built in the 1950s, 1960s and 1970s as part of social housing programmes, are amongst the most energy inefficient dwellings in the UK which has led them to being categorised as "hard to treat" properties. Their upgrade is required to improve energy efficiency. EnerPHit, the retrofit version of the Passivhaus standard, has been gaining in popularity in some European countries in the last two decades. EnerPHit far exceeds the requirements of the UK building regulations; thus, it can provide an opportunity to achieve a high level of energy efficiency in the existing building stock including hard to treat tower blocks. Wilmcote House, located in the City of Portsmouth, is the first example of high-rise social housing in the UK being refurbished to EnerPHit. However, the project has been facing challenges at different stages. Based on the case study of Wilmcote House, this paper provides a critical appraisal of how complying with EnerPHit standard affects the refurbishment design solutions for a tower block. The purpose of the paper is to identify the major challenges related to the design process.

The main research methods are reviewing the feasibility reports including the architects' design proposals, structural appraisal of the building and the analysis of the heating options, conducting interviews with members of project teams and the client, direct observations on site, and reviewing data related to similar retrofit projects. The most challenging aspects of developing the refurbishment scheme are found to be the superinsulation of the building, minimising thermal bridges and complying with primary energy requirement of the EnerPHit standard.

Keywords

Tower block refurbishment, EnerPHit design challenges

1 Introduction

The construction of residential tower blocks in the UK started after the Second World War when the country was facing a housing shortage. However, the use of unsuitable materials, poor workmanship, and insufficient supervision led to serious problems in the tower blocks, particularly energy inefficiency [1]. Lack of energy efficiency in tower blocks increases the risk of fuel poverty because most of their tenants live on lower incomes. In fact, 71% of tenants

living on or above the fifth floor are social rented sector tenants [2]. In addition, the energy inefficiency of the buildings results in high level of CO2 emissions which affect the carbon reduction targets of the UK adversely. One of the most important targets which was set in 2008 through the UK Climate Change Act was the reduction of GHG emissions by 80% by 2050 compared to 1990 levels [3]. Because a quarter of the UK's greenhouse gas emissions are related to households [4], it is necessary to improve the energy efficiency of existing buildings to achieve the target.

Currently, the only refurbishment benchmarks in the UK that existing buildings are required to comply with are the UK building regulations. The energy efficiency requirements are provided in document L1 B under "Conservation of fuel and power in existing dwellings". Performance targets and assessment methods such as the Zero Carbon Policy introduced in 2000s were designed to be applied in new buildings and did not address refurbishment schemes. However, improving the existing stock is more vital because it is predicted that around 75% the housing stock will exist in 2050 due to low demolition and replacement rates in the UK [5]. Therefore, using a standard which would significantly upgrade the efficiency of existing buildings will have a considerable contribution to carbon reductions in the UK.

The German Passivhaus standard has been widely adopted in some European countries during the last two decades. It specifies clear energy performance targets for the buildings. However, it is not always viable to fully comply with Passivhaus in refurbishment of existing buildings; thus, the PassivHaus Institute in Darmstadt introduced EnerPHit, the retrofit version of Passivhaus. EnerPHit has less stringent performance criteria than Passivhaus [6]. The first refurbishment project to achieve EnerPHit in the UK was completed in 2008 [7] and since a significant number of buildings covering residential, commercial and educational projects have achieved EnerPHit. Nevertheless, the use of EnerPHit in the UK has been mostly limited to low-rise buildings and despite a few attempts, no existing high-rise building has achieved EnerPHit yet.

Wilmcote House in Portsmouth is the first residential tower block in the UK which is being refurbished based on EnerPHit standard. The building is a post-war tower block completed in 1968. By 2010, some of the main elements of the building were near the end of their serviceability [8]. Furthermore, the tenants were at the risk of fuel poverty due to the poorly insulated structure of the building and the costly and inefficient heating system [9]. Following their consultations with the project architects, the Portsmouth City Council decided to upgrade Wilmcote House to the EnerPHit level to maximise its energy efficiency and to minimise the energy bills of the tenants. After this project is completed, the building will comply with all EnerPHit requirements except primary energy demand. This paper aims to examine the challenges of applying EnerPHit to UK tower blocks using Wilmcote House refurbishment as a case study. The study focuses on the difficulties encountered at the design stage of the project.

2 Background

The UK Government has designed different programmes to cut the carbon emissions in the existing housing stock and to improve their energy efficiency. In 2000, the government introduced *Decent Homes standard* and committed to bringing all public dwellings to a basic level of decency through this standard by 2010 [10]. Adequate thermal comfort inside the building is one of the main requirements of achieving this standard. The measures required to

improve the thermal comfort were identified as cavity wall insulation, loft insulation and providing an efficient heating system; however, some of the social housing stock did not achieve this standard by 2010 [11]. Following the Decent Homes standard, the government devised new schemes such as *CERT* (Carbon Emissions Reduction Target) and *CESP* (Community Energy Saving Programme) which obliged gas and electricity suppliers to achieve energy savings in homes [4]. CERT prioritised more cost-effective measures such as cavity wall and loft insulation, and delivery of low energy light bulbs, while CESP focused on upgrading hard to treat properties by taking measures such as solid wall insulation and replacement of heaters [11]. In 2010s new schemes were designed which particularly targeted harder to treat dwellings with solid wall insulation, hard to treat cavity wall insulation, and vulnerable or low-income households. The *Green Deal* scheme was designed to make energy improvements at no upfront cost for householders while reducing CO2 emissions and helping the vulnerable [4]. Under the Green Deal, the homeowners could pay for the improvement costs through savings on their energy bills [12]. *ECO* (Energy Company obligation) another government scheme which initially worked alongside the Green Deal, provides further assistant for hard to treat properties and vulnerable households. This scheme is funded by energy suppliers and has replaced CERT and CESP [4]. ECO provides primary measures including solid wall, cavity wall and loft insulation, connections to district heating systems and secondary measures such as double glazing [12]. Some of the UK Tower blocks have been affected by the schemes while the others have not been upgraded since they were built.

Regardless of their effectiveness, these schemes demonstrate the government's approach to upgrading the existing housing stock which focuses on improving individual elements such as replacement of heating systems and the installation of insulation, but there have been no specific targets for the overall performance of the building. EnerPHit standard, in contrast, provides a model for a more comprehensive and holistic approach to the refurbishment. It addresses energy consumption, building elements, and services and specifies clear performance targets. Table 1 [13] shows the energy performance targets of EnerPHit for cool and temperate climate. As it can be seen from the table, the specific heating demand of EnerPHit is 25 kWh/m².yr or less. In comparison, the average heating use for the existing building stock in the UK is 180 kWh/m².yr, for the refurbished stock it is 100 kWh/m².yr, and for the new builds it is 50-60 kWh/m².yr [11]. Hence, EnerPHit has the potential of reducing the heating energy demand of the existing stock by close to 75%.

Table 1: Energy performance targets of EnerPHit

Criteria	**EnerPHit**
Specific Heating Demand	≤ 25 kWh/m².yr
Specific Cooling Demand	≤ 15 kWh/m².yr
Primary Energy Demand	≤ 120 kWh/m².yr + ((Specific Heating Demand - 15 kWh/ m².yr) x1.2)

As shown in table 2 [13][14], the U-value targets of EnerPHit are more stringent than the UK building regulations targets. Furthermore, the EnerPHit standard requires an airtightness of 1.0 air changes/ hr @ n50 which is challenging to achieve in the UK. In fact, the UK building regulations does not specify an airtightness target for the refurbished existing stock. The airtightness requirement for a new build is a maximum of 10 m3/hr/m² @ 50 Pa [15] which is

not difficult to achieve. It is worth noting that only a building which is more airtight than 3 m3/hr/m² @ 50 Pa is considered to be airtight to a level that the utilisation of mechanical ventilation will be required [16].

Table 2: The U-value targets of EnerPHit vs. UK building regulations

Building elements	**U-value (W/m².K)**	
	EnerPHit	**UK building regulations**
Walls	0.15	0.30
Roof	0.15	0.18
Floor	0.15	0.25
Windows (overall)	0.85	1.6
Doors	0.85	1.8

To comply with the performance requirements of EnerPHit, the building must be superinsulated, thermal bridges should be minimised, and efficient airtight barrier must be used. Mechanical ventilation and heat recovery system is also required to be installed. Ventilation is a significant factor in Passivhaus buildings because they are very airtight; nevertheless, they should not rely on natural ventilation because it contributes to heat losses. The mechanical ventilation and heat recovery system ventilates the building while minimising the heat transfer; furthermore, it maximises energy efficiency by recovering the heat from stale air. Compliance of the design with Passivhaus/EnerPHit is assessed via PHPP (Passivhaus Planning Package). PHPP software is used to calculate the performance targets of the building and evaluate them against Passivhaus/EnerPHit criteria [13].

Typically, tower blocks have certain advantages over low-rise buildings in terms of compliance with EnerPHit because they are more compact. Consequently, they are expected to be more airtight and to have a lower level of heat transfer. Based on the case study of Wilmcote House, the research aims to analyse the complications of complying with EnerPHit requirements on a tower block scale. The case study shows that it was not theoretically challenging to enhance the existing airtightness of the building to the level required by EnerPHit because the flats had relatively good level of airtightness as anticipated. However, the structural weaknesses of the building created difficulties with applying insulation to the building, minimising thermal bridges on the building façade and using a heating system which would reduce the primary energy consumption to the EnerPHit level.

3 Superinsulation

Wilmcote House had a thermally poor building envelope. The external elements of the building had high U-values. For instance, the U-value of outer walls was 0.72 W/m².K [17], far below the EnerPHit target of 0.15 W/m².K. The poor performance of the building contributed to the specific heating demand of 178 kWh/m².yr [8] which was more than 7 times higher than the level required by EnerPHit. Therefore, it was necessary to utilise a significant level of insulation to meet EnerPHit. However, prior to adding insulation to a high-rise building, it should be examined whether the building structure is sufficiently strong to carry the additional load. Generally, the post-war tower blocks in the UK were not constructed efficiently. Many

of them including Wilmcote House were built using the large panel system (LPS) [1]. These blocks typically consist of precast concrete floors, roofs and wall panels made off-site which are connected by different kind of joints on site. However, the process of applying LPS technique to buildings in sixties was inappropriate in many ways. [18]

To assess the efficiency of Wilmcote House structure, the structural engineers carried out a full structural analysis. The outcomes of their investigations revealed that the different layers of the outer walls were not sufficiently tied together. These walls were comprised of an outer layer, an internal layer, and a thin layer of polystyrene insulation between them. The external layer was tied to the internal layer only with phosphor bronze wire ties which were not effective in all instances. It was also found that the outer walls were built from the unreinforced concrete. Consequently, it was concluded that the insulation could not be installed to the external walls in conventional ways such as using adhesives or mechanical ties because it would result in fracturing of the unreinforced concrete in the outer layer of the walls. Thus, a solution was developed based on using an external steel grillage of channel sections which would be installed to the structure at each floor. The additional insulation would be carried by the still grillage. Using an unconventional method added to the complexity of design and created challenges at the construction stage. [19]

4 Minimising thermal bridges

The case study of Wilmcote House revealed that the uneven façade of the block can create complications in terms of removing thermal bridges and applying insulation. It should be noted that the arrangement of Wilmcote House was more complicated than a typical tower block. The three interlocked blocks of Wilmcote House contain maisonettes which are spread in two floors. The entrance doors of the maisonettes are located on the lower floors and open to communal walkways. The upper level of each maisonette is extended over the walkway on the lower floor. Before the refurbishment, there was a balcony on the upper floor of each maisonette. As it can be seen from figure 1 [20], the existence of the open walkways and the balconies had resulted in an uneven rear façade; therefore, it would not be possible to provide a continuous layer of insulation on the whole façade. In addition, according to the project architects, it was impractical to insulate the surface of the walkways due to their changes in level and the drainage issues [8].

Figure 1. The rear façade of Wilmcote House before refurbishment

Alternatively, the insulation could be applied to the ceiling of the areas below; nevertheless, this would leave thermal bridges at the slabs and exposed precast structure [8]. In an interview with ECD Architects, the project architects, they explained that it would not be possible to achieve EnerPHit if the existing arrangement of the façade was maintained [21]. Therefore, the architects designed a new façade with enclosed walkways. To create an even façade, they proposed to remove the balconies and to extend the living rooms to reach the boundary of the walkways at the lower floor. However, consultations with the residents showed that some of them did not support the removal of balconies because they used this space for smoking and drying their clothes [21]. Consequently, the architects proposed to convert the balconies to sunspaces. Bi-fold windows would be placed in the walls of the sunspaces so that they could be temporarily opened for drying the clothes or any other purposes [8]. Figure 2 [8] shows the alterations made to the rear façade which resulted in a new even façade.

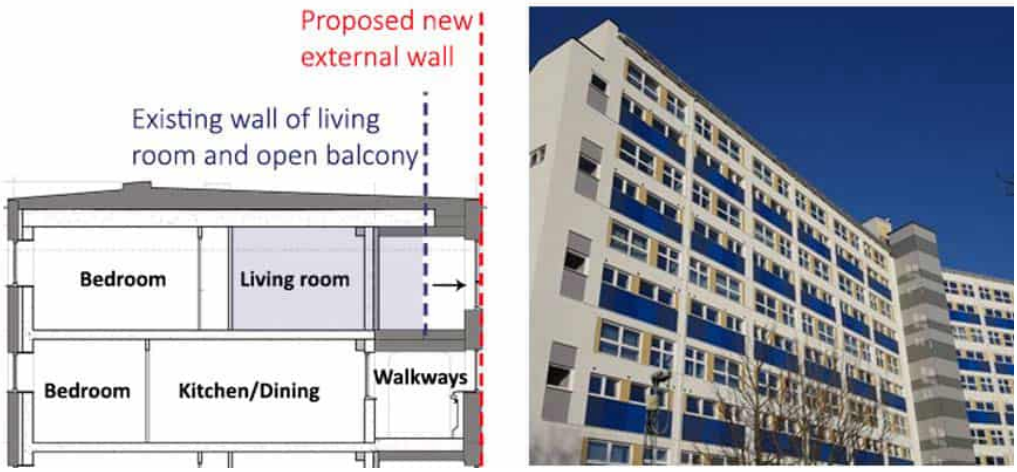

Figure 2. The design of the rear façade of Wilmcote House

The proposed alterations required a significant level of additional design and construction works because the structure of the building was not sufficiently strong to carry the additional loads of the enclosed balconies and walkways; thus, a solution had to be developed to transfer the load to the foundations. The structural engineers recommended the using of a steel framework and columns supported by the piled foundations. The frame which would be bolted to the existing concrete walkway structure would facilitate the floor extensions made of timber. Similar to the front façade, a steel grillage was also required to be incorporated to the new rear façade to carry the insulation [19][Fig.3, 22]. Thus, the issues related to the inefficient construction of the building restricted the application of external insulation and the reduction of thermal bridges. Consequently, it was necessary to change the design of the rear façade which became overcomplicated due to the structural weaknesses.

Figure 3. Steel framework and grillage on the rear façade of Wilmcote House

5 Primary energy demand

The most serious challenge with achieving EnerPHit in Wilmcote House is to meet the primary energy target. At the time of the project completion, Wilmcote House will achieve all the EnerPHit requirements except the primary demand. This problem has roots in the structure of the building. In 1968, Ronan Point, a residential tower block in London, partially collapsed followed by a gas explosion. The investigations revealed that the block which was built with large panel system was designed and constructed inefficiently [23]. Partial collapse or disproportionate collapse means the building's collapse in case of an accident to an extent disproportionate to the cause [24]. To avoid their disproportionate collapse, the piped gas supply was removed from the post war tower blocks built with LPS system including Wilmcote House. As an alternative, individual electric heaters have been used in Wilmcote House. Nevertheless, PHPP calculations carried out by the Passivhaus consultants revealed that using electric heaters would result in exceeding the primary energy demand of EnerPHit [21]. The reason is that the electricity is a secondary energy generated from primary resources such as gas, coal, wind and sunlight. Through this process not all of the primary energy transforms to electricity and part of it converts to heat [25]. Thus, Wilmcote House would meet the primary energy target if the heating was provided by gas because natural gas is a primary energy resource which is supplied to consumers through pipelines and there is only a small waste of energy through this process. Consequently, the primary energy demand would be significantly lower. However, it is not possible to switch to piped gas due to the structural issues.

In addition to using piped gas, it would also be possible to reduce the primary energy demand by using a community heating system supplied by gas or renewable energy sources such as biomass. Nevertheless, the feasibility of installing and operating a communal heating system depends on different factors such as the affordability of higher capital costs and the availability of storage space on site. One of the difficulties of using this system in Wilmcote House would be the installation of a heat distribution system. To transfer hot water to the flats, the pipes would need to penetrate the enclosed walkways [17]. Furthermore, the client did not want to be responsible for operating a communal heating system. In an interview with a member of the clients' team, he explained that they were particularly concerned with the tenants'

payment of bills [26]. If any of the tenants did not pay their bill, the council would need to cover their share in order to keep the communal system running. Thus, they preferred an individual system where every tenant would be responsible for paying their bills. Due to the structural infeasibility of using piped gas and the challenges of using a community heating, the heating system of the building will continue to be provided by electric heaters although it will result in lack of full compliance with EnerPHit.

However, there is still an opportunity for Wilmcote House to achieve EnerPHit by using renewable energy sources. The new version of PHPP has made it viable to calculate primary renewable energy demand. With the publication of PHPP 9, Passivhaus Institute launched new categories of Passive House. Unlike the traditional Passivhaus version which did not assess renewable energy, the new categories are based on primary renewable energy demand and the building's own renewable primary energy production [27]. Even though the new method provides a new opportunity for the tower blocks to comply with the primary energy demand of EnerPHit, using this method will depend on the client's financial capability to cover the costs of utilising renewable energy sources.

6 Conclusions

Even though the general traits of high-rise building typology are suitable for achieving Passivhaus standard and they have some advantages over low-rise buildings such as form and compactness, the case study of Wilmcote House shows that the low quality of structure and inefficient methods of construction can create challenges with upgrading the UK tower blocks to EnerPHit level. The investigation of the design stage of Wilmcote House refurbishment revealed that the poor structure of the building made it infeasible to install insulation to the building in conventional ways. Following their consultation with the structural engineers, the architects came up with a more complicated and uncommon solution to load the insulation to the building. Minimising the thermal bridges, another requirement of EnerPHit, was also difficult to achieve due to the physical conditions of the building. To comply with this requirement the architects found it necessary to enclose the open walkways of the building and to make certain alterations to the façade affecting the interiors of the building as well. These alterations were going to impact the ways the residents use the building. After the enclosure of walkways, they could no longer stop in walkways to smoke or to get fresh air without opening the walkway windows which would be operated by the client. In fact, the walkways would become passages which would lead the residents to their homes rather than a place where they could stop and interact with each other. However, the scheme would provide more privacy and safety in the walkways. Furthermore, the residents would also benefit from larger living rooms. Thus, the case study of Wilmcote House suggests that compliance with EnerPHit requirements in the UK tower blocks can limit the design solutions. In general, it is easier to achieve Passivhaus in more compact buildings with simple forms. Regarding tower blocks, the structural issues add to the complications and make it necessary to adopt a design approach which prioritises the compactness of the building and avoids any complex forms.

It can be understood from the Wilmcote House refurbishment that it would be specifically challenging to achieve EnerPHit in the post-war tower blocks built with large panel system. The inappropriate methods of applying this method to the tower blocks have resulted in poor building structures which are at risk of disproportionate collapse in case of hazards such as

gas explosion which is the reason why the blocks with large panel system rely on electric heating systems. Based on the Wilmcote House case, the use of electric heaters would result in exceeding the primary energy demand of EnerPHit. Therefore, alternative forms of heating apart from the piped gas should be utilised in the blocks to reduce the primary energy consumption. Alternatively, renewable energy technologies can be incorporated to the building and the primary energy calculations carried out with PHPP can be based on primary renewable energy demand. However, it should be investigated whether switching to alternative forms of heating system is feasible from technical and financial points of view. For the Wilmcote House refurbishment project complying with primary energy demand is the only obstacle on achieving EnerPHit. However, the difficulties of complying with EnerPHit requirements in UK tower blocks would to some extent depend on the project-specific factors such as the structural efficiency of each building.

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INFLUENCES OF SHADING DEVICES ON ENERGY AND DAYLIGHT PERFORMANCE OF OFFICE BUILDINGS IN TEMPERATE-HUMID CLIMATES

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Abstract

Nowadays, energy consumption in buildings has increased day by day. To reduce this consumption, energy efficient measures should be applied in buildings. Office buildings among these buildings have high internal heat gains and these gains lead to high cooling energy consumptions. Heating energy consumptions are not so important cooling energy consumptions. To minimized these energy consumptions, many active and passive energy efficient measures are applied in these buildings. Use of shading devices in building facades is among these meausure and their usage in recent year has become widespread. Cooling energy consumptions can be reduced in a significant ratio with determining of appropriate shading device design strategies in early design stage. Another issue that needs to be considered in shading devices is daylighting performance. This is why the effect of shading devices on daylight and cooling energy consumption is opposite. From this viewpoint, this study focus on determination of optimum shading device's scenarios in south facade to reduced cooling energy consumptions and to find the best daylighting performance for an office building in temperate-humid climates. For this study, a hypothetical office module was created with a single zone. While south facade of the office module was assumed as exterior wall, other facades are accepted as a partition. For south façade, four window wall ratio scenarios (%25, %50 ,%75 and %100) was investigated. In these scenarios, different types of fixed external shading devices (overhang, overhang with left side fin, overhang with right side fin, overhang with left and right side fins) was only applied on the south window. Length of these shading devices were determined as 0.5, 1, and 1.5 meters. Each scenario was evaluated according to energy and daylighting performance of the reference scenarios. The office module was simulated in DesignBuilder energy simulation program. Results of simulations were presented in tables and graphics as comparative. Optimum solutions for temperate-humid climates was discussed and recommended.

Keywords

Shading device, office building, cooling, lighting, DesignBuilder

1 Introduction

The conscious and unconscious consumption of energy resources and the environmental effects of this consumption have become a serious problem in the world. According to the International Energy Agency (IEA), considering the total amount of energy consumptions in the world; the commercial sector will be the first by an average growth of 1.6% per year between 2012 and 2040. [1]. This situation brings serious economic consequences in countries where a large part of the energy resources is imported. At the same time, the problem is getting worse when considering the environmental damage caused by this consumption, which is the majority of fossil fuel [2].

As is known, building façade is the most important factor that causes energy loss and consumption in buildings. On the building facades, windows play a significant role in energy loss. With the development of technology, glass production systems have been developed and large size glazing has started to be produced. Structures with a high transparency ratio for architectural aesthetic and functional purposes, or structures completely covered with glass, are applied especially in office buildings. This increases the cooling load in the overheated period and increases the annual energy consumption. At this point, the shading devices are the most important design parameter. As a solution to this, the proposed shading devices should reduce the cooling energy consumptions and provide daylighting performance at the same time.

Many studies have been carried out with the aim of determining the optimum shading devices for buildings. The impact of shading device types on energy use has been questioned by many researchers. Khoroshiltseva et al. [3] conducted an optimization study using the Pareto statistics and harmony search algorithm. Energy Plus program is used in the study. By selecting an existing residential building in Madrid, the effect of fixed shading devices designed on the windows on the south and west facades by changing the area and shape is investigated in terms of energy and comfort conditions. As a result of this study; it was determined that increasing the usage area of the shading devices leads to energy demand during the heating season when it is overheated in the cooling season and adversely affects comfort conditions. Lau et al. [4] used three types of shading devices in every facade of an existing office building in Malaysia, located in the hot and humid climate region, and compared them according to two different glazing types. Results from the IES (VE) program that shading device using single glazing provided more energy conservation than using double glazing. Rocha et al. [5] published uncertainty and sensitivity analyses of shading devices on single glazing in their published articles. New York and Miami were used as climate data, and four representation days were selected, 21 March, 21 October, 21 July and 21 December. As a result of the study, the maximum uncertainty values affecting the building energy balance have been reached in the warmer months from March to September, when the solar radiation intensity is higher. Manzan and Clarich [6] have compared the results to optimize the results using algorithms with minimum energy consumption, useful daylight indicator, and daylight performance using predefined lighting time history. Fixed external shading and interior blinds reduced energy consumption by up to 26%. In the study, no significant difference was found between the double glazing and the 3 glazing used as window system. Yasar et al. [7] have determined the effects on building's life cycle costs and heating and cooling loads of different glazing types in high rise residential buildings for moderate-humid climate in Turkey. A similar study was done by Maçka et al. [8] have realized for a cold climate region. Result of this study, the blue reflective double glazing unit with the low-E coating on surface 2 was found as the best scenario in terms of economic efficiency.

As understood from above studies, many factors such as climate, building geometry, glazing type, size, shading device type and length effects building energy and daylight performance. Shading devices are especially important improvement of cooling energy performance of building. Optimum shading device should provide high performance in cooling and receive daylight to interior from exterior. In this context, this study aims to find appropriate fixed external shading devices improved energy and daylight performances of a hypothetical office module for temperate climate regions according to type and length of shading device.

2 Methodology

In this study, firstly, energy and daylight performance of a hypothetical single-zone office module were investigated for four window wall ratio in south facade and three glazing type in the case of no-shading. After, investigated these office modules were attached four different type shading devices that have three different lengths. In total, 12 scenarios without shading and 144 scenarios with shading belong to office module were simulated by means of DesignBuilder energy simulation program. From simulation results, annual cooling and heating energy consumptions of each scenarios were obtained and compared with 12 scenarios without shading that are reference cases. After that, daylight performance of the scenarios compared by means of daylight map obtained from program.

2.1. Climate data

The office module was located in Antalya (36.37_N, 30.73_E, altitude 43 m), in Climate Region I, representing the temperate-humid climate of Turkey [9]. In Fig. 1, monthly climate data are given. As can be seen in the figure, the annual temperature average is high. For this reason, Antalya climate can be defined as a cooling-dominated climate. Due to its location and climate characteristics, the cooling loads is more important than the heating loads.

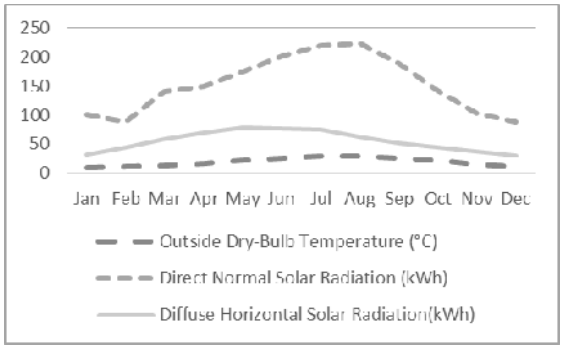


Figure 1: Climate Data of Antalya [9]

2.2. Office Module

For this study, a hypothetical single-zone office module (4.60x5.20m) was created at a height of 4.5 m. In Figure 2, plan and perspective of office module were given. There is only one window on south façade, other facades are opaque because of internal walls. Construction details of office module are shown in Table 1. It has been noted that U-values of building elements are in accordance with TS 825 (Turkish thermal insulation standard).

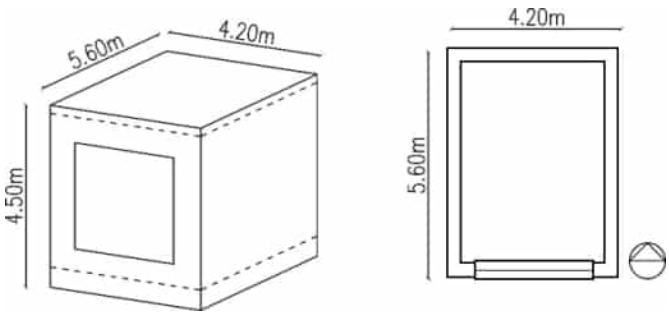


Figure 2. Office Module Plan and Perspective View

It is assumed that the occupant and equipment schedule is between 08.00 and 18.00 hrs. For mechanical systems, the schedule has been set between 07.00 and 17.00 hours. Calculations are not included on Sunday. The occupant density of the office module is 0.55 people/m^2. It is assumed that heating set-point and set-back temperatures are 20°C and 18°C, while cooling set-point and set-back temperatures are 26°C and 28°C, respectively. Heat gains of office equipments are 10,80 W/m^2.

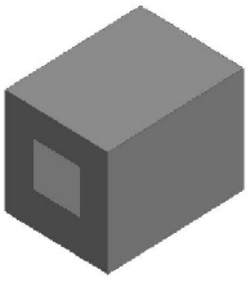
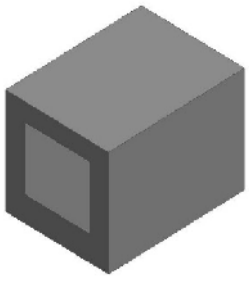
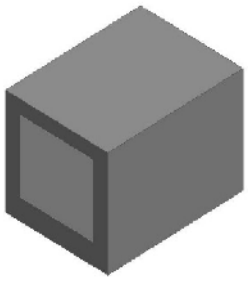
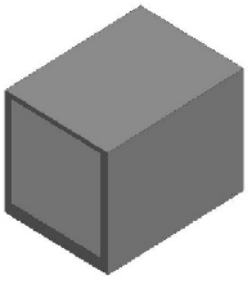
Table 1: Properties of construction materials used in office module

Layers		Thickness (cm)	U-Value (W/m2 K)
Walls	Gypsum Plaster	0.03	0.385
	XPS Extruded Polystyrene-CO2 Blowing	0.05	
	Concrete Block (Lightweight)	0.2	
	Gypsum Plaster	0.02	
Partitions	Gypsum Plaster	0,02	1,128
	Concrete Block (Lightweight)	0,10	
	Gypsum Plaster	0,02	
Ground Floor	Gypsum Plaster	0.03	0.256
	XPS Extruded Polystyrene-CO2 Blowing	0.05	
	Concrete Block (Lightweight)	0.4	
	Gypsum Plaster	0.02	
Roof	Gypsum Plaster	0.03	0,442
	XPS Extruded Polystyrene-CO2 Blowing	0.05	
	Concrete Block (Lightweight)	0.1	
	Gypsum Plaster	0.02	

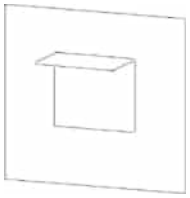
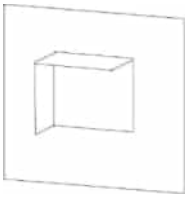
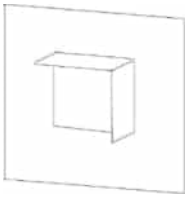
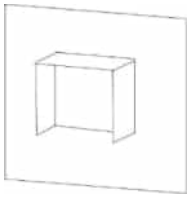
2.3. Shading Device Scenarios

For this study, different shading device scenarios on window in south facade of office modules with %25, %50, %75 and %100 of window wall ratios and three different double glazing types (clear, low-e #2 and reflective) were created. In Table 2, investigated office modules' scenarios are given.

Table 2. Investigated office modules' scenarios

OM1_WWR_25%	**OM1_WWR_50%**		**OM1_WWR_75%**			**OM1_WWR_100%**
						
Glazing types	d (mm)	Gas	T_{SOL}	T_{VIS}	SHGC	U-Value (W/m^2K)
DCLR	6-12-6	Air	0,60	0,78	0,70	2,8
DLOW-E#2	6-12-6	Air	0,32	0,69	0,40	1,6
DRFL	6-12-6	Air	0,32	0,30	0,40	2,8
Alu.(thermal break)	70	-	-	-	-	5,0

Continued Table 2.

Shading device types			
OH (0.5m, 1m, 1.5 m)	OH + LFS (0.5m, 1m, 1.5 m)	OH + RFS (0.5m, 1m, 1.5 m)	OH +LFS +RFS (0.5m, 1m, 1.5 m)
			

For all scenarios, window frames is aluminium with thermal break. Cooling loads are great importance in office buildings and temperate-humid climates. So, low-e #2 and reflective glazing types that have high cooling performance were selected as alternative to reference glazing (DCLR). Four external fixed shading device types on the south window were proposed. These devices are overhang (OH), overhang with left side fin (OH+LSF), overhang with right side fin (OH+RSF), overhang with left and right side fins (OH+LSF+RSF). For each shading device type, three different length were used: 0.5 m, 1m, and 1.5 m.

All scenarios were analyzed using DesignBuilder energy simulation program. Heating loads, cooling loads, total loads and daylight maps obtained from the program were compared with reference scenarios. Reference scenarios (No- shading (NS)) was assumed for each different WWR, glazing type and shading device combinations without shading device on the south window.

3 Results and Discussions

In the scope of the study, annual heating and cooling loads were calculated and daylight maps were obtained according to various shading device scenarios of a hypothetical office module through DesignBuilder energy simulation program. Outputs of the simulations were analyzed as three main categories: Annual heating and cooling loads, annual total energy loads, daylighting performance of investigating scenarios. Evaluations were made according to 50 WWR which is regarded as medium value and which is effective in terms of heating, cooling and lighting performance.

3.1. Annual Heating and Cooling Loads of Investigating Scenarios

In the study, firstly, the annual heating and cooling loads of each shading device scenario were compared as percent increase and decrease according to the reference cases (Table 3). When the results are compared in terms of cooling efficiency, 3 variables were considered. These; WWR, glazing type, shading device type and lengths. As you can see in Table 3, as the WWR increases, while heating load decreases, cooling load increases. The reason of increment in cooling load is that amount of solar radiation penetrating into the module depend on window surface area increases. On the other hand, selected glazing types have low heat transmission coefficient (U-value) and allow incoming to indoor wanted solar gains in winter unlike opaque element and this case improves heating loads Figure 3 shows relationship between window wall ratio and heating and cooling loads according to glazing types in the case of no-shading.

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Table 3: Change of heating and cooling loads according to reference scenarios (%)

		Glazing Type																							
SD type	SD length (m)	DCLR								DLOW-E#2								DRFL							
		Heating				Cooling				Heating				Cooling				Heating				Cooling			
NS*	-	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
OH	0,5	16	17	16	13	-20	-24	-24	-20	11	14	13	12	-13	-18	-18	-18	9	12	11	9	-10	-17	-17	-17
	1,0	27	31	28	24	-29	-45	-47	-43	18	26	24	23	-18	-32	-34	-38	13	21	19	17	-10	-28	-30	-34
	1,5	35	41	38	34	-33	-59	-63	-63	24	35	32	28	-20	-41	-44	-45	19	29	27	23	-12	-35	-39	-41
OH+LSF	0,5	23	26	25	21	-26	-33	-34	-29	16	21	25	20	-17	-24	-30	-26	13	18	17	15	-13	-22	-23	-23
	1,0	38	45	42	38	-37	-64	-67	-65	26	37	39	36	-21	-44	-52	-54	16	31	29	28	-29	-37	-40	-48
	1,5	47	57	54	51	-42	-83	-91	-100	33	49	49	46	-24	-55	-66	-69	26	41	39	23	-14	-45	-52	-41
OH+ RSF	0,5	24	27	25	21	-26	-33	-33	-28	17	22	26	20	-17	-24	-30	-25	14	18	18	15	-13	-22	-23	-23
	1,0	39	46	43	39	-38	-63	-66	-63	27	38	40	37	-22	-44	-52	-53	21	32	30	29	-13	-36	-40	-47
	1,5	48	58	55	52	-40	-83	-90	-96	33	50	51	47	-21	-55	-66	-68	25	42	40	38	-12	-43	-51	-60
OH+LSF+ RSF	0,5	31	35	33	28	-32	-43	-44	-38	21	28	28	27	-21	-31	-32	-34	18	24	23	20	-16	-29	-29	-30
	1,0	48	57	54	50	-46	-84	-90	-91	34	48	46	48	-26	-56	-60	-72	27	40	39	37	-16	-45	-51	-63
	1,5	57	70	67	64	-47	-111	-124	-133	40	60	59	59	-23	-72	-80	-98	32	51	50	49	-15	-54	-65	-82
		OM1	OM2	OM3	OM4	OM1	OM2	OM3	OM4	OM1	OM2	OM3	OM4	OM1	OM2	OM3	OM4	OM1	OM2	OM3	OM4	OM1	OM2	OM3	OM4
		Office module type																							

■Reference scenario, *No Shading, positive values means increased energy consumption, negative values means decreased energy consumption as percentage (%) according to reference case in first row of each column.

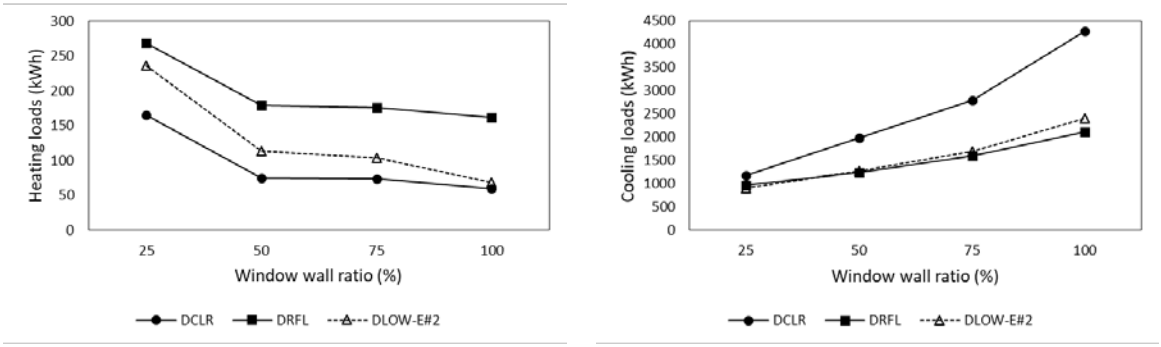


Figure 3. Relationship between window wall ratio and heating and cooling loads according to glazing types in the case of no-shading.

In Figure 3, when glazing types were evaluated in terms of heating load, it was seen that DCLR performed 34% and 58% better performance than DLOW-E#2 and DRFL in 50% of window wall ratio, respectively. The reason is that DLOW-E#2 and DRFL prevent the wanted solar radiation in underheating season because of their low solar heat transmission values. When glazing types are compared in terms of cooling load, DRFL has the best performance according to other glazing types. DFRL provides 3% and 38% more cooling energy saving than DLOW-E#2 and DCLR, respectively. Energy consumption performances of shading device types change depend on glazing type. In Figure 4, heating and cooling loads of shading device types with 0.5 m length in 50% of window wall ratio are given

according to glazing types. The Scenario with no-shading in DCLR glazing type provide 17%, 26%, 27% and 35% more heating energy saving than OH, OH+LSF, OH+RSF and OH+LSF+RSF, respectively. In addition, these shading device types show same performance in other glazing types. For usage shading device prevent incoming solar radiation, increased domain area of these device cause high heating energy consumption. When cooling load is investigated, OH, OH+LSF, OH+RSF and OH+LSF+RSF provide 24%, 33.5%, 33% and 43% more cooling energy saving than scenario with no-shading in DRFL glazing type has the best performance, respectively. It is seen that cooling energy consumption is not considerable effect of applied left side fin or right side fin on window in south facade. In terms of cooling energy consumption, OH+LSF+RSF scenario shows the best performance but it is minimized incoming daylight. So, it is significant that natural daylighting demand is known.

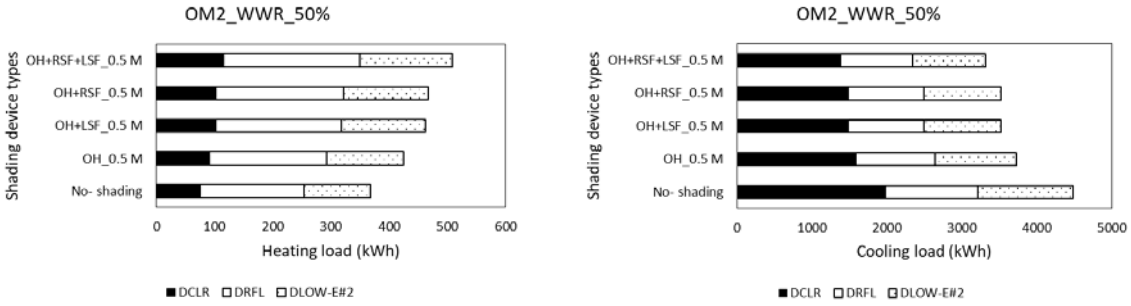


Figure 4. Heating and cooling loads of shading device types with 0.5 m length in 50% of window wall ratio

Length of shading device types effect heating and cooling loads according to glazing types. In Figure 5, it is shown that effects on heating and cooling loads of alteration in length of overhangs. As you can see in this figure, increment in lengths of overhangs cause high heating energy consumption and low cooling energy consumption according to alternative with no-shading. In terms of heating energy consumption, OH_0.5 M shows 17% worse than alternative with no-shading, it provides 20% more cooling energy saving. It is not forgotten that cooling energy consumption is more important than heating energy consumption in office buildings. In Figure 6, heating and cooling loads of all shading device types were given according to their lengths for DCLR glazing type in 50% of window wall ratio.

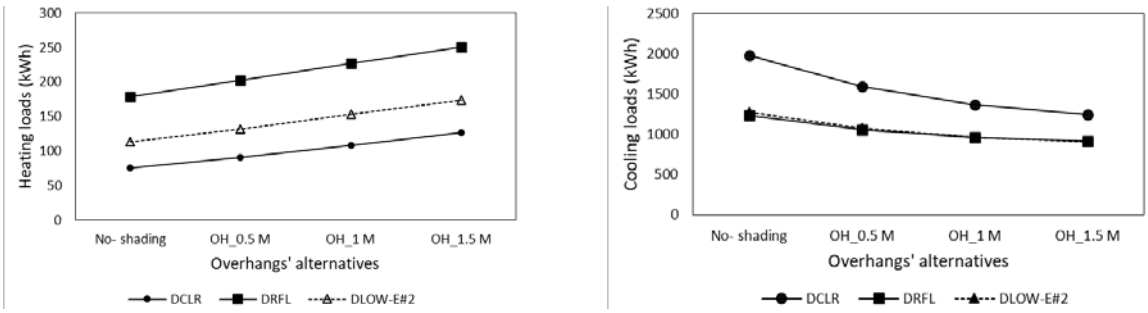


Figure 5. Heating and cooling loads of overhangs' alternatives according to glazing type in 50% of window wall ratio

When the cooling energy performance is evaluated in terms of the shading device, it is determined that the shading devices are effective in decreasing the cooling load. As dimensions and area of a shading device increase, cooling energy performance of office module increase. As you can see in Table 3; when 0,5 OH scenario which is the smallest dimension and area of all shading devices is used in the DRFL glazing type in 50% of window wall ratio, the cooling load decreases by 14% according to the reference case. When using 1,5 OH+LF+RF scenario which is the largest dimension and area of all shading devices in same case, the cooling load decreases by 35%. For both case the DFRL is the most efficient glazing type scenario according to cooling energy performance. When compared in

terms of heating and cooling energy performances, the OH+LSF and OH+RSF shading device scenarios differ. The OH+RSF scenarios are more effective in reducing the heating load while the OH+ LSF (toward west orientation) scenarios lower the cooling load more than the OH+RSF (toward the east orientation) scenarios.

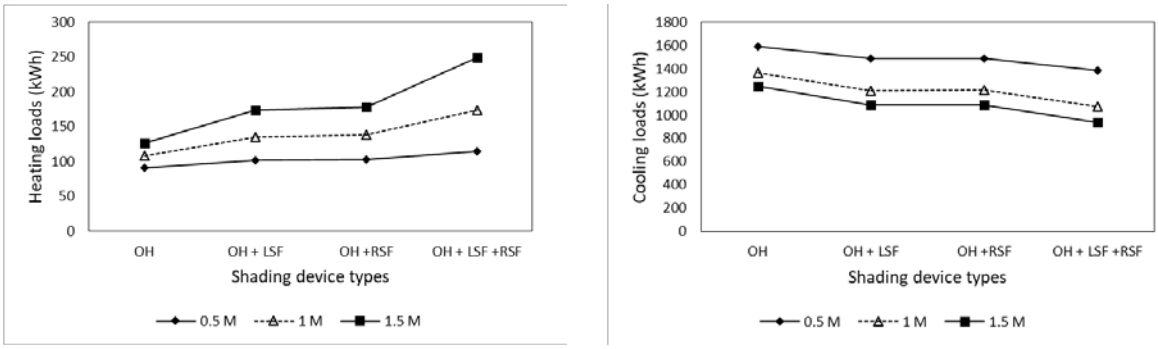


Figure 6. Heating and cooling loads of all shading device types according to their lengths for DCLR glazing type in 50% of window wall ratio

3.2. Total Loads of Investigating Scenarios

Low-E#2 and DRFL compared to DCLR types, they increase the heating load while decreasing the cooling load by a substantial amount. For this reason, these glazing types need to be evaluated in terms of annual total loads.

Table 4: Total Loads of Shading Device Scenarios in 50% of window wall ratio

SD type	SD length (m)	Glazing Type		
		DCLR	DLOW-E#2	DRFL
NS	-	2053,45 ■	1386,24 ■	1412,35 ■
OH	0,5	1681,55	1209,31	1258,11
	1,0	1469,65	1114,17	1189,38
	1,5	1371,84	1077,71	1166
OH+LSF	0,5	1585,92	1168,39	1227,74
	1,0	1345,41	1067,92	1160,15
	1,5	1257,26	1040,47	1153,92
OH+RSF	0,5	1589,46	1169,84	1228,8
	1,0	1351,53	1070,4	1168,83
	1,5	1262,31	1046,29	1166,6
OH+LSF+ RSF	0,5	1498,54	1131,24	1190,74
	1,0	1249,61	1034,32	1150,28
	1,5	1186,76	1028,62	1170,32

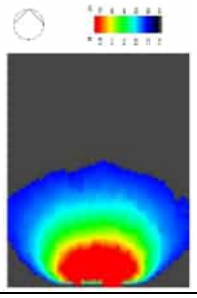
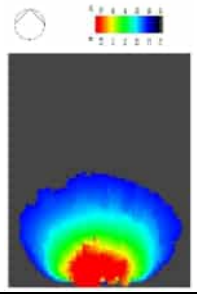
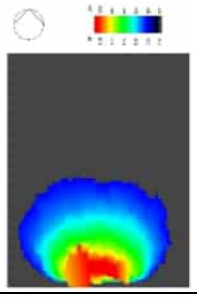
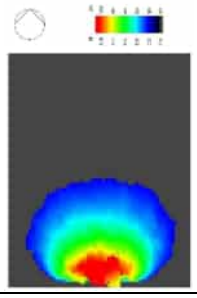
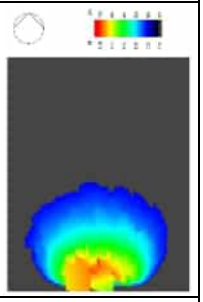
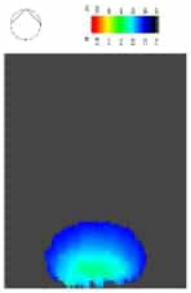
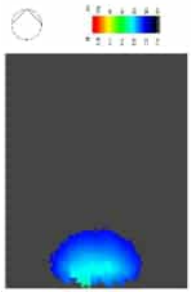
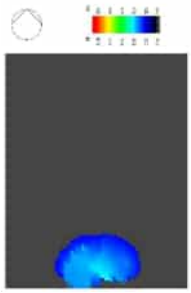
■Reference scenario

Table 4 shows the total annual loads for all scenarios in 50% of window wall ratio. Although the DLOW-E#2 increases the heating load compared to other glazing types, it shows the best energy performance in the majority of scenarios. DRFL consumes between 2%-12% more energy than DLOW-E#2. The use of shading devices for all glazing types significantly reduce the total load. As the size and area of the shading device increase, the total load decreases accordingly. This reduction was most evident in the DCLR according to the reference situation. To illustrate this, adding only shading device in an office building with DCLR can significantly improve the energy performance of the building.

3.3. Daylighting Performance of Investigating Scenarios

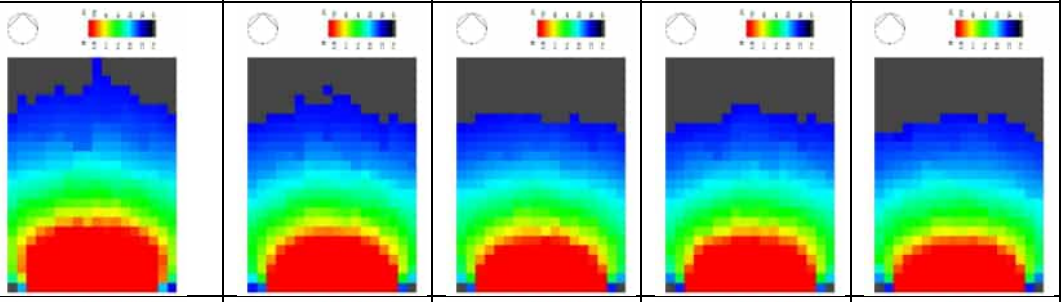
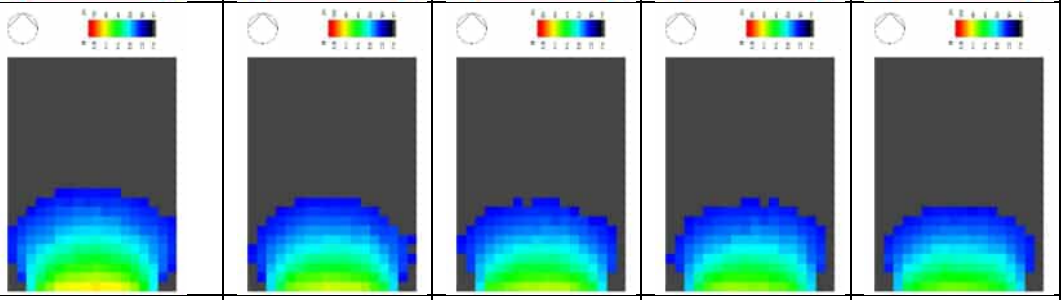
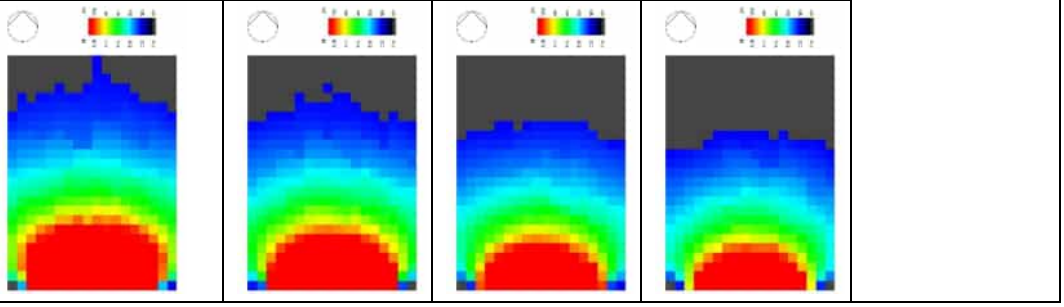
Within the scope of the study, daylight maps of 156 scenarios were obtained. When the obtained maps were considered, it was observed that the DCLR and DRFL glazing types have the highest and lowest light transmission (T_{VIS}) values. For efficient worked of office occupants, sufficient amount of natural daylight should be received into interior. This case depend on glazing types and shading device type and its dimensions. On the other hand, in office module, scenarios with DRFL because of their low light transmission values reflects a large part of the incoming sunlight. Thus, they prevent a significant amount of daylight entering the interior. In Table 5, the effect of different shading device usage on daylight performance on the office module with DCLR and DRFL were given through daylight maps according to 25% of window wall ratio.

Table 5: Effect of shading devices types on daylight maps with DRFL and DCLR according to 25% of window wall ratio

		Shading device type				
Glazing type		No-shading	OH	OH+LSF	OH+RSF	OH+LSF+RSF
OM1_WWR_25%	DCLR					
	DRFL					

As you can see from this table, 25% of window wall ratio for an office module is not suitable in terms of natural lighting. In 50% of window wall ratio, the office module is better illuminated through natural light and artificial lighting requirement of its is decreased (Table 6). It is seen that the use of shading devices affect the significant part of natural light penetrating into the office module according to the reference case with no-shading from Table 5, 6. This situation changes as depend on the shading device type and its dimensions, glazing type. OH+LSF and OH+RSF scenarios of the daylight performances are almost identical and their performance is less than the OH scenarios. Especially, in the 1,5 OH + LSF + RSF scenarios, the natural light penetration into the office module is very low. It is an undesirable situation especially for offices with high daylight requirements. As a result of daylight performance analysis, it was observed that in the scenario where the window wall ratio is greater than 25, the use of the shading device due to the increase of the glazing surface area does not prevent the daylight much from the reference situation. This is a very positive situation due to Antalya has cooling-dominated climate type.

Table 6: Effect of shading devices types on daylight maps with DRFL and DCLR according to 50% of window wall ratio

		Shading device type				
Glazing type		No-shading	OH	OH+LSF	OH+RSF	OH+LSF+RSF
OM2_WWR_50%	DCLR					
	DRFL					
	DCLR	No-shading	OH_0.5 m	OH_1.0 m	OH_1.5 m	
						

4. Conclusions

In this study, heating, cooling and lighting performances of a hypothetical office module were evaluated in Antalya representing temperate-humid climate of Turkey. A total of 156 scenarios were created with 3 glazing types and 4 window wall ratio for 4 types of shading device at 3 different dimensions. These scenarios were simulated with the DesignBuilder energy simulation program. Since Antalya had cooling-dominated climate and office building types has too many internal gains, the cooling load is very important. For this reason, shading device and glazing type that are effective in terms of cooling load are evaluated in this study, especially. According to outputs of simulations, using shading device on windows of an office building significantly reduces cooling loads. As increase the dimensions and area of the shading devices, cooling load is reduced. Other factors that are affected the cooling load window wall ratio and glazing type. As the WWR increases, while the cooling load increase, heating load decrease for all scenarios. When glazing types are compared in terms of cooling load, DRFL provides minimum cooling load for all shading device types of 0.5 M. However, as increased length of shading device, DLOW-E#2 is more cooling energy performance than DRFL. DRFL glazing type increases the heating load because of its high reflectivity. Although it increases the heating load, DFRL together with DLOW-E#2 show same energy performance for all scenarios when the results are evaluated according to the total load. DRFL consumes between 2%-12% more

energy than DLOW-E#2. DFLR reduces daylight performance due to its high reflectivity value, but this negative effect can be removed by increasing the window wall ratio. Table 6 provides a guide for designers to guide them. According to this table, the shading design approach can be decided in temperate climates.

Table 6: A guide for designers to decide shading device on the south facade for temperate climates for an office building

	Heating Load	Cooling Load	Total Load	Daylighting
NS	●	●●●●●	●●●●●	●●●●●
OH	●●	●●●●	●●●●	●●●●
OH+LSF	●●●	●●	●●	●●●
OH+RSF	●●●●	●●●	●●●	●●
OH+LSF+RSF	●●●●●	●	●	●

●the best performance, ●●●●● the worse performance

In this study, energy and daylight performance of an office building module was assessed by creating a shading device scenarios for temperate climates. Future studies may cover other types of shading devices, other climate and glazing types that have been ignored in the context of this study. Simulation analysis and cost analysis can be done with statistical analysis methods.

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SAMPLING OF THE ANALYSIS OF BUILDING ENVELOPES IN TERMS OF ENERGY CONSERVATION IN RURAL SETTLEMENTS

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Abstract

Eastern Black Sea Region is located to the northeast of Turkey, and extends through the shore of Black Sea. Given its geographical location and climate characteristics, forests cover large areas in the region; hence the predominance of wood materials in the characteristic architectural texture of the rural areas of the region. In time, however, this texture was disrupted due to a number of reasons, and was replaced with uncharacteristic structures built with materials such as concrete and bricks, not to mention an insensible perspective to construction. Numerous policies have been put in place in recent years as proposed solutions to this problem. Furthermore subsidies are provided and efforts are made to vitalize the tourism potential of the region.

An analysis performed to determine the state of affairs in the region with a holistic approach to the problems, and developing alternative solutions are crucial. One such alternative is through the investigation of energy insulation characteristics of existing structures, and proposing solutions.

Taking into account the hilly terrain of rural Eastern Black Sea Region and climate conditions prevailing, the existing structures' energy needs stand out as significant. The use of fossil fuels to meet these needs pose a significant problem. The delivery of fossil fuels to rural areas is not easy, and certainly not a very economic solution. Furthermore, the intensive use of fossil fuels leads to significant pollution in the environment, deterioration of the natural environment, and therefore negative consequences for tourism. Any reduction of the volume of energy needed, through the use of architectural solutions would bring in economic benefits, and will go a long way in terms of avoiding major environment-related problems. The study carried out in this context reviews various types of structures located in an area designated as a tourism hotspot of the region, in terms of the energy insulation properties of their building envelopes. Both traditional and rather modern types of structures were analyzed with respect to the form of their building envelopes, and alternative building envelope models were developed in consideration of the characteristics of the region. The models developed were then transferred to an energy simulation software, analyzing energy gain-loss values in a comparative perspective. In the conclusion of the study, certain recommendations were provided to enhance energy insulation through structural measures to be taken in the building envelopes of the structures in rural settlements of the Eastern Black Sea region.

Keywords

Black sea region, rural architecture and tourism, energy conservation, energy-saving.

1 Introduction

Given the geographical location and climate characteristics of the Eastern Black Sea region, forests cover large areas; hence the predominance of wood materials in the characteristic architectural texture of the rural areas of the region. However, this characteristic texture of settlements composed of residences built with traditional methods had deteriorated over time due to various reasons, being replaced with completely unremarkable structures built with materials such as concrete and bricks, not to mention an insensible perspective to construction. Numerous policies have been put in place in recent years as proposed solutions to this problem. Furthermore subsidies are provided and efforts are made to vitalize the tourism potential of the region.

In the region, the development of rural tourism and the conservation of rural architectural texture runs hand-in-hand. The region offers a significant example where rural architectural heritage contributes to the development of tourism. In other words, the rural architectural texture of the region is perhaps the most important element supporting the development of tourism in the region. That is why the development of tourism as a domain of economic activity contributes to the preservation of the rural architectural texture of the region. As tourism began to arise as an important activity in the rural parts of the region, it can bring in positive effects and expectations, as well as certain problems to threaten the very existence of natural components. The list of such problems is topped by energy-related ones.

Taking into account the hilly terrain of rural Eastern Black Sea Region and climate conditions prevailing, the energy needs of the structures used for tourism purposes stand out as significant. The use of fossil fuels to meet these needs pose a significant problem. The delivery of fossil fuels to rural areas is not easy, and certainly not a very economic solution. Furthermore, the intensive use of fossil fuels leads to significant pollution in the environment, deterioration of the natural environment, and therefore negative consequences for tourism. Any reduction of the volume of energy needed for the tourism-related buildings in the rural areas of the region, through the use of architectural solutions would bring in economic benefits, and will go a long way in terms of avoiding major environment-related problems. In this context, the present study focused on Hıdırnebi Yayla Kent-I site, the first designated rural tourism settlement of the Eastern Black Sea region of Turkey given its date of construction, and analyzed the "U" values (total thermal conductivity coefficient - W/m^2K) of the exterior walls of the buildings comprising the site, and other buildings included in the sample from the neighborhood. The data gathered through the analysis, combined with the observations noted in the literature culminated in recommendations for alternative building exterior construction preferences that are characteristic to the region. The recommendations thus formulated were then tried on TGUB (Thermal Insulation Software), to establish their "U" values and energy conservation characteristics. The study aims to come up with alternative exterior wall construction recommendations to cut back on energy consumption in rural tourism structures in the Eastern Black Sea region, and thus to contribute to the efforts concerning the conservation and supply of energy, which pose a major obstacle in terms of preserving the rural

architectural texture of the region and the development of rural tourism activities in the region[1, 2, 3].

2 Eastern Black Sea Region and the Rural Architectural Texture

Located to the northeast of Turkey, the Eastern Black Sea region is essentially a shoreline surrounded by the Black Sea to north, Georgia to northeast, Eastern Anatolia to south, and Central Anatolia to southwest. The region extends from the Georgian border in the east, and extends through the shore, up to the river Melet to the east of the city of Ordu. Physically, the general outlook of the region is characterized by mountains extending on the east-west axis, valleys and river beds perpendicular to the shoreline, and agricultural lands between the mountains and on the shoreline.[3] Throughout the history, various populations occupied the Eastern Black Sea region. The mosaic-like structure developed through a synthesis of such a wide range of cultures occupying the area through the history brought about what we today call the traditional culture of the region. The cultures which came to live in the Eastern Black Sea region were very successful in terms of making good use of what the region offered to them. The climate and topography, not to mention the interactions between various cultures co-habiting the region for extended periods, against a background of accepting the requirements of and keeping up with the natural environment, played a major role in shaping the local architecture.[4, 5, 6]

The Eastern Black Sea region exhibits interesting features in terms of the diversity of local architecture that came to be expressed in the rural areas of Anatolia. The local architecture dominating the region was shaped by the cultural assets and wealth of the population, which often experienced extended periods of isolation from external influences. This process of shaping and defining architectural themes was dominated by the natural (topography, geological structure, climate and flora), economic and socio-cultural (materials-material availability, utilization and experience, modus vivendi, religion, customs, traditions, and culture) structure of the region. The architecture of the region was shaped by the combination of these factors through the lens of the expertise and skills of local masters, and the living practices of the people, and exhibited features to match those of the place and the locale.[4, 5, 6]

The hilly terrain of the Eastern Black Sea region made huge settlements a challenge, and brought about a dispersed form of settlement throughout the region. The construction of the buildings took into account the topographic features of the land, and the structures were installed on the land facing the valley and the slopes. Houses shaped by all these influences exhibit a distinctive and authentic architecture, especially when combined with endemic building materials[4].

Figure 1. A Rural Settlement and Rural Residence from the Eastern Black Sea Region.

The primary materials used for rural architecture in the Eastern Black Sea region are also the oldest and most basic natural materials available to man: wood and stone. The prevalence of these materials can perhaps be a result of the climate characteristics of the region and the dense forests covering it, making wood available in plenty. On the other hand, stone could also be supplied easily from river beds and quarries[1, 4].

Figure 2. Leading materials used in Rural Construction in the Eastern Black Sea region.

3 The Relationship between the Rural Architecture of the Eastern Black Sea region and Conservation of Energy

The simple and practical maxims of construction of local architecture prevailing since the olden times, exhibiting harmony with the environment, were conveyed by father to son, master to apprentice, one generation to the next, with a focus on and actions using the materials supplied in plenty by the nature. However, since the mid 20th century, the rapid development in industry, followed by standardization and a tendency to use construction materials which are not inherently compatible with the nature of the region, not to mention the changes occurring in the social life of people, caused and continues to cause a rapid deterioration of the rural architectural fabric in the Eastern Black Sea region. Moreover, the young generations are not very fond of existing buildings, which are often old and in disrepair. This perspective also does not do much good for the precious texture[1, 4, 6].

Figure 3. Images evidencing the destruction inflicted on the Rural Architectural Texture of the Eastern Black Sea region.

Recent years saw a number of studies and efforts seeking to provide solutions to problems afflicting the rural architectural texture of Turkey. These studies aim to go beyond

the physical conservation of individual structures comprising the rural texture of the region, and seek to render the intangible cultural heritage of the region sustainable, and to preserve the rural architectural texture through these means. However, most of the endeavors to develop the tourism potential of the region and to preserve the rural architectural texture fail to achieve their goals due to issues concerning the conservation and supply of energy. The present study focuses on a solution for these problems.

The study aims to analyze the building envelopes of the structures located in an area designated as a rural tourism site, and to develop alternative building envelope models compatible with the characteristic architectural texture of the region.

In the conclusion of the study, certain recommendations were provided to enhance energy insulation through structural measures to be taken in the building envelopes of the structures in rural settlements of the Eastern Black Sea region. The recommendations developed serve as preliminary attempts to reduce the volume of energy needed by the buildings (tourism facilities), to register economic gains as such, and to prevent major environmental issues by doing so.

4 Field Study

The study aims to identify energy-related problems incurred in the efforts to develop rural tourism activities, which intend to contribute to the preservation of the rural architectural texture, and to present alternative external wall solutions for use in rural areas with a view to minimizing the problems thus identified. In this context, a field study was performed and various analyses were applied:

4.1 Designation of the Study Area, and its Features

The Eastern Black Sea region sees the most intense efforts for the development of rural tourism in Turkey, given its location and natural and human characteristics. Against this background, the study focuses on Hıdırnebi Yaylası, which is home to the first rural tourism facility of the Eastern Black Sea region.

Hıdırnebi Yaylası contains approximately 250 houses which exhibit a dispersed form of settlement. The local houses on the highlands are often constructed with wood and stones supplied from the neighborhood. The first attempt to develop rural tourism in Turkey was made in this area, in the form of the Hıdırnebi Yayla Kent-I complex. Hıdırnebi Yayla Kent-I was chosen as the focus of the study due to its proximity to the city center, its characteristic as the first model facility built to develop rural tourism activities, and the pleasant natural characteristics of the area the facility is located in.

Hıdırnebi Yayla Kent-I Tourism Facilities and the surrounding area is located at an altitude of approximately 1450 m. The site was built and opened in 1999 as a highlands holiday village by the local government agency (Trabzon Special Provincial Administration) to develop highlands tourism in the province. The facility covers an area of approximately 7500-8000 m^2. A glance at the layout plan reveals two-floor bungalow houses on the northern part of the holiday village, and single-floor ones on the east, west and south sections of the complex. The restaurant, recreational facilities, rest areas and playgrounds as well as a building containing double-rooms, in turn, are located in the central section. Furthermore, to the left of the entrance to the complex, there are a volleyball-basketball court and parking lot, while to the right is a green space. In addition to accommodation

facilities, the complex contains recreational ones such as a restaurant and cafeteria. Furthermore, the complex has some commercial elements in the form of a supermarket, butcher, baker, and local handicrafts shop[7].

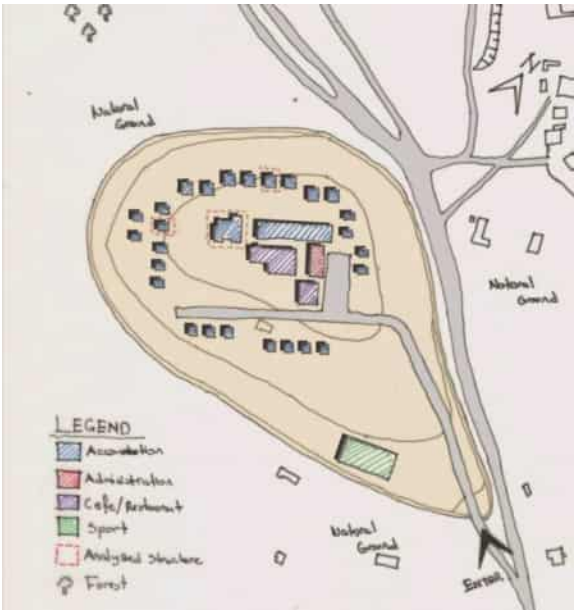


Figure 4. Hıdırnebi Yayla Kent-I Layout Plan.

The buildings at the complex are built on top of a 50-100 cm high concrete basement, using wooden materials all through the construction. The complex contains a total of 26 bungalows, 18 of which provide accommodation for 4 guests, and 8 providing accommodation for 8. The 4-bed ones are single-floor structures, while the 8-bed ones are built as two-floor bungalows. Moreover, the complex contains 12 double rooms located in a single-floor building[7].

Figure 5. Images from the exteriors of Hıdırnebi Yayla Kent.

In front of each bungalow there is a veranda (or porch). The entrance to the building is through this space accessed through a set of stairs. The building of Hıdırnebi Yayla Kent-I complex put an end to the scarcity of accommodation available for tourism on Hıdırnebi Yaylası, and contributed to increased tourism activities in the region. The building of the complex made this highland a settlement where tourism activities became ever more important[7].

Figure 6. Images from the interiors of Hıdırnebi Yayla Kent.

4.2 Selection of Buildings Included in the Sample, and the Analysis of External Walls

The study is based on a sample of a single accommodation unit for 4 guests, as part of Hıdırnebi Yayla Kent-I complex, and 4 residential buildings close to the complex. The buildings were selected on the basis of the use of various materials to constitute different layers of external walls. The details of the buildings selected are presented in Table 1. and Table 2.

The external walls of the buildings included in the sample were then analyzed using TGUB software, which serves to calculate thermal insulation values in the form of specific heat loss, annual heating requirement, and condensation graphs of the building materials constituting the layers, in compliance with the assessment procedures and criteria specified in the thermal insulation regulations of Turkey. These efforts culminated in the establishment of the "U" values of the buildings, for comparison against the standards established in the regulations. Certain pieces of technical details and terms used for energy gain-loss assessment of the external walls of the building are detailed below.

-Overall thermal transmittance factor (W/m²K) - U Value: U value refers to the amount of heat passing through 1 m² of the construction element comprised of various layers of materials, in a given time frame. The lower the U value, the less the heat loss the building would suffer.

-Thermal conductivity calculation value (λh)(W/mK): Thermal conductivity calculation value refers to the level of heat conductivity of a given material. The lower the thermal conductivity calculation value, the less heat-conductive the material would be[8, 9, 10].

Table 1: Accommodation unit for 4 persons in which facility of Hıdırnebi Yayla Kent-I

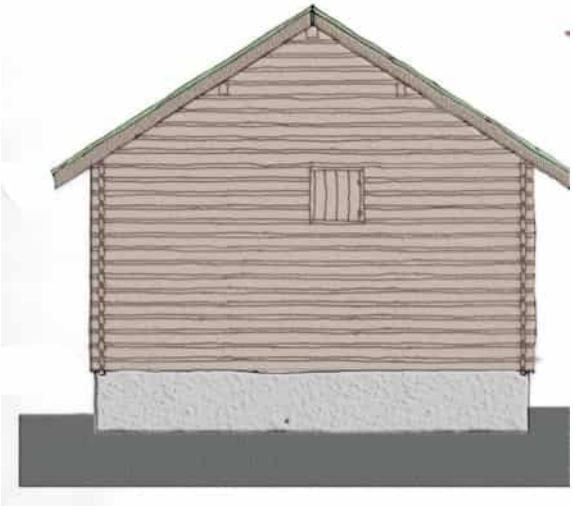
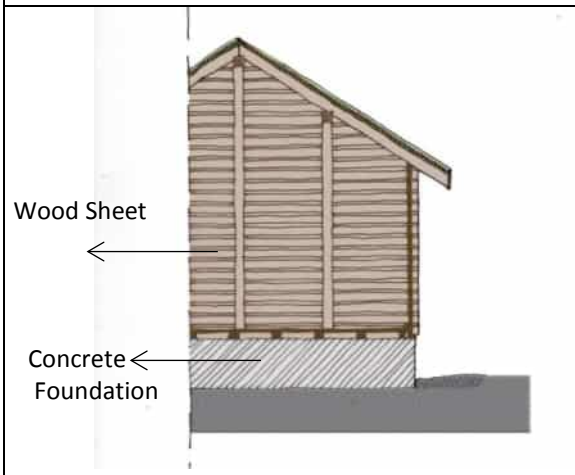
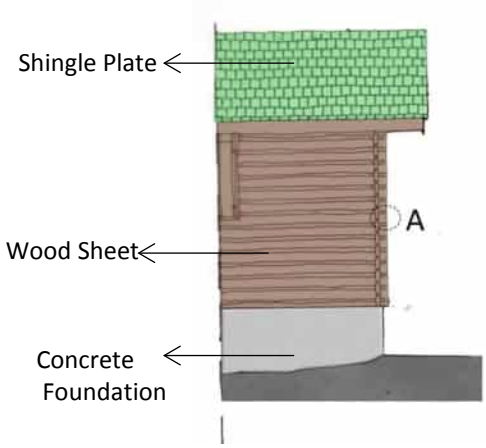
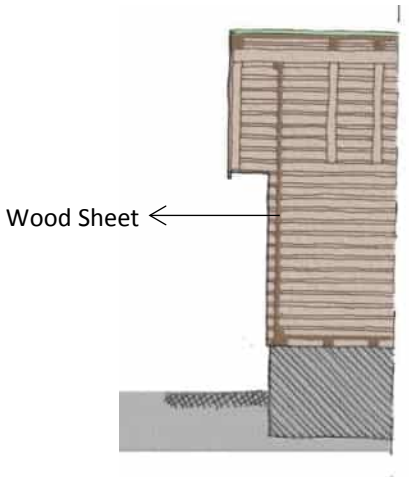
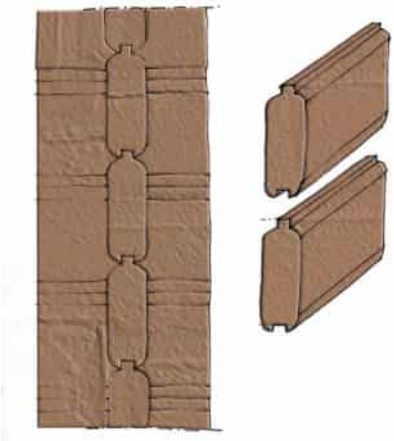
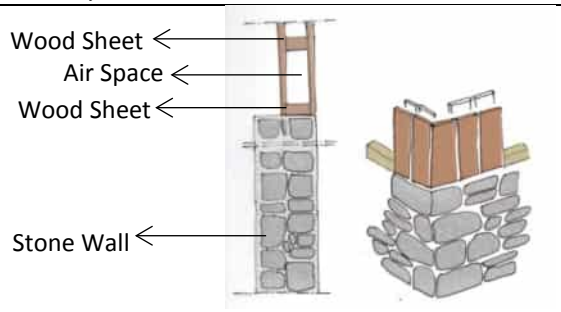
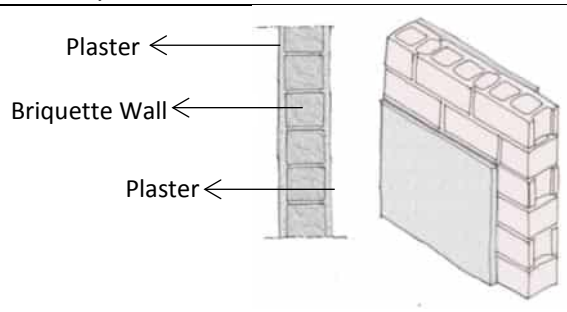
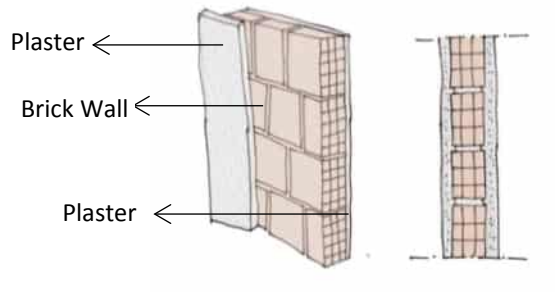
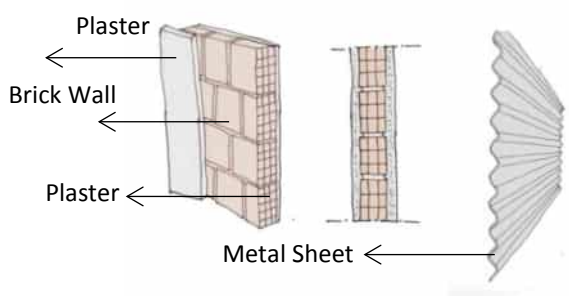
EXAMPLE STRUCTURE-1/STRUCTURE DEFINITION	**FRONT ELEVATION**
All the structures of the "Hıdırnebi Yayla Kent-1" accommodation facility were formed by the mixed use of wooden stacking and skeleton system. -The structure belonging to the study is in 4 * 4 m plan and 4 m height. -The structures are 5 cm thick and pine timbers are used in various lengths. 3 mm thick membrane cover is covered with shingle plate. -The windows and doors of the buildings are made of wood and single glass. -The floors of the buildings are covered with 5 * 5 wooden cadrons, 3 cm thickness and various width of wooden material. -The buildings are built concrete and the buildings are built on water basin in the range of 50-100 cm.	
SECTION-1	**LEFT SIDE ELEVATION**
	
SECTION-2	**WALL COMBINATION SYSTEM - A DETAIL**
	
U Value: 1, 803	

Table 2. Four example building located in near Hıdırnebi Yayla Kent-I facility.

Example Building-II	**Example Building -III**
	
U Value:1,232	**U Value 1, 284**
	
Example Building -IV	**Example Building -V**
	
	
U Value: 1, 414	**U Value: 1, 335**

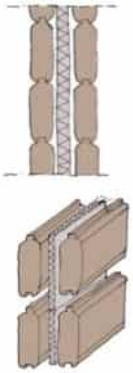
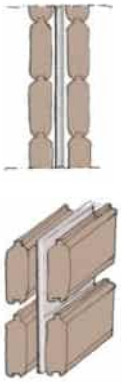
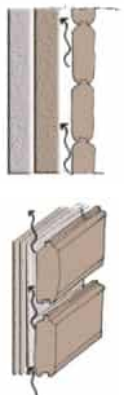
5 Development and Analysis of Alternative External Walls

The applicable regulations in Turkey divide the lands of the country into 4 zones. Trabzon province where the study was carried out is in Zone 2. The U value recommended for the region is 0.60 W/m²K. As the tables reveal the buildings included in the sample have not been constructed in a manner to achieve the U value the regulation recommends for the region.

At this junction, the study developed alternative external wall designs to meet the thermal insulation values recommended, for use in construction activities to be carried out

in the rural parts of the Eastern Black Sea region. The proposals thus developed are categorized under 3 groups, one where the existing state of affairs was improved, one where next-generation materials were applied, and one where new construction systems were implemented. The alternatives proposed in the study were limited to just 3, as the study was intended not as an exhaustive analysis but one focusing to present the issues and to raise awareness for their solution. The proposed alternatives were also analyzed in TGUB software to determine their ability to conserve energy. The details regarding alternative external walls are presented in table 3.[8, 9].

Table 3. Information about exterior walls of the alternative building.

Proposed Building Exterior Wall Section-I (Formed with commonly used insulation material)					
	Information about wall section (Inside-out)	Wall thickness	Thermal conductivity cal. value	Thermal conductivity resistance	thermal transmittance factor
		d (m)	λh	R (m^2K/W)	U(W/m^2K)
	Superficial thermal cond. (Ins.)			0,13	
	Coniferous tree -Plate	0,03	0,13	0,23	
	Wood fiber thermal insulation	0,05	0,050	1	
	Coniferous tree -Plate	0,04	0,13	0,31	
	Superficial thermal cond. (Out)			0,04	
	TOTAL			**1,71**	**0,585**
Proposed Building Exterior Wall Section-II (Formed with new generation thermal insulation material)					
	Information about wall section (Inside-out)	Wall thickness	Thermal conductivity cal. value	Thermal conductivity resistance	thermal transmittance factor
		d (m)	λh	R (m^2K/W)	U(W/m^2K)
	Superficial thermal cond. (Ins.)			0,13	
	Coniferous tree -Plate	0,03	0,13	0,23	
	Vacuum ther. insulation panel	0,025	0,004	6,25	
	Coniferous tree -Plate	0,03	0,13	0,23	
	Superficial thermal cond. (Out)			0,04	
	TOTAL			**6,88**	**0,145**
Proposed Building Exterior Wall Section-III (Formed with wood-concrete composite panels)					
	Information about wall section (Inside-out)	Wall thickness	Thermal conductivity cal. value	Thermal conductivity resistance	thermal transmittance factor
		d (m)	λh	R (m^2K/W)	U(W/m^2K)
	Superficial thermal cond. (Ins.)			0,13	
	Lightweight concrete wall slabs	0,05	0,58	0,09	
	Wood fiber thermal insulation	0,05	0,050	1	
	Air Space-Vertical	0,05	0,278	0,18	
	Coniferous tree -Plate	0,03	0,13	0,23	
	Superficial thermal cond. (Out)			0,04	
	TOTAL			**1,67**	**0,6**

6 Conclusions and Recommendations

The Eastern Black Sea region focused in the study stands out as a major center of tourism given its rural architectural heritage. Yet, that very architectural texture is deteriorating over time, and is replaced with totally unremarkable structures, due to a number of reasons. There are various efforts in place to protect the characteristic texture of the region. In this context, the efforts to utilize the tourism potential of the region are at the top of the list.

The efforts for preserving the rural architectural heritage and developing rural tourism in the region are mutually reinforcing. The development of tourism in the region contributes substantially to the preservation of the rural architectural texture. However, a number of studies found that the development of rural tourism in the region has been lackluster on this front, due to a number of issues observed. The present study tries to identify problems concerning energy, as a major source of such problems, and to discuss proposed solutions. Such a discussion was based on the analyses performed with respect to the external walls of 4 buildings located in and around a complex built for tourism in the region.

The analyses culminated in the following conclusions:

- The insufficiency of facilities is a major problem in terms of the development of tourism with a view to preserving the rural architectural texture of the Eastern Black Sea region. The number of facilities should be increased in order to further tourism in the region. The leading obstacle preventing such an increase is the substantial volumes of energy such facilities would need, given the climate characteristics of the rural areas of the Eastern Black Sea region. Certain architectural measures to be applied on the external walls of the buildings can go a long way in overcoming this obstacle.

- Given its topography, the Eastern Black Sea region poses various problems in terms of energy transmission/supply. Efficient insulation to conserve energy may go a long way to minimize the impact of these difficulties.

- The buildings constructed in the region should reflect the character of the local architecture, and meet the required thermal insulation values. Next-generation thermal insulation materials and wood-concrete composite panels may offer some solutions. The use of these can result in the building of structures to reflect the character of the region, all the while achieving efficient conservation of energy.

In conclusion, the authentic contribution of the study is about raising awareness by presenting the utility of external wall systems in rural tourism facilities and buildings in the region, contributing to the solution of the problems such as environmental pollution, destruction of the landscapes, and negative consequences for tourism, by compliance with the architectural characteristics of the region, not to mention the standards required in applicable thermal insulation regulations, and conserving energy through effective thermal insulation.

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EXPERIMENT STUDIES OF DOUBLE SKIN FAÇADE FOR TROPICAL ENVIRONMENT

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Abstract

The design of double skin façade is likely to be worldwide trend as it goes as lightweight system for reducing heat transfer into the building. Yet, Indonesia with its tropical climate are on lacking of standards validation. Several of research state that the system should be ventilated, considering the humidity by variate the air gap design. However, this research was built to test the exposed material as building coverage or the outer skin in DSF system. Real scale model of ventilated double skin façade designed to attach on four level building on one room. Four types of characters of glass material also involved. A material with lowest transmittance grade and the highest reflectance grade could be potential to reduce 9.66^{0}C air temperature indoor among other tested material. This paper will reveal an experiment data through diagram generate by OriginPro 2017 and analysis with JMP 7.0 and shows how vital is the setting of outer skin on DSF in tropical context case.

Keywords: Double Skin Façade, Glass Material, Outer Skin.

Topic: [T08], Energy Saving

1 Introduction

Many design of double skin façade come from the area of temperate climate corresponding its condition in extreme temperature. This system basically sorts of façade consist with two layers to increase comfort level of air temperature indoor[1]–[4]. The design variation in temperate is quite manifold compare to tropics, whether it is related to the material or the air gap setting. As researches take into account that those are two of the vital part in double skin facade[5]. Motives are built to represent a saving energy concept system[6], [7]. Barbarosa informing a same statement regarding this system as it become popular to combine a transparent façade on the building[8].

Variation on this system are likely different each area, depending on the demand by the condition in site. Several cases require a full vacuum of façade to generate a comfort temperature indoor, meaning there is no air circulated in a certain part. Simple example, this setting involved an argon in air gap part, a type of gas scientifically proven as a good reactor

substance to solar heat radiation from outside[9]. It is vacuumed inside the gap between two layers. Moreover, the experimental research took in tropical case done by Martokusumo, shows an interesting variation. This experiment was take under the weather and climate condition on Bandung, Indonesia. This area represents a tropical area with higher solar radiation, the need of cooling indoor is tend to happen than a heating demand. An involvement with algae was set in the gap to supress the heat transmission into the building. This involvement of vegetation is being highly maintained due the living organism in the system which vertically attached on building facade[5], [10].

However, following research states that double skin façade in tropical area should be ventilated, considering the humidity and the high solar radiation through the year. Otherwise, Martokusumo's research indirectly shows a limited ventilation with the same design likewise the system on such a temperate climate. Whilst those parameters in air gap has proven many technique and variation, the setting of outer skin material becoming important to generate a specific solution as an additional validation in similar research and design of double skin facade. Furthermore, a specific solution might contribute to an affordable recommendation since it will not equalize with another case[11] .

This research experimented on 4 types of glass as outer skin. This part of double skin façade is component which exposed directly by the sun and the first layer that received the load of solar heat radiation[12]. Several research states material glass is a type of lightweight material that suit into this system[5]. That is our focus to observe which glass material has the highest potential to reduce solar hear radiation into the building as double skin facade, by providing a real scale of model to be tested in tropical context. So that this paper would add another knowledge regarding the recent research about similar thing or building a new collaboration in further research.

2 Previous Research

A Several researches by the team regarding this topic has been done to comprehend the issue, these efforts construct try to produce an applicable solution directly to the building. It begins with an idea to control temperature indoor by providing a double layer as an additional envelope on the building, this system generally called by double skin façade (DSF) or secondary skin. A research that focus on the gap was quite an interest at the start phase, we conducted a simulation with Ansys to see the principal of air behaviour in air gap [13]. Then we also measured the most efficient width of air gap with clear glass as the most popular choice of curtain glass material in the market at the time [14]. A new trial was also designed to observe other possible variation on double skin façade system, as we provide more ventilated opening design in first layer of the system [15].

Those research were design sequentially try to find the bottom of the issue which mostly related to saving energy and efficiency[16]. This research's motives were actually as simple as revealing an experiment data, only it is oriented to an effort for supress the load of air conditioning in the office building, since it is almost cannot be avoided. Additional data in this area are always be needed to gain a valid result of this effort, as it become recent issue in our environment that impact many aspects.

3 Methodology

An experimental quantitative method was the first step we took to gain a micro result as in raw data. The motives we previously discuss was quite a background that encourage us to build a real scale of testing model. A model in real scale of ventilated double skin façade made to accommodate this objective. The model was tested in daylight time between 8.30 AM to 3 PM in real condition environment of Bandung, Indonesia as tropical case.

3.1 Testing Model

This model was design only for this research purposes and flexibly enough in outer skin panel setting, the part which received the most radiation load on the field (figure 1). Poirazis suggested that this part should be lightweight as glass, and capable of letting natural light come through in certain amount [3].

Figure 1. Building panel on double skin façade testing model

The 4 types of glass in this research coded by its energy characteristic of transmittance. This choice of characteristic by authors related to its ability to transmit the radiation from solar as electromagnetic wave consist with heat, later we are going to discuss the relation of this in further.

As an advance information, all the glass used in this research has the 5mm of thickness (figure 2). The first type of glass has the highest grade of transmission will show as T81 (means energy characteristic of transmittance by 89%), this kind of glass material commonly known as clear glass, float glass, etc. The second type of glass will show as T56 (means: energy characteristic of transmittance by 48%), in this research we used brown coloured with the high absorption characteristic among all tested material and known as Heat Absorptance Glass, some of literature inform that this type of glass could trap the heat that came as the light because its ability. The Third, we use type of reflective glass colour classic green with grade of transmittance 24% and it will show as T24. This type of glass also commonly known as Reflective Glass. Then, we have another type of reflective glass with different grade of transmission, it will show as T30, mean transmittance grade by 30% (table 1)

No	Type of Glass	Thickness (mm)	Colour	Energy Characteristic: Transmittance (%)	Code
1	Clear Glass	5	Clear	81	T81
2	Heat Absorptance Glass	5	Brown	56	T56
3	Reflective Glass	5	Classic Green	24	T24
4	Reflective Glass	5	Super Silver Dark Grey	30	T30

Table 1. Tested material on research including 4 type of glass material as outer skin in DSF

Figure 2. Tested material in panel, those are: (1) T81. (2) T56. (3) T24. (4) T30.

Next, we also design an indoor environment for this model with a full black box, this indoor model designed without opening or a such so that we could control in particular environment indoor. This model also built in the same of need of main model DSF and it would be placed on the back of the DSF model. The changing of air temperature that indicate indoor would be observed later on.

3.2 Measurement Device

The involvement of measurement device is also corresponding to the research objectives to reveal the pattern of temperature changing. Authors provide 8 points of measurement on the tested model (figure 3).

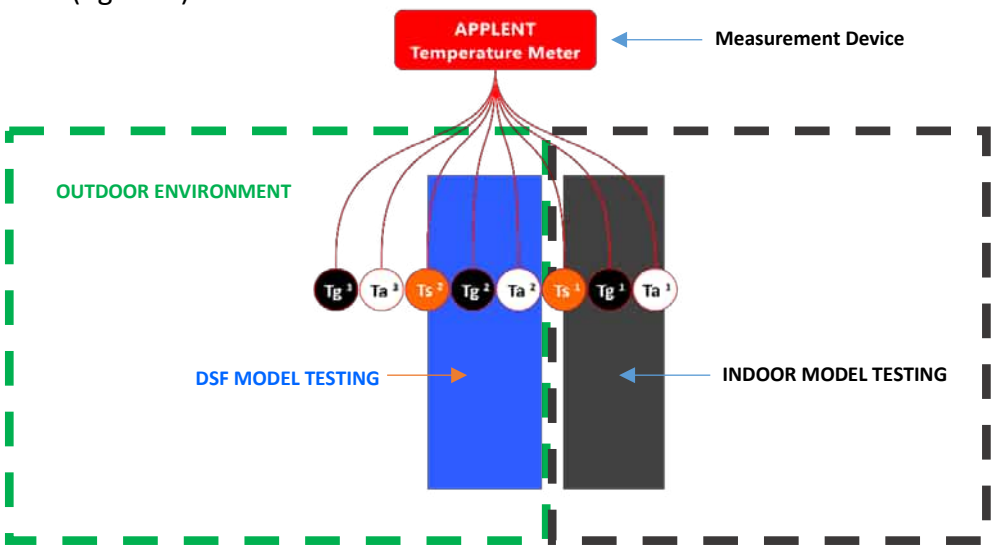


Figure 3. Measurement scheme in the research

This requirement of observing then we provide a device identified as Applent AT4508A *Temperature Meter* 8 *sensor.* This device allows us to measure temperature with hot-wire sensor 8 point in the same time. Figure above shows variable Tg, Ta, and Ts, these later on would be representing each, Globe Temperature, Air Temperature, and Surface Temperature.

As we have informed on the previous statement, the 8-point measurement consisted Air Temperature (Ta), Globe Temperature (Tg), and Surface Temperature. Air temperature would be informing the real air temperature data when the experimentation, then we have globe temperature which will be informing an amount of heat radiation on the environment. Globe temperature would be place on 3-point of measurement, that is Outdoor, Air Gap DSF, and Indoor. Likewise, the air temperature (Ta). The surface temperature would be placed on 2-point, those are the inner side of the outer skin (secondary skin) DSF model, and inner side of the first skin DSF model (figure 4). This parameter conducted try to reveal the amount of heat that the material tested received, this data would help describing its ability in receiving heat load of the solar radiation of each scenario.

Figure 4. (Left) Putting sensor on inner side of outer skin T81. (Right) Putting sensor on inner side of first skin on model DSF.

3.3 Data Processing Methods

This research step by step try to combine previous researches. Authors will reveal an indoor data of air temperature indoor in every tested glass material in width of 1.5 meter as it suggested in previous research. There are several spots in the model that we had measured with to see the pattern of temperature changing. A comparison will be also informed by the distribution diagram after the raw data be gained, an involvement of statically software JMP also help to analyse the anomaly result that might happen in each scenario of research. [14]. Data gained would be shows as average number of all result tested.

Several researches inform methods which mostly done by simulation. Nasrollahi unfold a research to evaluate hypotheses of performance double skin façade in hot and dry climates with CFD (Computational Fluid Dynamics) [17], likewise the research by Darkwa explaining an interesting methods used mathematical modelling and Software Fluent to simulate the airflow and temperature distribution in the air gap part of the double skin façade, in China climate case [18].

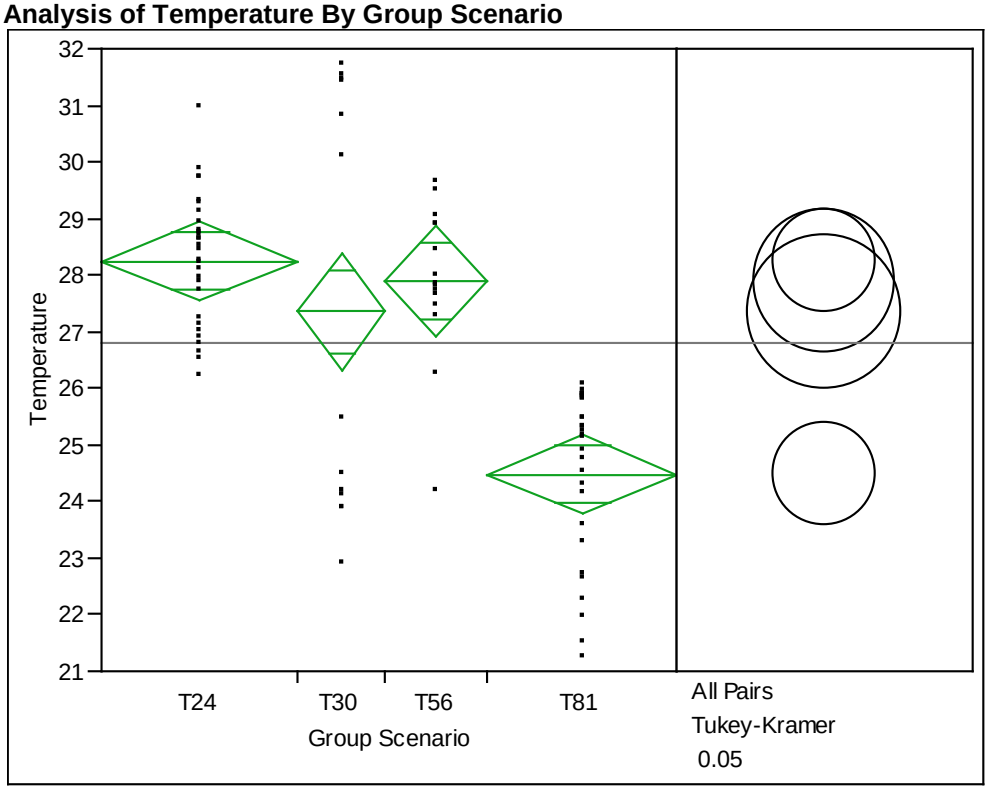
In This research we process data simply by using analysis distribution which would be inform in diagram figure and each parameters of research would be also analysed to see other pattern.

4 Result and Analysis Discussion

This diagram below would inform the first data of indoor air temperature in width 1.5 m scenario of DSF. Every glass material as outer skin in model DSF was tested, this analysis tries to compare and reveal the pattern of the temperature changes.

Fit Y by X Group

Oneway Analysis of Temperature By Group Scenario



Oneway Anova
Summary of Fit

Rsquare	0.446484
Adj Rsquare	0.425983
Root Mean Square Error	1.890016
Mean of Response	26.80765
Observations (or Sum Wgts)	85

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Group Scenario	3	233.39486	77.7983	21.7791	<.0001
Error	81	289.34507	3.5722		
C. Total	84	522.73993			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
T24	29	28.2500	0.35097	27.552	28.948
T30	13	27.3569	0.52420	26.314	28.400
T56	15	27.8873	0.48800	26.916	28.858
T81	28	24.4804	0.35718	23.770	25.191

Std Error uses a pooled estimate of error variance

Figure 5. Analysis of Variance for all measurement in-group scenario

First analysis made by statistic software JMP. 7.0, this software allowed us to regenerate all the scenario of research measurement data to be classified as their group by showing its temperature, all data measurement was involved in this process. The diagram above informs that scenario of setting material outer skin DSF T81 was different among another (figure 5).

To see a more precise result, authors using distribution diagram by OriginPro 2017 to help compare (figure 6).

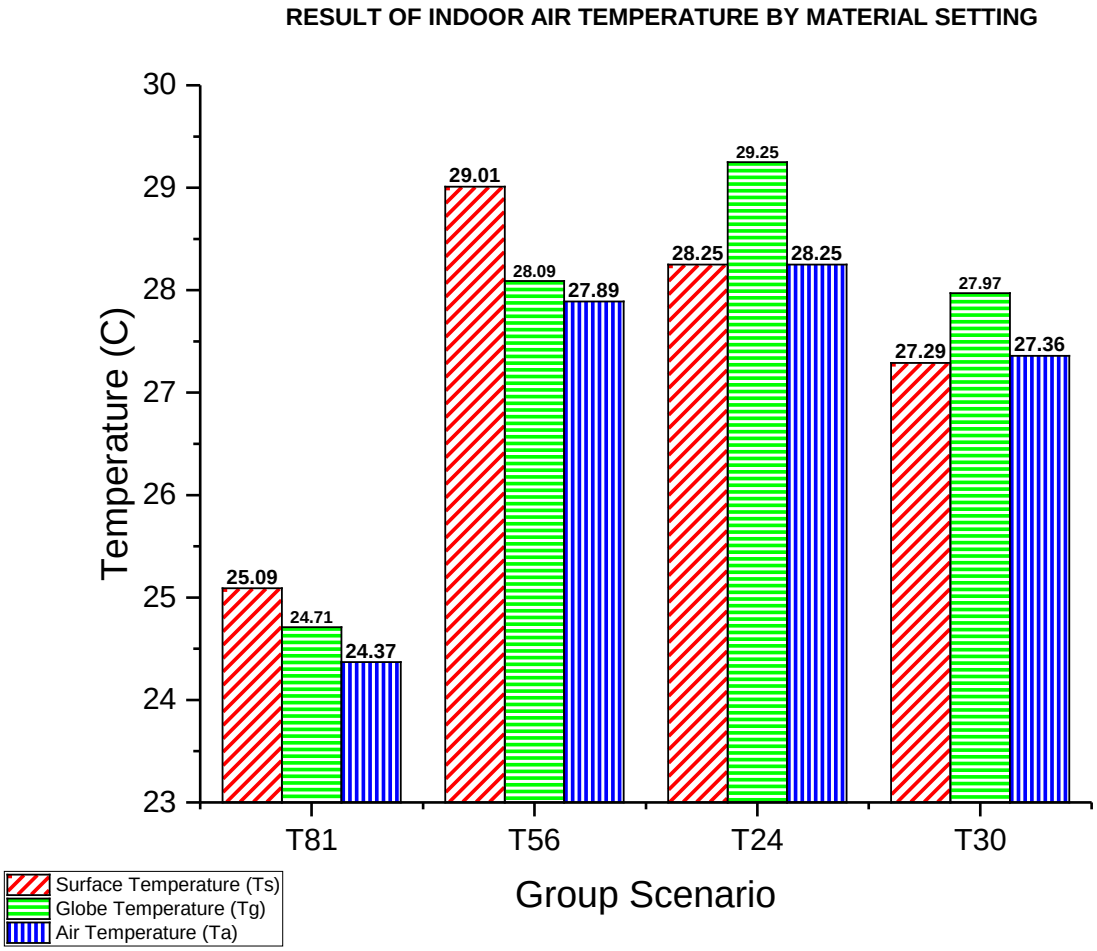


Figure 6. Comparison between materials on indoor temperature

Diagram above generally showing the differences of air temperature indoor after the application of several type of material in outer skin part (figure 6). In this diagram consisted information of temperature in Ta (air temperature) Tg (globe temperature) and Ts (surface temperature), Ta and Tg sensor were both placed indoor, floating in the air, while Ts patched on the inner side of the first skin of the system, this point representing the first layer of the building have.

The highest air temperature indoor was show by material T24 with number of 28.25^0 C, and the lowest was on T81 with number of 24.37^0 C. Both diagram also shows that T56 has the highest number of Ts (figure 5,6). It's confirming its ability on absorbing solar heat is higher than others. Then there is Tg who represent globe temperature, which this point informing the amount of radiation after the setting of material outer skin. The lowest indication was shown by scenario of T81 with number of 27.71^0 C, meanwhile the highest was also shown by material T24 with number of 29.25^0 C.

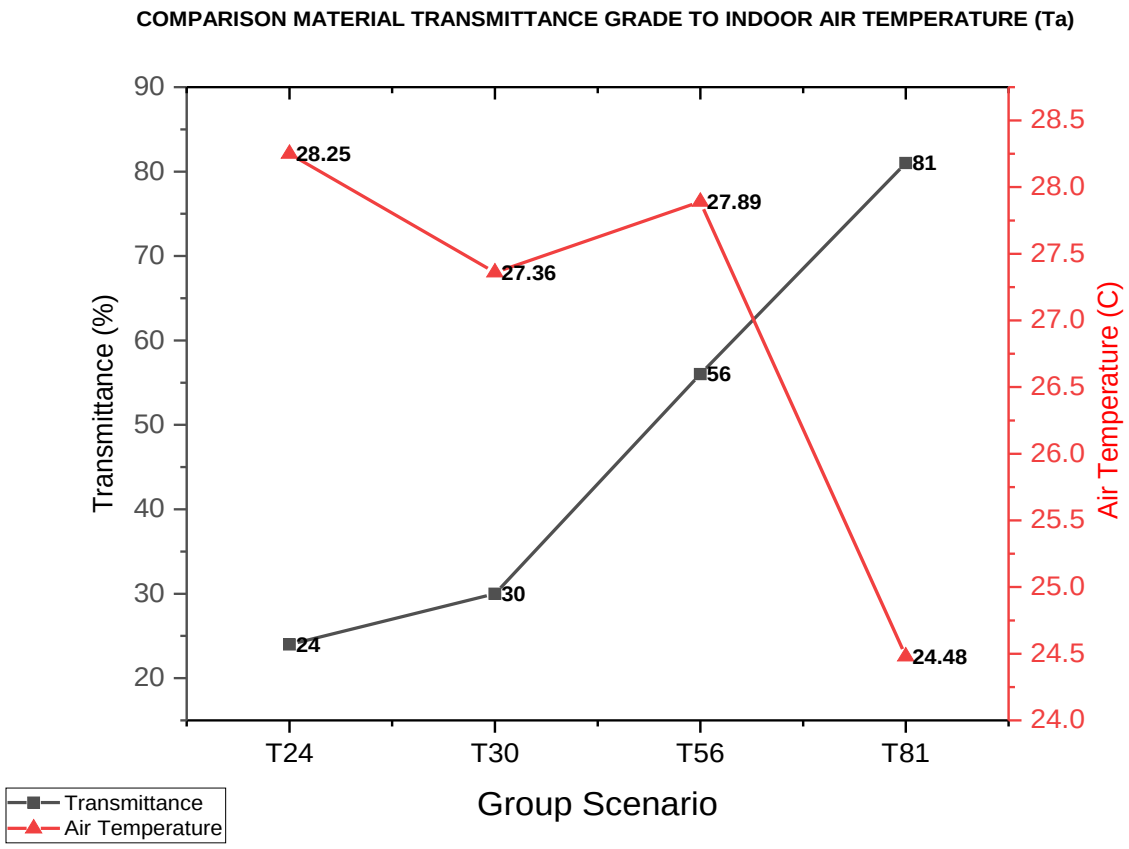


Figure 7. A Contradictive result data in analysis

From this data, we could assume pragmatically that material T81 has the best ability to reduce the heat from outside, and then there is T30 in second place. Meanwhile, the worst performance to reduce the heat is T24 in which this result was contradictive (figure 6). Authors assume that this caused by another uncontrolled parameter. Whereas T24 is represent a material with lowest transmittance grade that is 24%, it should indicate a better performance to reduce the heat among other tested material. Because it should only allow smaller amount of radiation to enter the building by reflecting it. In contrary, T81 has the highest transmittance grade among all material tested, yet it has the best result in reducing heat from outside temperature. The cause of this result must be analysing further. It is then authors conduct another discussion and analysis.

4.1 Analysis Outdoor to Indoor Air Temperature

First, the concern of outside temperature must be discussing further, and compare to each scenario. Since the outdoor temperature was not one of the controlled parameters in research, because it depends on the weather of measurement day as it experimental research. This diagram below will inform the first requirement of this discussion and analysis (figure 8).

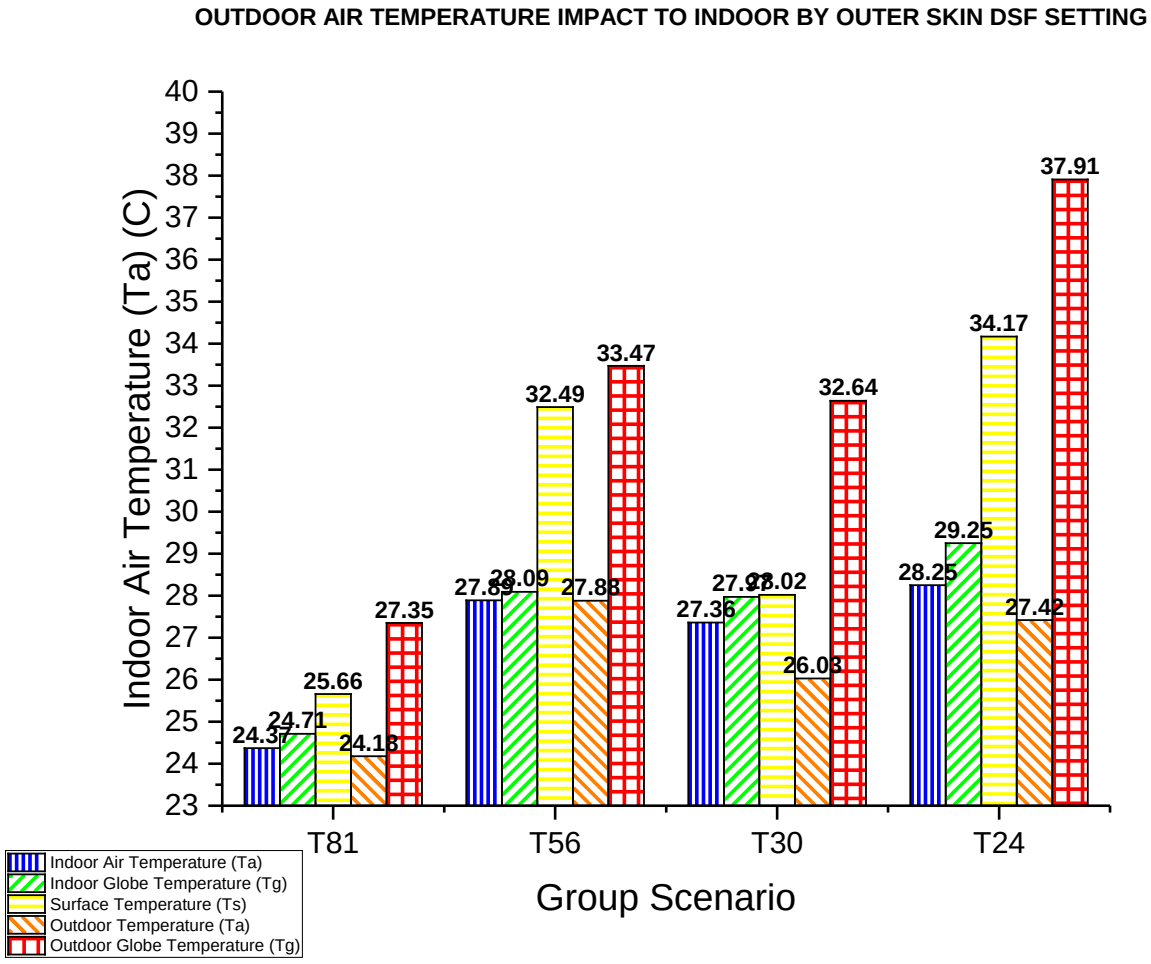


Figure 8. Comparison outdoor air temperature in every scenario of research

Diagram above shows an interesting data regarding outdoor air temperature. It is clear that when measurement on scenario T81, outdoor temperature was on the lowest number among all scenarios. In sequence from highest to lowest is T24, T56, T30, T81. Thus, it confirms the authors' assumption on why T24 has the worst performance. Likewise, this parameter is the factor that caused T81 to have the higher number of reducing air temperature from outdoor. In theory, this type material T81 are the type of glass with the highest grade of transmittance, which mean it allows more light that consist solar heat radiation to transmit into the building. It should produce higher temperature inside than other tested material.

From the charts above we also known the potential of every material in transmitting heat to outdoor by look at the deviation value (ΔT) of Ts to Indoor Tg. T81 has the lowest value of ΔT which mean this material release the radiation higher than others. Meanwhile, T24 has the highest ΔT, which mean this material has the potential to hold the heat better than others.

Even though these diagrams might explain the cause of contradictive result from previous one, the data still lack of general hypothesis. Which that would be the higher of transmittance grade, the lower it would perform in reducing heat, because the higher grade of transmittance, the higher it would allow the light to come through as solar heat radiation. Furthermore, this invalid result then provokes authors to do more read on the same data.

4.2 Analysis Correlation Globe Temperature Outdoor to Air Temperature

In this section, discussion would focus on revealing the cause of globe temperature to indoor air temperature. Regarding this discussion, authors concern that the value of globe temperature would indicate the radiation which transmit to indoor through skins and air gap of DSF. In advance, a bivariate diagram by JMP Software has been conducted to indicate this significance and correlation. All value probability in each scenario has <0001*, while RSquare value each for T81, T56, T24, T30 are 0.74, 0.23, 0.51, 0.89. Meanwhile the value of Tg outdoor to Tg indoor are 0.82, 0.17, 0.42, 0.98. Both of this value in analysis bivariate mostly has the number close to 1, meaning that the correlation is quite significance. Thus, the discussion in this section is relevant to be analyse further.

Diagram below would inform the value of globe temperature indoor to reveal indirectly the radiation amount from outside. This step is to help to read and understand the occurrence that happen in measurement (figure 9).

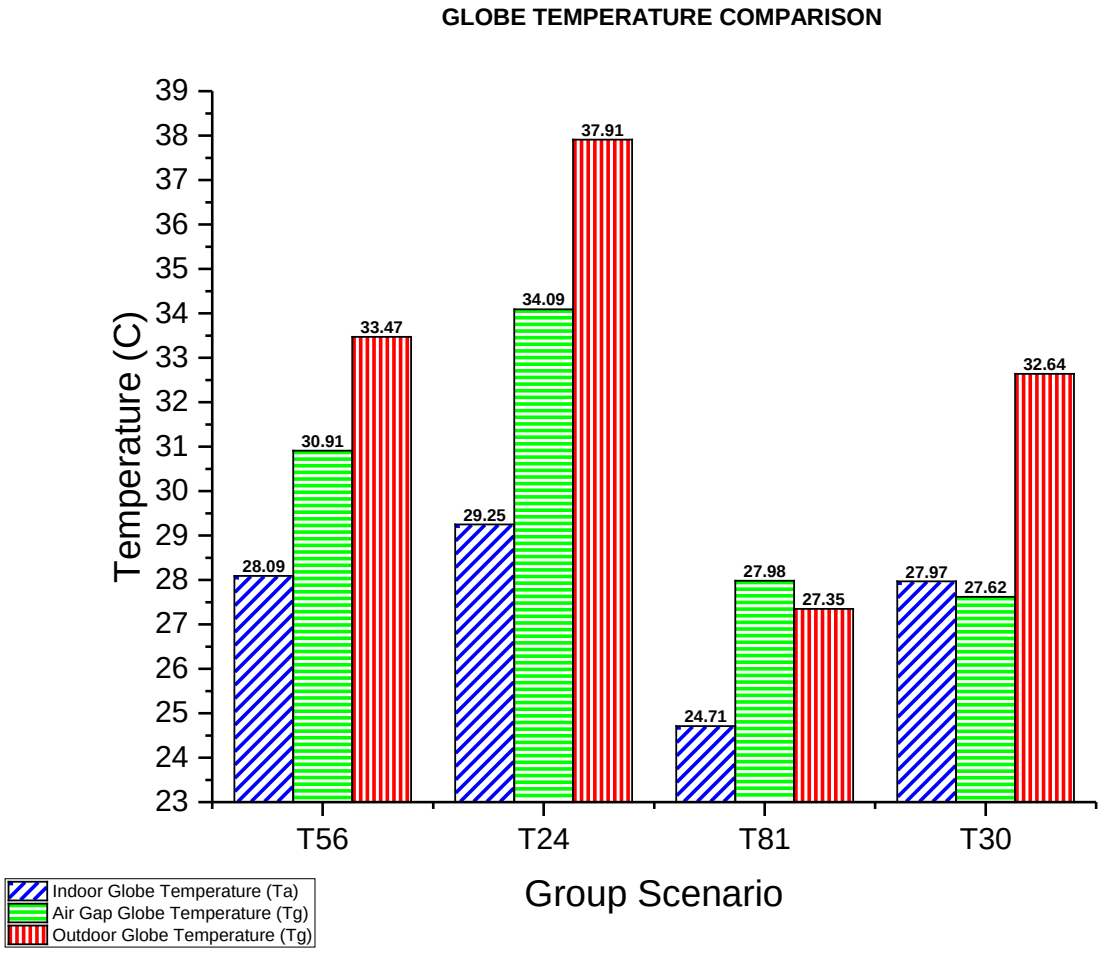


Figure 9. Globe Temperature to reveal a data about radiation

T24 and T56 has the similar pattern to response the load of solar radiation, it happened a reduction every DSF part from outdoor to indoor. Whereas T81 has the overheating occurrence in air gap part, this mostly happen in many cases in the world. A simple cause has been analysed on previous research, suggested to use ventilated design. This strategy simply could push the air flow which consist a heat that happen in air gap before it enters the building.

T30 has a different pattern itself, whilst the radiation in air gap is higher than indoor, yet the reduction is still happened from outdoor to indoor in a quite number of deviation (ΔT).

From both previous analysis data above, we could be informed that T24 has the most higher value of radiation and air temperature. Then this confirm authors' assumption and add another cause why it was contradictive on earlier result. Then we could represent each air temperature from outdoor and indoor and the table below (tabel2)

	T81	T56	T24	T30
Indoor	24.37	27.89	28.25	27.36
Outdoor	24.18	33.47	37.91	32.64

Table 2. Tested material on research including 4 type of glass material as outer skin in DSF

From this step, authors then involve the deviation data (ΔT) from table above, that is outdoor air temperature to indoor air temperature in each of scenario. The deviation then could be representing which one has the best performance to reduce the heat from outside (figure 9). A relation of the transmittance characteristic of material might change the previous pragmatic assumption on previous figure.

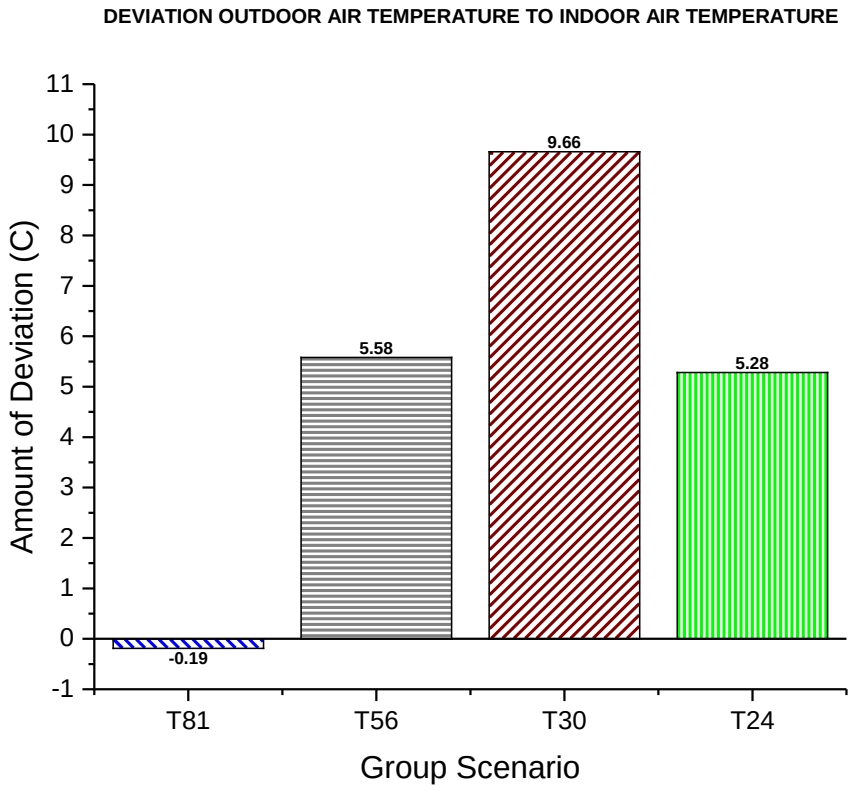


Figure 10. Comparison outdoor air temperature in every scenario of research

Diagram above directly reveal why there was a contradictive result on the previous analysis. Scenario T81 shows a minus number of temperature, it means that the air temperature degradation from outdoor to indoor did not happen in the most tested time. T24 scenario has also shows that it has the highest air temperature when the measurement made. The outdoor temperature in this scenario was 37.91^0 C, this number is the highest average temperature of all scenario experimented in this research. The deviation (ΔT) shows above inform T24 has the

biggest amount of changes of air temperature; meanwhile the smallest is scenario material T81.

4.3 Analysis Material

This step analysis conducted to provide an additional data about material tested regarding its characteristic. In this research there was measurement point consisted surface temperature data, in this analysis we would revealing the data result and gain another knowledge in this relevant case. Authors using globe temperature outdoor data to reveal solar radiation amount, which would affect surface temperature.

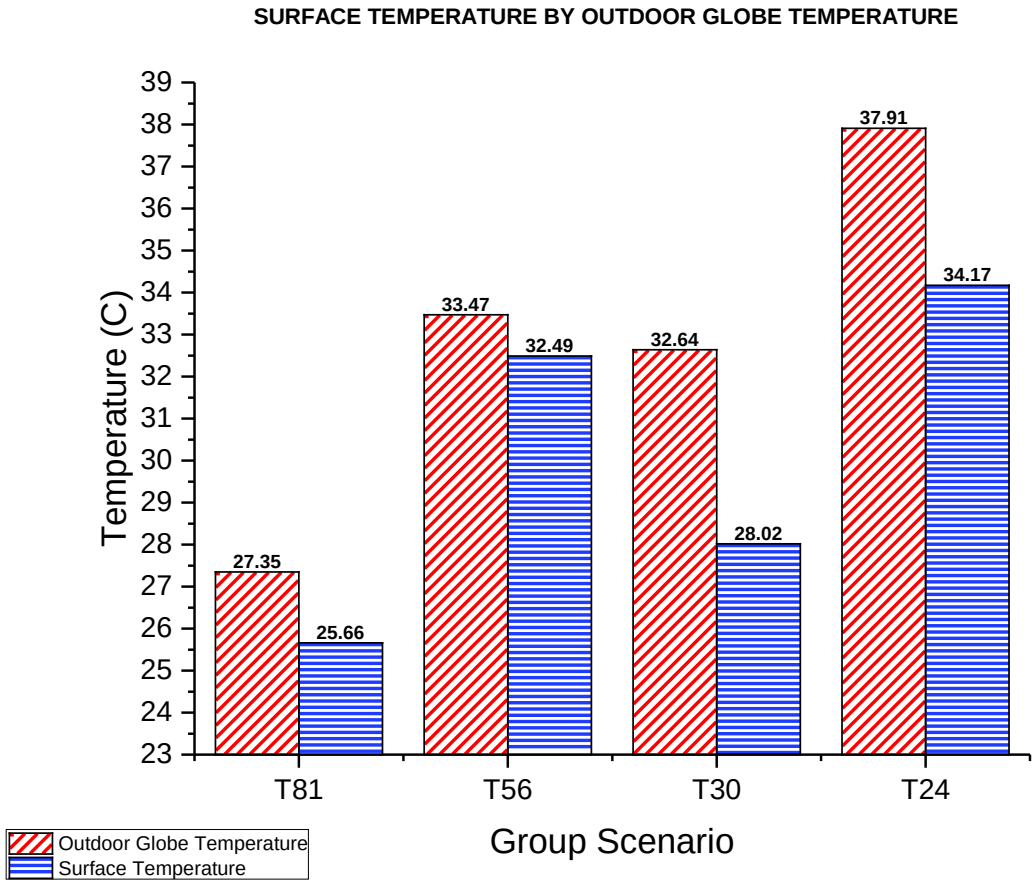


Figure 11. The potential outer skin material DSF in responding solar radiation outdoor

In contrary with on previous deviation (ΔT), in this case we would focus on the smallest number of deviation as the worst potential among tested material. This small deviation between outdoor globe temperature and surface temperature DSF indicate how small potential of certain material in responding radiation load. The differences between these two point of measurement shows how much the material could keep the radiation by absorbing it and affect the air gap and indoor temperature. Before we go further, from the diagram above we could regenerate the deviation data in this sequence:

T81	T56	T24	T30
1.69	0.98	3.74	4.62

Table 3. The deviation (ΔT) between outdoor and surface temperature DSF

The highest deviation (ΔT) shown by scenario T30 and T24, this confirm the type of both material are reflective type of glass. The glass with the ability to reflect the solar light consist with radiation. In theory, the bigger reflectance the bigger the radiation that could be reflected. Then we have T81, it has a close result of deviation with T56. Moreover, we need to be inform the energy characteristic of material tested to understand further (table 4).

No	Glass Type	Code	Energy Characteristic (%)		
			Transmittance	Reflectance	Absorption
1	Clear Glass	T81	81	7	12
2	Heat Absorptance Glass	T56	56	5	39
3	Reflective Glass	T24	24	24	52
4	Reflective Glass	T30	30	21	49

Table 4. Energy characteristic material tested.

Accordance to table above, unlike T24 and T30 that has close grade of reflectance and absorption characteristic, T81 and T56 has its pattern to show a low grade of reflectance characteristic. Although, both absorption characteristic is lower than others, the combination on these characteristic needs to be proportional corresponding to this demand in tropical context. The characteristic data above shows that the grade of reflectance plays important on this impact.

To see direct impact of this surface temperature material to indoor air temperature, authors then provide a line diagram, which inform in this result. In this diagram, still, globe temperature in air gap part and indoor are used to reveal the radiation amount in the air indoor. This diagram also provide a transmittance grade each group scenario, which it should not be contradictive as it is.

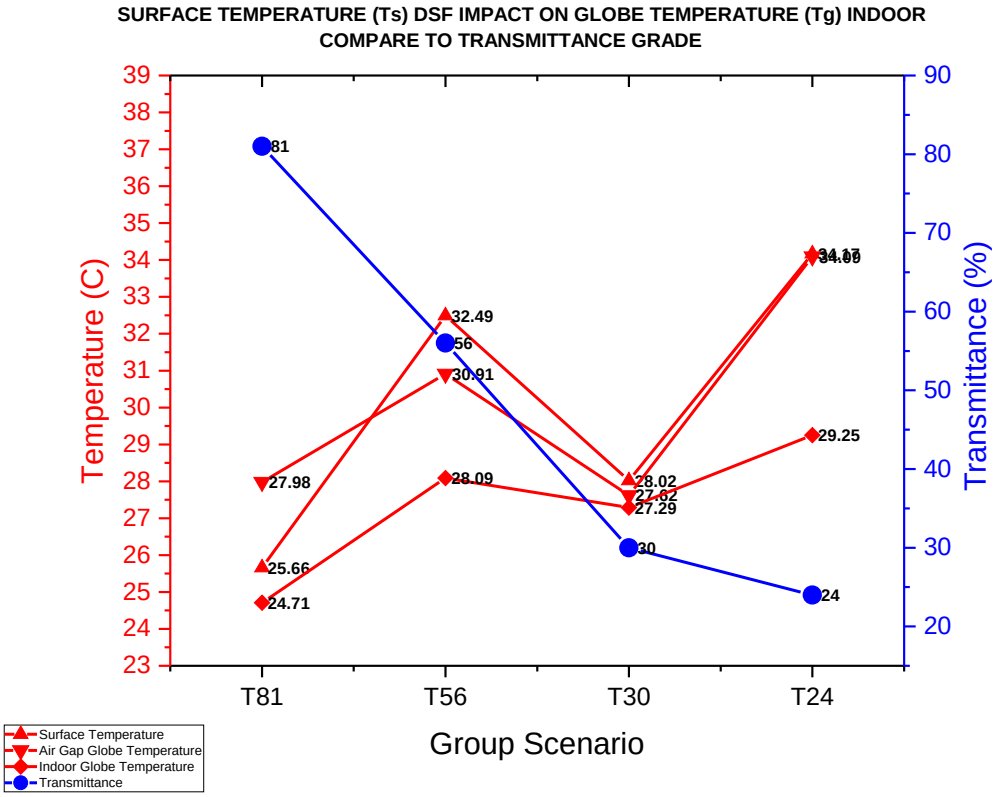


Figure 12. The diagram, which show a release amount of solar radiation through outer skin material DSF to another part

The value in Tg air gap represent the amount of radiation that Ts DSF has been released. T81 likely has a quite deviation to air gap which impact on indoor globe temperature. Unlike it, T30 and T24 release an almost the same amount of radiation in air gap. T56 reduce its solar radiation by absorbing it, meanwhile T81 has the worst potential to release a solar radiation in bigger amount, this could be harming the air temperature indoor.

5 Conclusion

Several data reading has been conducted to reveal the result of research experiment coherently. Analysis in certain point reveal the cause of the phenomenon and contradictive result that showed in discussion. This strategy was intentionally conducted to confirm result to result, analysis to analysis. The data step by step being check and interpret, to gain an exact result for saving energy by supressing the cooling demand indoor in tropical case.

Generally, the authors would suggest the using of reflective material in DSF to avoiding the solar radiation, the performance of high absorptance grade of material also show a good result. T56 has a quiet potential to delay the heat before entering the deeper part of building. A better combination of low transmittance grade and high absorptance grade would gain a better result by reflecting it and absorbing the radiation amount left. A using of material with high transmittance grade keep showing a bad result in tropical context. The high intensity of the sun over the year could do harm if the building envelope/coverage keep pass through the solar radiation because it's easily transmit those electrical waves to the building. This kind of material with its transmittance grade will not be suggested.

Authors also suggest to use controlled parameter in every stage in research methods in the future of this similar case. The uncontrolled outdoor environment indeed could produce a contradictive result, because the differences of the load that object would face during the experiment. Thus, this result and research shall be continuing in simulation to gain a better result by involving a real data of field experiment. So that a more variation could be done in the future and produce an effective and variative recommendation to achieve this aim.

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IMPROVEMENT OF ENERGY PERFORMANCE OF RESIDENTIAL BUILDINGS: YILDIZLI TOKI EXAMPLE, TRABZON

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Abstract

Residential buildings are an important part of the building industry and have a significant share of primary energy consumption. Reducing the amount of primary energy, which represents the total energy consumed for heating, cooling and lighting purposes in residential buildings, both contributes greatly to the economies of countries and helps to reduce environmental pollution. Many world countries have implemented legislative measures to improve energy performance especially by reducing the amount of primary energy consumption in new residential buildings; however they did not give the same importance to the existing residential buildings. However, it is possible to improve the energy performance with much shorter time and more economical improvements in existing residential buildings instead of rebuilding them. Within this context, in this study it has been focused on to what extent that energy performance of a residential block in TOKİ mass-housing in the province of Trabzon located in north-east Turkey can be increased with practical improvement scenarios. As improvement scenarios, changes in the glazing system and building use conditions that do not require serious modification have been taken into consideration. As glazing system; low-e coatings applied in different positions scenarios in which air, argon and air + argon gas mixtures were used in the space between double and triple layered glasses and the glass layers of these glasses; the temperatures settings for the heating and cooling season were changed according to the use of the building and it has been determined at what rate the primary energy consumption values of the residential block have been improved compared to the current situation by using the DesignBuilder energy simulation program. In the results of the study, it has been seen that in the K_02 usage scenario, where setting temperatures for heating and cooling are assumed to be 16^0C and 29^0C respectively, in cases when the block is not used; double-layered DGLZ_08, where the air + argon gas mixtures are and located on the 2nd and 3rd surfaces of the low-e coating in terms of annual total primary energy consumption value and the scenario, in which argon gas is used in three layered TGLZ_03 glazing system, where low-e coating is located on the 2., 3. and 5. surface, improve the energy performance of the building by 9.6%.

Keywords

Residential buildings, energy performance, energy simulation, glass system, use condition

1 Introduction

The energy consumption in the residential building sector is quite high compared to transportation, industry and commercial sectors in the world. When national energy consumption according to sectors is examined, it is seen that consumption in the residential building sector varies approximately between 16 % and 50 %. The energy in the residential building sector is consumed the most in Saudi Arabia and the least in Finland. When we look at the situation in Turkey, we see that the energy consumption in this sector consists of 31% of the total national energy consumption [1]. The fact that the energy consumption rates are so high in the houses requires that the parameters affecting the energy consumption in these buildings are well known for efficient use of energy. These parameters are listed as items below [2].

- Climatic and spatial parameters (Temperature, Solar radiation, Wind speed and direction, Latitude, Longitude, Height from sea level)
- Building design parameters (The orientation, Building geometry, Physical properties of the building envelope, Impermeability Position of buildings according to other buildings)
- Building system parameters (Lighting system,Heating, ventilation and air conditioning (HVAC) systems, Equipment, User profile and Building usage scenario) [2].

In order to be able to calculate how the above listed parameters affect the energy consumption of residential buildings, it is necessary to be able to use energy simulation programs and interpret their results. There are many energy simulation programs on the market developed to calculate the energy consumption of buildings. Some of these programs; EnergyPlus, DesignBuilder, IES-VE, TAS, DOE 2.1., Blast, ECOTECT, Revit, Esp-r [3]. These programs calculate the energy consumption of buildings according to semi-dynamic and dynamic calculation methods which are accepted in international and nationally accepted standards [2]. In recent years, directives have been published in many parts of the world for the efficient use of energy in buildings. One of the most important of these directives is the directive 2010/31/EC on Energy Performance of Buildings prepared by the European Union for member states. This directive, which Turkey also takes into consideration, the new buildings to be built until the end of 2020 should be near zero energy building (nZEB) and that the member states of the European Union have to fulfill this requirement with a cost-optimal approach [4]. In addition to the new buildings to be built, it is important to use energy efficiently in existing buildings. Therefore, many studies have been carried out in order to reduce the energy consumption of existing residential buildings [5-15]. In these studies, the effects of the climatic and spatial parameters, building design parameters and changes in building system parameters on the energy consumption of residential building. Yaşar et al. [5] calculated the effects on the life cycle cost of the building of each glass type examined in high-rise residential blocks in the temperate-humid climate region of Turkey determining the effects of different glass types on the building's heating and cooling load. A similar study was conducted by Maçka et al. [6] for a cold climate region. In studies carried out for temperate-humid climatic regions and cold climatic regions, while the double-layer glass with low-e coating on surface 2 shows the best performance in terms of energy efficiency performance, the blue reflective double-layer glass with low-e coating on surface 2 showed the best performance in terms of economic efficiency. Pikas et al. [7] have worked on cost effective zero-energy solutions have worked on cost effective zero-energy solutions. In this context, they examined different types of three-layered glasses. They used three-layer clear glass in different window types and

changed the types and ratios of gas used between glass layers. They used air, argon and krypton gas as gas type. Among the three-layer glass types examined, it has been found that argon gas gives the best results in terms of energy and cost effectiveness. Thalfeldt et al. [8] have studied how window type, wall insulation thickness, transparency ratio and changes in external shading elements contribute to the energy and cost effectiveness of buildings in Estonia, which is in the cold climate region. They have shown that heating load is reduced by using low-e coating in multi-layered glass. At the end of the study, they have determined energy and cost effective window type, wall insulation thickness, transparency ratio and external shading elements. Saroglou et al. [9] they have examined the effect of the type of glass in the building envelope and gas type in the gap between glass layers on building energy performance in multi-storey buildings. In the spaces between the windows, they used air and argon gases. Çetiner et al. [10] have studied the effect of air and argon gas usage on the energy and cost effectiveness of the building in the space between different types of multilayer glasses. In another study [11], they tried to determine how the energy consumption of the building changed in the direction of the changing width of the gap between the glass layer in accordance with the situation that low-e coating is on the inner surface, outer surface or lacking.

Like the studies above, besides the studies focusing on determining the building design parameters affecting the building's energy consumption and/or cost, there are also studies on the effects of changes in the use of the building on energy consumption. Parys [12] studied on glass ratios, glass types and user behavior in cost optimization study based on building energy simulation for an office building in the temperate-humid climate region. In another study, Ascione et al. [13] made calculations of the annual energy consumption of a public building, whose model was established with the help of building energy simulation. However, they have seen that their current energy consumption and the results of building energy simulation programs do not match. As a result of the work, they have concluded that the reason why energy consumption values differ from those in energy simulation programs and current situation is due to the differences in the use of the building. Bourgeois [14] has studied on the building energy simulation programs and user behavior. In the study, he aimed to make the user factor influencing the use of energy in buildings a self-running simulation module. Martinaitis et al. [15] have studied on buildings' energy consumption, on the effects of building users. In this context, a test model was created with an energy simulation program for testing and inspection of energy use. Changes in energy consumption have been examined by changing the temperature of the users and the interior space.

Within the scope of this study, it has been examined in the studies how glass type,gas type used in the gap between glass layers and changes in building use conditions increase the energy performance of buildings in mostly pre-design buildings or hypothetical buildings. In this direction it has been determined how the current energy consumption of Yıldızlı TOKİ mass housing project in the moderate- humid climatic region of Trabzon has been reduced by changing these parameters and suggestions have been made.

2 Method

For this study, Yıldızlı TOKİ mass housing, in the province of Trabzon and built by the Housing Development Administration, was selected as the pilot campus. From the 22 residential blocks in the settlement, the current state of the block located at the top of the land and shadowed the least by neighboring blocks has been examined. Since the orientation and the effect of building height on energy consumption are not taken into account, the normal floor plan consisting of 4 apartments was simulated using the DesignBuilder energy simulation program and the study has been carried out about

recommendation to improve the energy performance of the floor. Heating, cooling, lighting obtained from the simulation results and primary energy consumption from other equipment have been accepted as reference for the study. Considering the glass types, the gases used in the space between the windows, and the hours when building users use the building in the current status accepted as a reference, a total of 39 primary energy consumption improvement scenarios have been created where changes are made in the indoor setting temperatures. Each of the created scenarios has been simulated and it has been determined how these scenarios improve the primary energy consumption resulting from heating, cooling, lighting and other equipment.

2.1. Climate data

According to the Standard of Heat Insulation Rules in TS 825 Buildings, Turkey has been put into the four climate region. Trabzon (39.72°N, 41° E) is in the second climate region and under the influence of the Black Sea climate, which has a moderate-humid climatic characteristic [16]. The climate data of Trabzon are given in Table 1.

Table 1. Climate data of Trabzon [2]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Outside dry bulb temperature (°C)	7,5	7,5	9,3	11,2	15,7	20,2	23,9	24,7	21,0	17,6	12,7	9,2
Dew-point temperature (°C)	1,21	1,6	3,9	7,6	12,3	16,0	18,9	19,6	16,3	12,9	7,2	3,1
Wind speed (m^2/s)	2,8	3,0	2,9	2,5	2,2	2,4	2,5	2,5	2,7	2,5	2,7	2,8
Wind direction (°)	176,8	178,0	166,2	174,6	175,2	180,2	174,1	183,5	175,4	174,6	177,3	176,7
Atmospheric pressure (kPa)	100,8	100,8	100,9	100,9	100,8	100,9	100,9	100,9	100,8	100,9	100,8	100,9
Direct normal solar (kWh)	58,1	67,1	66,2	72,4	99,9	109,3	82,6	91,3	81,4	58,9	55,5	45,7
Diffuse Horizontal Solar (kWh)	28,7	34,4	63,7	71,8	78,7	86,0	87,5	79,2	59,9	48,8	29,8	27,9

2.2. Building Model

Yıldızlı TOKI, mass housing settlement built on the northern slope of the mountain in Trabzon by the Housing Development Administration of Turkey, consists of 22 blocks. The position of the housing block being examined in this complex of different types of blocks is shown in Figure 1. In the housing block examined, each floor consists of 4, 3 + 1 flats of approximately 113 m^2. The elevation and plan drawings of the seventh floor, selected as reference for the study, are shown in Figure 2, and the construction information of the floor is given in Table 2.

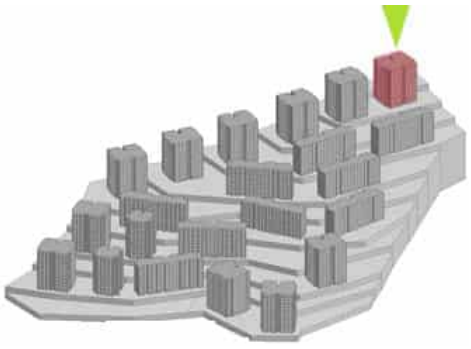


Figure 1. Location of investigated residential building block

Figure 2. Elevation and plan of reference residential building block

It has been assumed that the apartments are used by a family of 4, consisting of mother, father and 2 children. The heating needs of the residential blocks on the settlement are provided by the solid fuel boiler, cooling and hot water needs are provided by individual electricity. No mechanical or natural ventilation has been established and ventilation need has been left to the users.

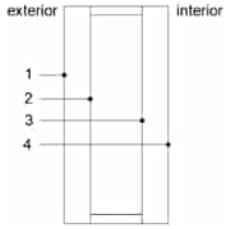
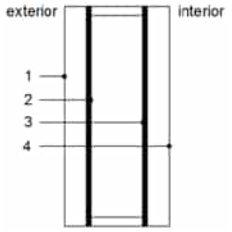
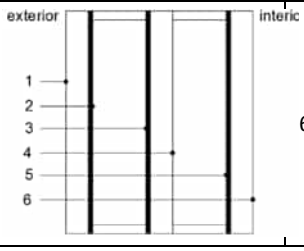
Table 2. Flat properties

Main buildings dimensions					
Gross width-length	23.1 m - 25.9 m		Gross Floor Area	476.84 m^2	
Storey	7 / 12		Gross Volume	272.69 m^3	
Gross Height	2.7 m		Gross Roof Area	48.90 m^2	
Building geometry-residential					
	Total	North	East	South	West
Gross Wall Area (m^2)	340.80	93.60	76.60	93.60	76.80
Window Area (m^2)	45.02	7.43	15.08	7.43	15.08
Window-Wall Ratio (%)	13.21	7.94	19.64	7.94	19.64
Weather data	Trabzon IWEC		Number of zones	4 Thermal zones	
Environmental control					
	Heating (°C)	Heating set back (°C)	Cooling (°C)	Cooling set back (°C)	
	20	18	25	27	
Construction					
U_{wall}	0.530 W/m^2K		$U_{partition}$	1.665 W/m^2K	
$U_{internal\ floor}$	2.939 W/m^2K		Infiltration	0.8 ac/h	

2.3. Glass Types and Gas Types Used

In the study, as an alternative to the clear double-layered glass used in the reference housing block, double and triple-layer glasses, used in low-e coatings with an emissivity value of 0.157 on different glass surfaces, have been examined. The gaps between the glass layers of these glasses examined have been filled with argon and air + argon gas mixtures as an alternative to air. Thermophysical and dimensional properties of 12 scenarios investigated according to gas types used in glass types and gaps of glass plates are given in Table 3.

Table 3. Thermophysical and dimensional properties of window systems

	Window System Type	Thickness (mm)	Coating Position	Gas Type	U-Value (W/m²K)	Scenario Number
Reference double clear glass		4+12+4	-	Air	2,725	Ref_GLZ_00
Double low-e coating glass		6+12+6	2	Air	1,771	DGLZ_01
				* Air +Argon	1,642	DGLZ_02
				Argon	1,481	DGLZ_03
			3	Air	1,771	DGLZ_04
				*Air+Argon	1,642	DGLZ_05
				Argon	1,481	DGLZ_06
			2 ve 3	Air	1,681	DGLZ_07
				*Air+Argon	1,546	DGLZ_08
				Argon	1,377	DGLZ_09
Triple low-e coating glass		6+12+6+12+6	2,3,5	Air	0,976	TGLZ_01
				*Air+Argon	0,877	TGLZ_02
				Argon	0,759	TGLZ_03

*Mixed gas ratio; argon %45, air %55.

2.4. Indoor Setting Temperatures

In the study, setting temperature values for heating and cooling have been defined for the periods when the flats are used and not used according to the times of use of the flats of users in order to determine the effect of the change in indoor temperature on the energy performance of the building. The current situation of heating and cooling all day in the flats during summer and winter season has been accepted as a reference. In the created scenarios, it has been assumed that the building is not used between 08:00 and 17:00 on weekdays and it is used full-time in other times and weekends. Scenarios created in this direction are given in Table 4.

Table 4. Set-point and set-back temperatures values for heating and cooling according to occupancy period

	Weekdays 00:00-08:00 &17:00-00:00		Weekend 01:00 &00:00		
	Set point temperatures (°C)	Set back temperatures (°C)	Set point temperatures (°C)	Set back temperatures (°C)	Scenario number
Heating	20	-	20	-	
Cooling	25	-	25	-	Ref_K_00
Heating	20	18	20	-	K_01
Cooling	25	27	25	-	

Heating	20	16	20	-	K_02
Cooling	25	29	25	-	

3 Results and Discussions

In this chapter, in addition to the reference state the primary energy consumption values derived from annual heating, cooling, lighting and other equipment of a total of 39 scenarios including 13 glass systems and 3 different usage scenarios have been calculated in square meters of unit. These calculated values have been studied under 3 headings as the effect of glass system scenarios on the energy performance of the building, the effect of interior temperature-setting scenarios on the building's energy performance according to the use of flats and the effect of the glazing system and interior setting temperature scenarios on the energy performance of the building and comparisons have been made as well as presenting appropriate solution proposals.

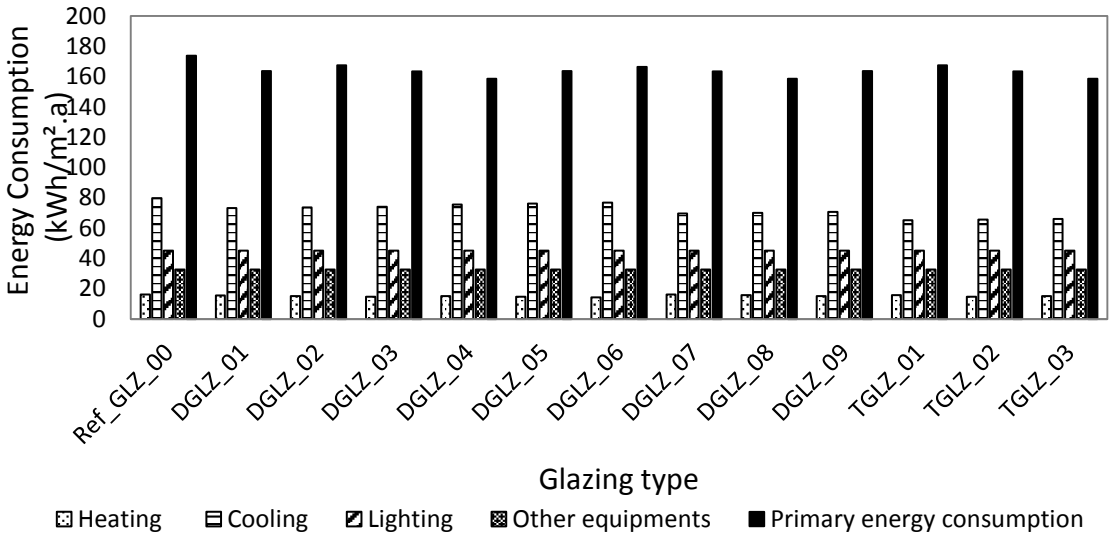
3.1. Examining the effect of glazing system scenarios on building energy performance

Each of the glazing system scenarios examined in the study has been compared in this part in terms of annual energy consumption from heating, cooling, lighting and other equipment and in terms of primary energy consumption, which is the sum of these consumptions. Findings obtained in reference use case (Ref_K_00) of glazing system scenarios examined for energy consumption and percentage changes in performance according to reference case are given in Table 5.

When Table 5 is examined, it has been seen that the performance of glazing systems using argon gas between glass layers shows better performance compared air and air + argon gas mixture systems in terms of consumption of heating energy since the thermal conductivity of the argon gas is lower than other gases. For example; argon gas filled double layer glazing system DGLZ_03 showed better performance than DGLZ_02 where the air + argon gas mixture is used and air-filled glass system DGLZ_01 at the rates of 2.8% and 5.1%, respectively. On the other hand, the double-layered glazing systems, where low-e coating is used on the two and three surface, DGLZ_07, DGLZ_08 and DGLZ_09, have shown the worst performance in terms of heating energy consumption because it prevents the entry of the desired sunlight in winter by means of low-emission coatings used on both surfaces. While glazing systems where low-e coating is used in surface 3 prevent heat losses due to the use of the coating in the interior direction and reflection of the heat inside to the interior again as a result of this use, it receives the desired solar radiation in winter from indoor to indoor through the outer layer. Therefore, these glass systems showed the best performance. The argon-filled double-layered glass DGLZ_06, on whose surface 3 low-e coating was used and which exhibits the highest performance in terms of heating energy consumption, has shown 3% better performance than argon filled DGLZ_03, on whose surface number 2 low e-coating was used, and 5.8% better performance than argon filled DGLZ_09, on whose surface number 2 and 3 was low-e coating was used. Since three-layer glass systems TGLZ_01, TGLZ_02 and TGLZ_03 have lower coefficient of thermal conductivity than other glass systems, they contribute positively to the performance of the heating energy consumption. However, the use of low-e coating on three surfaces prevents solar gains in winter that is why they have a negative effect on the consumption of heating energy. Therefore, these glazing systems exhibit low heating energy consumption

performance than DGLZ_04, DGLZ_05, and DGLZ_06 glazing systems, on whose surface number 3 low-e coating is used.

Table 5. Yearly primary energy consumptions according to glazing system scenarios



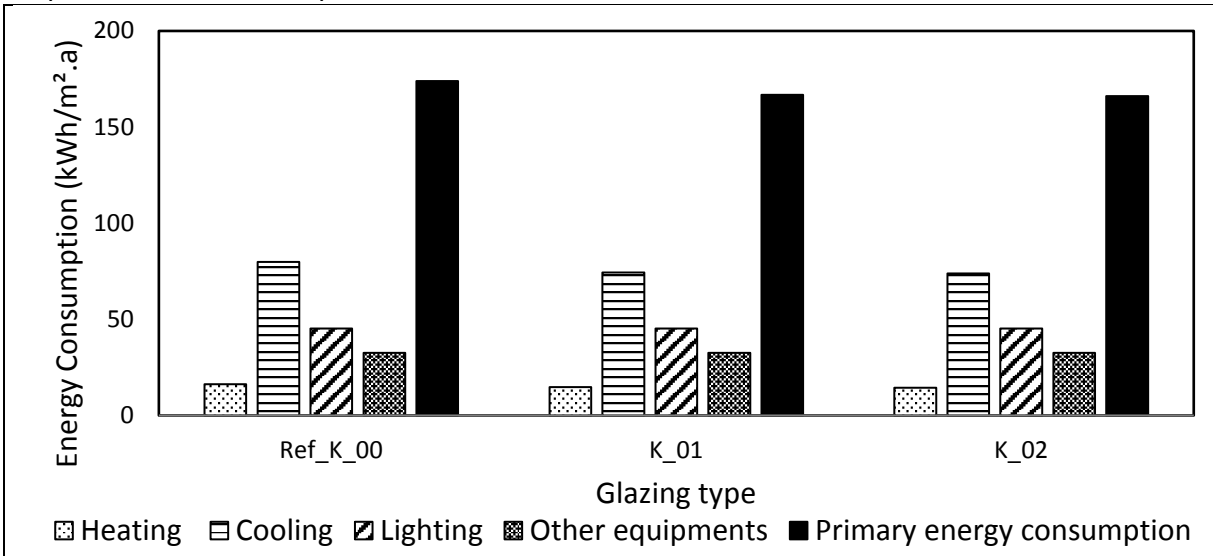
Energy Con. Perf.(%)	Ref_GLZ_00	DGLZ_01	DGLZ_02	DGLZ_03	DGLZ_04	DGLZ_05	DGLZ_06	DGLZ_07	DGLZ_08	DGLZ_09	TGLZ_01	TGLZ_02	TGLZ_03
Heating	Ref	4,0	6,3	9,1	6,8	9,2	12,1	0,7	3,2	6,3	3,2	8,9	7,4
Cooling	Ref	8,2	7,7	7,1	5,3	4,7	3,8	12,6	12,1	11,5	18,2	17,9	17,4
Primary Energy Cons.	Ref	5,9	3,7	6,0	8,7	5,9	4,2	6,0	8,8	5,9	3,7	6,0	8,8

Best performance in terms of cooling energy consumption has been shown by TGLZ_01, TGL, Z_02, and TGLZ_03, three-layer glazing systems on whose surfaces 2, 3 and 5 low-e coating is used. The reason for the best performance of these glazing systems is that low-emission coatings do not take in the solar radiation inside and are emitted back through the external centering radiation. The cooling energy consumption performance of the glazing systems, in which low-e coating is used on surface 3 and the heating energy consumption performance is high, is low. This is because the solar radiation transferred from the outside environment to the inner atmosphere does not encounter any obstacle as far as the 2nd glass layer and penetrate into the inner environment. Air-filled glazing systems showed the best performance in terms of cooling energy consumption. For example, the air filled TGLZ_01 glazing system has a 4.2% higher performance than the argon-filled TGLZ_03 glazing system. By using low-e coating on surface 2 (DGLZ_01), a performance increase of 8,2% has been observed in the reference glass system Ref_GLZ_00 in cooling energy consumption; an increase of 5,3% with the use of it on surface 3 (DGLZ_04); an increase of 12,6% with the use of it on surfaces 2 and 3. Finally, a performance increase of 18.2% has been observed with the use of the three-layered glazing system on surfaces 2, 3 and 5.

3.2. Examination of the Effects of Indoor Setting Temperature Scenarios on the Energy Performance of the Building

Heating, cooling, lighting, other equipment and primary energy consumption values in K_01 and K_02 use cases, where the conditions in which the building is not used are taken into account and the operation of the heating and cooling system is carried out according to a certain determined temperature during these conditions, according to the default reference case (Ref_K_00) where the building's heating and cooling system is operated 24 hours a weekday and weekend, have been summarized in Table 6.

Table 6. Energy consumptiom of building belong to Ref_GLZ_00 of glazing systems according to indoor set-point and set-back temperatures scenarios



Energy Con. Perf.(%)	Ref_K_00	K_01	K_02
Heating	Ref	9,4	11,3
Cooling	Ref	7	7,6
Primary Energy Cons.	Ref	4,1	4,5

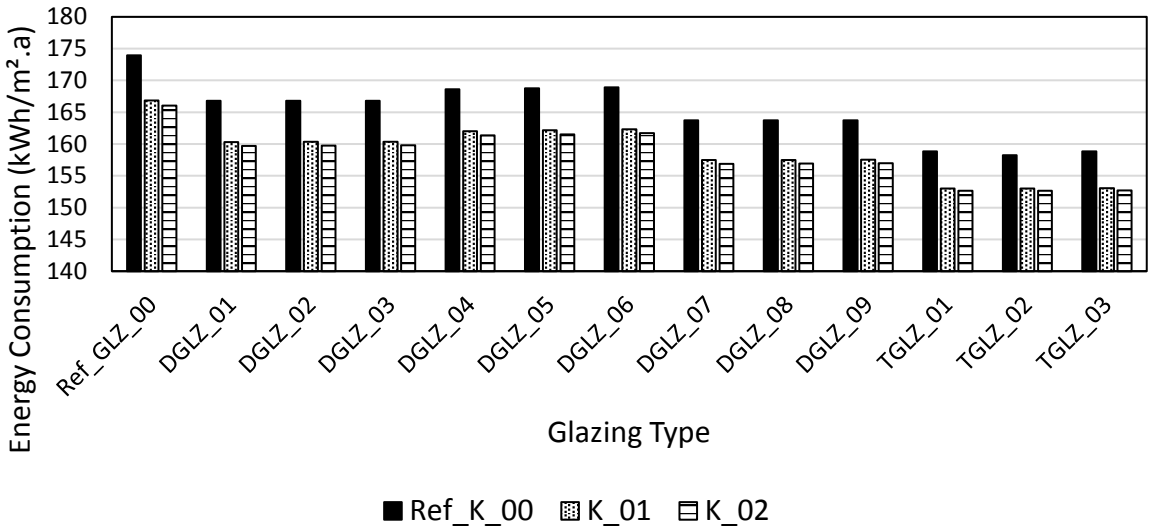
Also in Table 6, comparison of the energy consumption performances of usage scenarios as a percentage is also given. When Table 6 is examined, heating, cooling and primary energy consumption performance are observed to be the highest in the case of K_02 use. This is because in this case the interior setting temperatures are sufficiently improved when the building is not used. For example, in case the indoor temperature is not used for heating, 11,3% performance increase has been observed by reduction of 4^0C (K_02), 9,4% performance increase by reduction of 2^0C (K_01), whereas 7,6% performance increase has been observed by increase of 4^0C in the indoor setting temperature for cooling (K_02) and 7%

performance increase by increase of 2^0C (K_01). It has been observed that the change in indoor setting temperatures has more effect on the heating system.

3.3. Examination of the effect of glazing system and indoor setting temperature scenarios on the energy performance of the building

In this part, primary energy consumption values obtained from the use of indoor setting temperature scenarios with examined glazing system scenarios in 3 different usage cases have been compared and graphically presented in Table 7.

Table 7. Yearly primary energy consumptions of glazing system and indoor setting temperatures scenarios



	Usage scenario		
Glazing system	**Ref_K_00**	**K_01**	**K_02**
Ref_GLZ_00	■	+4,08	+4,55
DGLZ_01	+4,12	+7,84	+8,18
DGLZ_02	+4,11	+7,82	+8,15
DGLZ_03	+4,10	+7,80	+8,12
DGLZ_04	+3,06	+6,86	+7,24
DGLZ_05	+2,99	+6,78	+7,15
DGLZ_06	+2,89	+6,67	+7,03
DGLZ_07	+5,87	+9,46	+9,80
DGLZ_08	+5,87	+9,45	+9,78
DGLZ_09	+5,86	+9,42	+9,74
TGLZ_01	+8,67	+12,04	+12,25
TGLZ_02	+9,03	+12,03	+12,23
TGLZ_03	+8,67	+12,02	+12,21

The primary energy consumption performances are given in percentage according to the reference situation. As seen from the Table 7, 4^0C reduction of the indoor setting temperature in the present case for heating, 4^0C increase for heating when the building is not used (K_02) provide 4.55% to 12.25% improvement in primary energy consumption performance over the reference year; 2^0C reduction for heating, 2^0C increase for cooling (K_01) provide an improvement of 4.08% to 12.04%. There is little difference in the performance improvement between K_01 and K_02 use cases in terms of primary

energy consumption value. However, when each situation is addressed in terms of the heating and cooling energy consumption performance, there are clearer percentage differences.

4. Conclusions

Today there is a lot of interest in works to reduce energy consumption from heating, cooling, lighting and equipment in residential buildings that make up an important part of the building sector. The reason for this is that the residential buildings in the urban scale are quite numerous and therefore responsible for a large part of the energy consumed in the building sector. World countries put a lot of legislative regulations into practice on the reduction of energy use in residential buildings. With these regulations, the restriction of the energy consumed in residential buildings becomes compulsory and in the design phase, houses are designed according to energy efficient design principles. However, the life span of existing residential buildings has not been finished and these buildings are not designed according to energy efficient design principles, leading to high energy consumption. It is very important to know in short time and at low cost how energy consumption can be reduced in these buildings with a number of renewing without destroying them. In this context, it has been studied how the energy consumption will be reduced by changing the indoor setting temperatures in an existing block, which is discussed in this study and located in Trabzon, a TOKİ public housing, depending on the use of the glass types and the building without any destruction. The results obtained in the study are summarized in Table 8.

Table 8. Evaluation of investigating glazing system scenarios in this study according to reference glazing system

Glazing system	Heating	Cooling
Ref_GLZ_00	■■■■■■■■■■■	■■■■■■■■■■■■■
DGLZ_01	■■■■■■■■	■■■■■■■■■■
DGLZ_02	■■■■■■■	■■■■■■■■■■■
DGLZ_03	■■■	■■■■■■■■■■■■
DGLZ_04	■■■■■■	■■■■■■■
DGLZ_05	■■	■■■■■■■■
DGLZ_06	■	■■■■■■■■■
DGLZ_07	■■■■■■■■■■	■■■■
DGLZ_08	■■■■■■■■■	■■■■■
DGLZ_09	■■■■■■■	■■■■■■
TGLZ_01	■■■■■■■■■	■
TGLZ_02	■■■■	■■
TGLZ_03	■■■■■	■■■

■; the best performance, ■■■■■■■■■■■■■; the poorest performance

When Table 8 is examined in terms of heating and cooling energy consumption, it has been seen that different types of glazing systems perform best. For example; in terms of consumption of heating energy while argon gas filled DGLZ_06 glass, in which low-e coating is used on surface 3, has shown the best performance, it has been seen that in terms of cooling energy air filled TGLZ_01 triple layered glass, on which low-e coating is positioned on surfaces 2, 3 and 5 systems, shows the best performance. The use of low-e coating on surface number 3 reduces the consumption of heating energy whereas its use on surface number 2 reduces cooling energy consumption. The reason why Argon gas filled systems have poor performance in terms of heating energy consumption is that their thermal conductivity value is lower than of those with air-filled systems. On the other hand, in cooling energy is consumption argon

filled systems perform poorly compared to air-filled systems because their solar heat gains coefficient values are higher. Although the coefficient of thermal conductivity of three-layered glass is low, they have not been able to show high performance in terms of heating energy consumption. This is due to the use of low-e coating on three surfaces and these coatings prevent desired sunlight from entering indoor in winter.

By means of this work, it has been shown that energy consumption in existing residential buildings can be significantly reduced by renovation of glazing systems and shortening the working time of the heating and cooling systems according to the usage of the building only. It is important for home users to know how they can reduce their energy consumption by measures they can practice in their homes. In future work, the measures that can be taken on facade and roof systems, which are important elements of building envelope, may be the focal point. In this way, information can be provided about what can be done to reduce the energy consumption required by legal regulations and what measures can be taken to comply with the compulsory consumption rate.

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STUDY ON THE THERMAL ENVIRONMENT OF THE TRADITIONAL AND MODERN DWELLINGS BASED ON NATURAL ENERGY

- A Case Study on the Survey and Simulation of the Village Investigation in Central Zhejiang

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Abstract

Building energy conservation is an important way to reduce energy shortage and realize low carbonization development. [1] Most of the traditional houses all over the world use local building material, make full use of renewable energy, using the natural energy of natural climate actively such as light, heat, wind to adapt to the climate environment, with good adaptability to the local climate, topography and, is a model of passive building technology. [2] The design concept of Chinese traditional dwelling houses in the Jiangnan area emphasizes building shading, heat insulation and natural ventilation. Scholars have done some researches and found that the indoor thermal comfort of the traditional houses in the south of the Yangtze River is better than the modern ones.

The central Zhejiang region belongs to subtropical humid monsoon climate, warm and comfortable, with obvious dry and wet seasons. Based on Shentan villages, the ancient villages in the central area of Zhejiang province in China, as the research object. Through on-the-spot investigation, comparing the traditional house and modern house of ancient village from the factors of the village location, building orientation, spacing, the interior space layout, the design of opening ways, building materials and construction, the research makes the Qualitative analysis of climatic adaptability characteristics. As the measured object, in Feng Xuefeng's former residence and the village Party branch building, research group analyse the winter indoor and outdoor air temperature and humidity, the wall surface temperature and thermal comfort in the quantitative test and the simulation of the response. Through the above research, the group try to find the coupling between traditional local-style dwelling houses and modern residence in the design climate, so as to construct to climate as a bridge that crosses from the traditional local-style dwelling houses and modern residence design, and guide the village residence planning and design in the future.

Keywords

Energy; Traditional Dwellings; Thermal Environment; Climate Responsive

1 Introduction

1.1 The Natural Environment, the Technical environment and the social environment based on the energy perspective

Energy is the ability of a physical system to work for other physical systems.[3]It is the essential attribute of material, such as heat energy, mechanical energy and many other forms. In buildings, energy is mainly reflected in the form of heat. When reviewing the history of architecture related to energy, it is found that many traditional buildings in China and Western countries are closely related and adapted to the surrounding environment due to the regional differences of climate and culture. This is largely due to the pursuit of energy synergy. Moreover, Climate is the most intuitionistic influence factor of energy on architecture, and climate adaptability is the essential manifestation of building energy synergy. It enables the building to have the most direct and effective adaptation to the natural climate factors, so as to make full use of the climatic conditions and create more suitable living conditions.

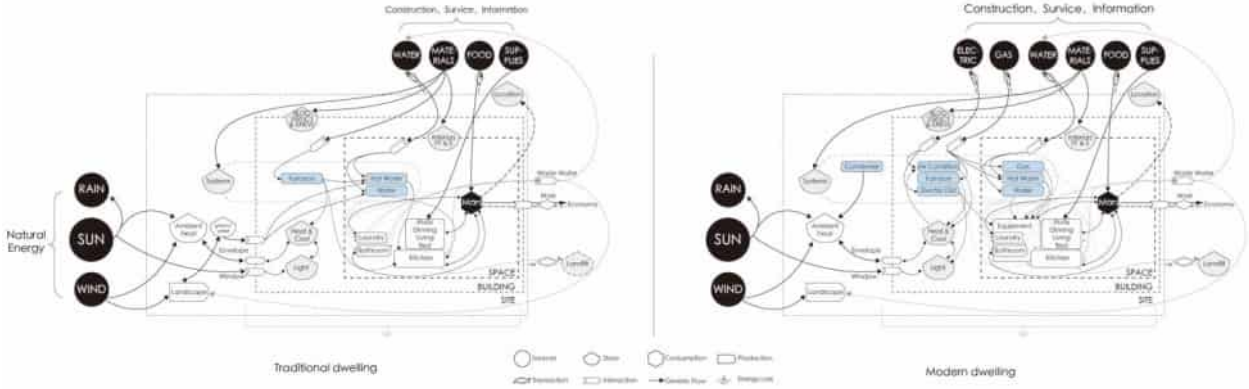

Figure 1,2 Traditional and Modern Dwellings' Energy Flow Diagram

According to the transformation of Odums' (Odum 2002) energy diagram, the author redraws the energy diagram of residential buildings. The input of climate energy, materials and construction, and other energy sources is the main source of external energy for the building environment. Traditional dwellings can maximize the use of climate energy to make buildings interact with them. In terms of local building materials and construction, they are usually built with local materials, relatively low technology means. At the same time, the energy sources also reduce the input of fossil energy. The climate adaptability design of contemporary vernacular architecture can achieve the effective combination of self-sufficient energy supply and architectural form, and correctly match the purpose and object of energy utilization. However, the traditional and contemporary local residences obviously have different kinds of building energy vocabularies. In the natural environment (site), technical environment (asylum interface), social environment (residence scene), the various kinds of flow of energy are not the same. In the context of Chinese vernacular architecture, drawing the energy diagram of vernacular dwellings helps to build up the possibility of maximizing cost and maximizing performance in the pursuit of material wealth and exploring uncertain factors of design. (Figure 1, 2)

1.2 Influence Factors of Thermal Environment and the Building Environment

The construction process of the residence reflects the complex interaction of multi dimensions and multi elements.[4] Especially in the construction of vernacular dwellings in China, besides considering the climate factors, we need to consider the elements such as economy, life habits and family composition. Therefore, the construction of a residential house cannot be determined solely by a certain element. The factors that influence the construction of vernacular dwellings include not only the objective elements such as climatic conditions, geographical conditions, technology, materials, but also the social and cultural elements such as economy and belief, including personal needs in traditional Chinese thoughts. In residence form and culture, Amos Rapoport elaborated on the influencing factors of the choice of residential morphology: “under the established climate conditions, building materials and technology conditions, the definition of ideal life for a particular community is defined. The process of all this pursuit is influenced by the social and cultural factors (social-cultural factors).” In the material and objective factors, Rapport discussed in detail how climate affects the architectural form of residential buildings, and put forward the concept of "climate scale". As for climate scale, human beings are often unable to control outdoor climatic conditions, but the purpose of housing construction is to cope with the impact of unsustainable climate stress on users. At the energy point of view, the more severe the climatic factors are, the lower the control force of the building form, the more obvious limitation of the natural energy. On the contrary, the better the climate, the more freedom of human control of the architectural form, and the limitation of natural energy is not obvious or even negligible. At this time, other factors will become the main force of the architectural form.

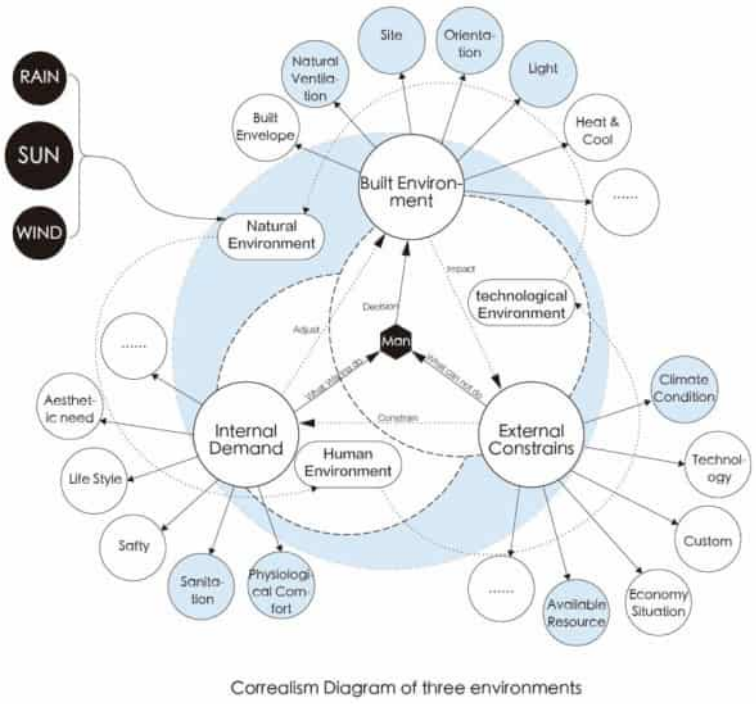

Figure 3. Diagram of Three different environments

Therefore, under the influence of specific material conditions and social and cultural conditions, the folk house is not only the satisfaction of people to the internal needs, but also the material embodiment of the life form of the vernacular architecture. The design and construction of local buildings have the unified characteristics of the decision-makers, the

builders and the users. Its choice of architectural form is often based on previous experience of residence, and the achievement after completion will become the experience and feedback to the next decision. In the feedback mode of local building construction, the control of all kinds of influence factors cannot be separated. Among them, people play the role of both users and decision-makers, and have three links with architectural forms through demand, function and evaluation. (Figure 3)

2 Basic Climate Data and Location — Take the Study on Yiwu District of Central Zhejiang as an Example

Yiwu is located in central Zhejiang, with 58km north-south length and 45km west-east length. Yiwu is ringed on three sides by mountains besides the lower terrain west side and the interior of Yiwu is flat. The Yiwu River flows through this 1105km^2 area 800 thousand population city, from east to west. As the "Zhejiang folk" [5] proposed "pay attention to various cultural phenomena of geographical distribution and difference", Zhejiang can be divided into five regions of the north, the south, the east, the west, the central Zhejiang.

Central Zhejiang region's central city is Jinhua. Yiwu belongs to Jinhua city, the climate analysis can refer to the whole central Zhejiang region partition. The central Zhejiang region belongs to the subtropical monsoon climate which has comfortable temperature, trenchant winter and summer. According to the Jinhua climate, the average temperature is at 5.2-29.0 degrees, the highest average temperature is at 9.1-33.8 degrees and the average minimum temperature is at 2.2-25 degrees. The average humidity is 74%-83%.

The settlement of the Shentan village shows an obvious concentric circle type, and the whole building group is built around the pond, as shown in Figure 4.17. Around the pond, it established the village committee and public place. Between the buildings arranged relationship in residence-residence, residence-public housing and community and the residence-settlement outer space. These three kinds of contact impact settlement function area layout. And the traditional houses are two basic layers, high modern dwellings 3-5 layer. The north and south sides of the settlement are mountain ranges, and the east side has rivers through the village gate. The overall layout is in line with the characteristics of the back mountain surface water of Chinese traditional villages.

2.1 Solar Radiation

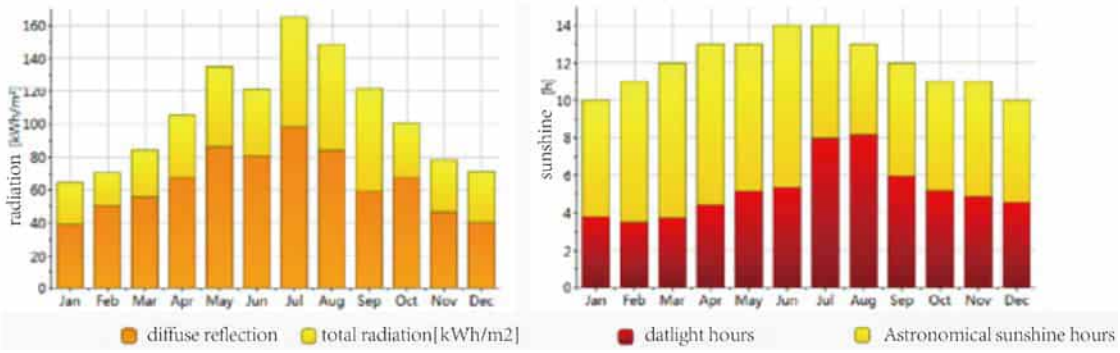

Figure 4. Radiation and sunshine time in Yiwu

The energy resources of the solar radiation in the Yiwu district are abundant. Annual sunshine duration was 1765h. 5-9 months more solar radiation intensity, were more than 120 KWh/ square meters, of which the intensity of solar radiation in July can reach 160KWh/ square meters, diffuse radiation intensity is about 80 KWh/ square meters, can be seen in Fig. 5 distribution direction of radiation more to the southwest side. The distribution of solar radiation in Yiwu district was significantly higher in summer, low in winter. The annual distribution in the southwest to the highest radiation intensity.

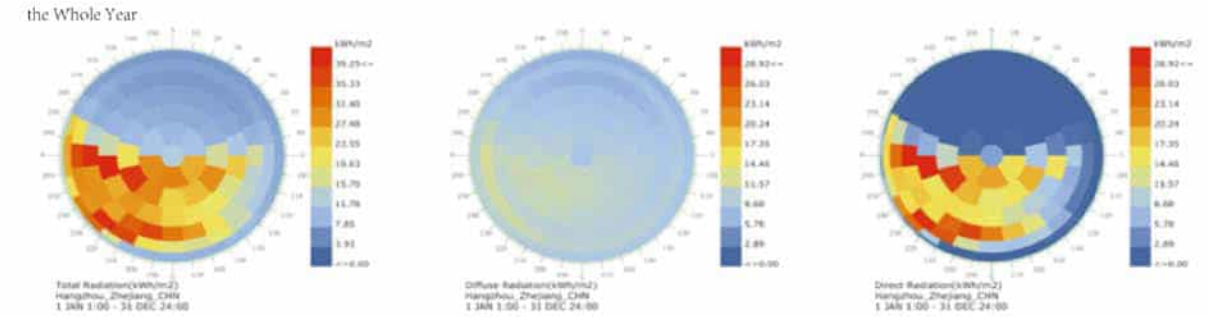

Figure 5. Distribution map of solar radiation receiving direction in Yiwu

2.2 Temperature and Precipitation

Yiwu's average temperature is 5.2 DEG -29.0 DEG C, the temperature was divided into two seasons of winter and summer. The highest monthly temperature in Yiwu is 43 C in July, the lowest temperature is in January, 3 degrees C, and the average daily temperature difference at 5 C -10 C. Under the influence of the subtropical monsoon climate, the temperature varies greatly, the highest temperature in summer can reach 43 degrees C, and the lowest temperature in winter can be at -7 C, such as Figure 6. In the architectural design, it is necessary to prevent the high temperature from entering the room in summer, and the indoor temperature should be increased in winter. The average annual total rainfall in Yiwu area is 1400mm, and the annual precipitation is more. However, with the season changing, there are more rainfall in spring, and more rainfall in rainy season.

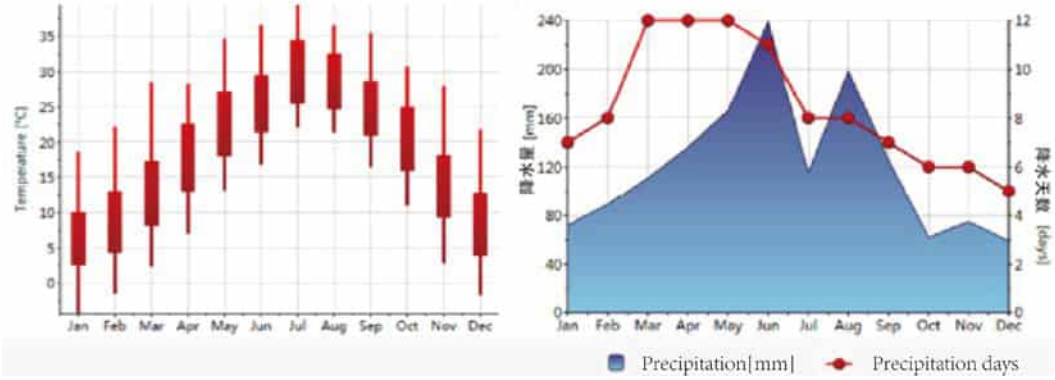

Figure 6. Temperature variation, monthly precipitation and precipitation days in Yiwu

2.3 Wind Speed

The annual wind speed in the area of central Zhejiang is relatively stable, the normal speed is about 0.8-2m/s. All wind directions are in all seasons, mainly in east and south. In summer, the main wind are the east wind and the south wind with west wind supplemented. In winter is dominated by the east wind, which is shown in Figure 7.

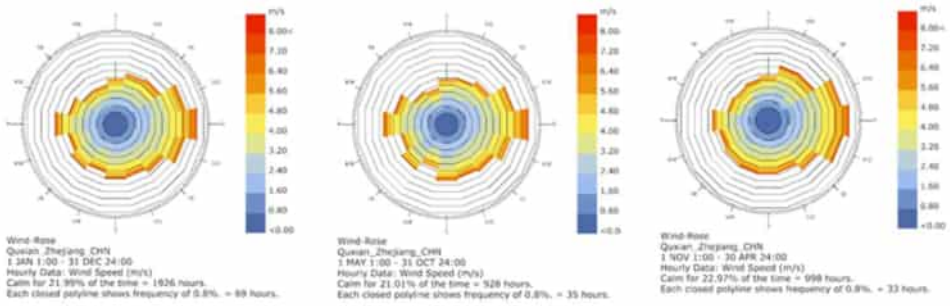

Figure7. Wind rose map in Yiwu

3 Research and Test — Zhejiang Traditional and Modern Dwellings Climate Adaptability

3.1 The Architectural Features of Traditional and Modern Dwellings

The traditional dwellings in Yiwu are affected by the terrain. On the site and layout of the building, the buildings have taken full account of the characteristics of the local hills, most of which are built on the back of the mountain surface water. The earliest settlements were only near the river and small streams. As the natural environment changed from adaptation to transformation, they gradually spread to the rivers and sea. The gates of the local dwellings are mainly toward the south. The architectural forms are the quadrangle and tree-courtyards, and the blocks of the buildings are more regular. The buildings are combined to form a single, juxtaposed or multiple compound building group to make the overall layout of the building better meet the needs of the use. However, the floors number of modern dwellings in Yiwu are generally more than the traditional, all of which are 2-5F, and brick wall structure is the main structure. Most of the dwellings are built in the homestead, with a strong feature of local climate suitable technology. Other features are similar to ordinary modern dwellings.

In air temperature and humidity measurement, considering the difference of outdoor microclimate at different heights, two different dwellings were measured nearby. 3 measuring points were set up in the modern dwelling, and 7 measuring points were set up in the traditional dwelling. During the test, the temperature and humidity and the wind speed were continuously monitored, and the data collection interval was 1 hours. The height of the indoor test points is between 1.2-1.5m. And in order to avoid the impact of indoor heat sources on the test results, the two buildings were measured without the air conditioning and other indoor heat sources.

The 3 measurement points of modern dwelling are as follows: the test point 1 in the residential outdoor, the test point 2 in the house room, and the point 3 in the indoor window of the residence. 7 measuring point of traditional dwelling were: 1 measuring points outside, the measuring point 2 in the hallway, measuring point 3 in the courtyard, the measuring point 4 in living room, and measuring point 5 and 6 for the one or two floor indoor, measuring point 7 on the two floor corridor. The distribution of the measured points of the two buildings is shown in Figure 8, and the red point represents the second floor position.

Figure 8. measurement points in modern dwelling and traditional dwelling

3.2 the Settlement Space of Traditional and Modern Dwellings

By measuring the climate data of traditional dwellings and modern dwellings in Yiwu Shentan village, we can get the characteristics of local vernacular architecture in settlement, building space and material construction. From the analysis of thermal comfort strategy in Yiwu area, we know that the effectiveness of improving thermal comfort level is the highest in winter, so the climate measurement in winter is of great practical significance.

3.2.1 Solar Radiation

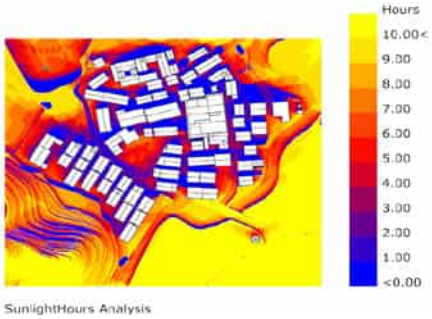

Figure 9. The analysis of the sunshine time of the settlement

The buildings have the best local sunshine in the direction toward south, they can get more heat radiation in the winter. The summer wind blowing can remove heat from the gable, at the same time the courtyard can also form hot air indoor and take the heat away. By simulating the annual average sunshine time of the settlements, we get the result of figure 9. The sunshine duration between most buildings is only about one hour, the larger aspect ratio and the direction of the building get better sunshade effect.

3.2.2 Wind Environment

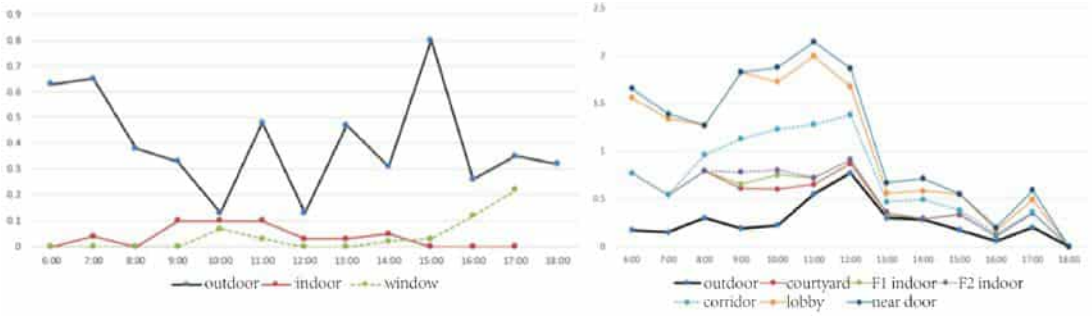

Figure 10 Wind speed change maps of modern dwelling(left) and Traditional dwelling(right)

The black lines in the wind speed change map (Figure 10) are the outdoor wind speed, the dotted lines are the wind speeds of the second floor, and the rest are the distribution of the wind speeds in the first floor. Because the wind environment measurement time is one hour, but the wind change situations are more complex. The broken lines in change chart only act as data connection. There is no real wind speed significance. The measured data are at the dots. The figure can be found in velocity sorting from large to small: main hall, hallway, the second floor corridor, the second floor indoor, the first floor indoor and the patio. The wind speed at the courtyard is close to the outdoor wind speed, and the wind speed at other points are relatively high. In winter, good natural ventilation can ensure air quality through air flow.

Based on the common east direction and 2m/s as the initial speed, the whole village's wind environment is simulated by software Pheonics. At different heights, the whole village's wind environment is good. As shown in Figure 11, there is no obvious wind shadow zone, the wind speed in the settlements at between 2-4m/s. At the pond at the centre of the village, the wind speed is low, and the wind speed is high between the streets and the streets. The wind can easily cross the street from the East and form the flow of wind throughout the settlement. In summer, wind can take out indoor heat through streets and courtyards, and because winter buildings are more closed, and wind environment has little influence on indoor insulation.

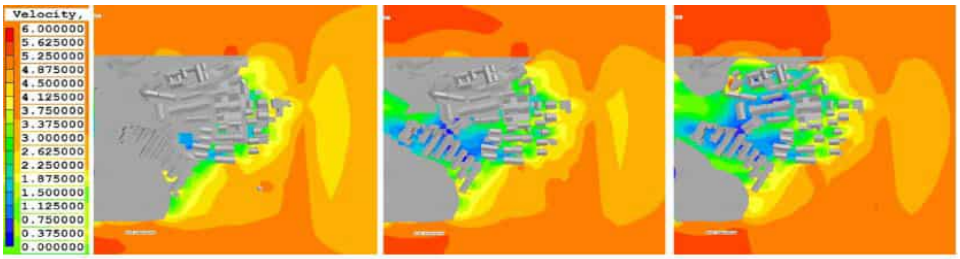

Figure 11. simulation results of wind environment at different levels of height

3.2.3 Temperature and Precipitation

The temperature of this measure refers to the temperature of the dry ball. The outdoor temperature is between -0.50-10.5℃ and the temperature at the courtyard is more intense than the outdoor temperature, at -0.23-7.94 ℃, and at noon, the temperature is higher than the outdoor temperature, and the other time is about 1-2℃ lower than the outdoor temperature; The indoor temperature in indoor temperature is at 0.26-6.27 ℃, and the temperature is intense in the morning, and the temperature in the afternoon is constant; The second floor indoor temperature at 0.12-5.80℃ is also intense in the morning, and relatively constant in the afternoon. The temperature of the hallway changes significantly, because the courtyard at noon will accept the light and heat.

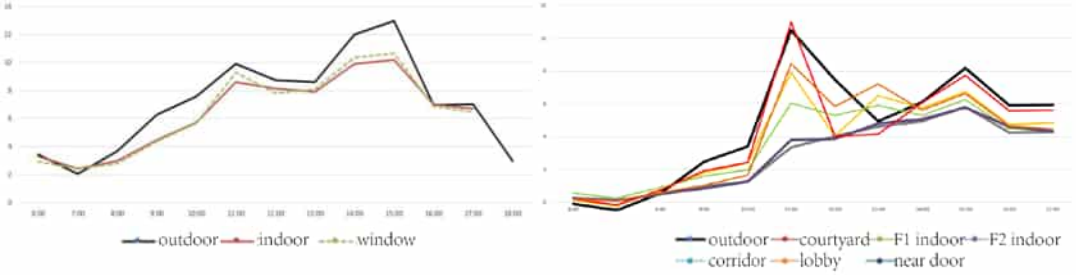

Figure 12. The temperature changes of traditional dwellings and modern dwellings

We can find that with the change of temperature, the change of humidity is the opposite. At 11:00, humidity decreased obviously, and humidity change of the hall and courtyard is at the most intense. The change of humidity in the first floor is more obvious than that of the second floor, and the change of humidity in 12:00~15:00 is smaller and the rest of time changes greatly.

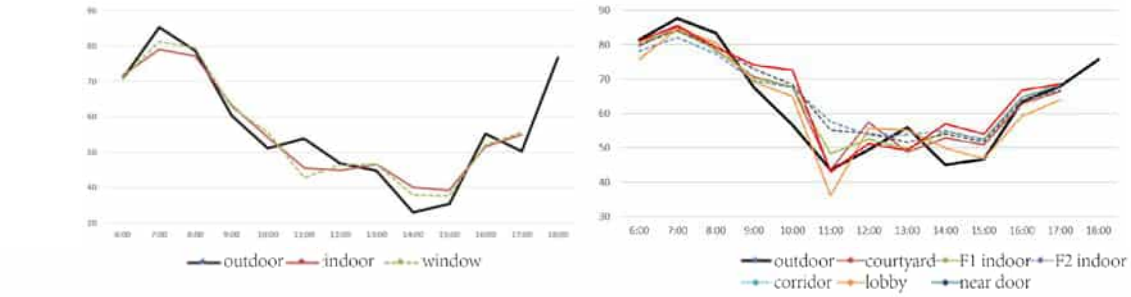

Figure 13. Moisture changes of traditional dwelling and modern dwelling

4 Conclusion

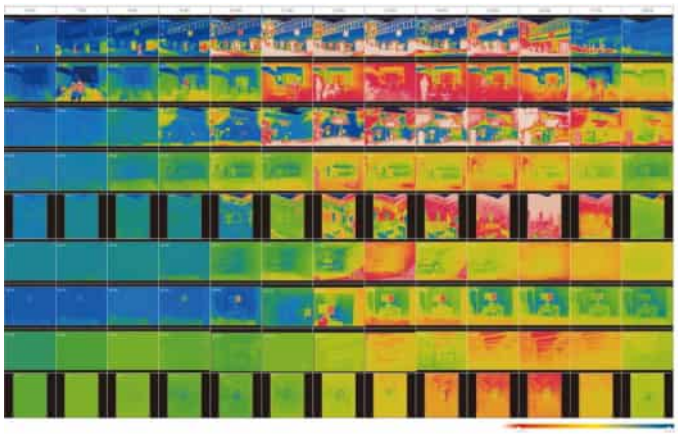

Figure 14. Thermal imaging of traditional dwelling and modern dwelling

Through the analysis of the indoor and outdoor temperature, humidity and wind environment, the transition space such as the patio and corridor can effectively improve the climate adaptability. These important places of life provide people better than the outdoor environment, and also play a climatic buffer to indoor space. In the former residence, the use of courtyard houses and thicker brick and high heat storage materials make the space temperature slow, but the thermostat characteristics of high heat storage make it maintain thermal stability for a long time. However, the temperature and humidity of modern dwellings are obviously changed with the outdoor, and the heat is rapidly rising after the solar radiation, but it is also faster in the evening because of the poor thermal storage of the materials. At the same time, under the condition of maintaining the need of temperature, a relatively closed enclosure structure has been formed, and the air circulation is weak.

After analyzing the measured and simulated data from the perspective of climate adaptability, it is found that in winter, the stone roof of former residence can receive more heat radiation, and its high heat storage makes the space thermostat stronger. Near noon time, the courtyard space could receive direct sunlight, which makes a relatively large effect on the nave and a layer of floor to improve indoor temperature. At the same time, the courtyard space also has a good effect on the indoor air circulation and the air quality regulation. The double window

of the residence can promote convection ventilation in summer, also can achieve better insulation in winter.

From the measurement of temperature and humidity in the traditional dwelling, it is found that in the case of low indoor temperature in winter, a certain indoor heat source can be added to the wall material with strong heat storage. The use of heat sources can keep the temperature of the room at a more suitable temperature, and it is not easy to dissipate heat. The form can be considered continuous wall, the use of “Kang” (a heat-able brick bed) arranged in the kitchen and bedroom.

Acknowledgements

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GETTING BUILDINGS CLOSER TO THE NEARLY ZERO-ENERGY BUILDINGS BY CHANGES IN HEATING AND COOLING SYSTEMS: THE CASE OF IZMIR

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Abstract

Energy is not only something that is used for produce anything but also it is the fundamental resource in human life. When the usage areas of the energy are examined, buildings have the significant place in it. Fossil fuels are used as the main energy sources, however, the use of renewable energy resources also increases significantly. In this direction, the use of renewable energy sources in buildings and the effect of these sources on energy consumption were studied. Thus, in the study, a hypothetical housing model was established in İzmir, representing a hot-climate region. The building was modelled in 9 different thermal zones by using the DesignBuilder energy simulation software. The sizes of the building were 7.8x6.8 meters and the building had two-storey. A family of four lived in the building. Natural gas was used for heating and domestic hot water (DHW) while electricity was used for cooling. These systems were determined as a reference system for heating, cooling ,and DHW. The building's design parameters were preserved. The heating, cooling and DHW systems, which affect energy consumption, were changed. Instead of natural gas and electricity-operated systems, ground source heat pump (GSHP) was used for creating a first alternative system. The hot water preparation system using solar energy was added to the first alternative system, and a second alternative system was established with solar assisted GSHP. While the devices of the second alternative system were the same as a third alternative system's, photovoltaic (PV) solar collectors were used in the third one. Thus, the building generated energy in addition to its energy consumption. At the end of the study, the primary energy consumption and generation of the reference systems and alternative systems were calculated, and all systems were displayed on the Nearly Zero Energy Building (nZEB) graph. The changes in energy consumption of the building by the change of heating, cooling and DHW system were examined and evaluated.

Keywords

Heat pump, solar energy, nZEB, heating system, cooling system, energy saving.

1 Introduction

In the design of nZEB, the parameters (such as the solar radiation; heating, cooling and electricity systems based on renewable energy sources; electricity generation with cogeneration; regional and central heating systems; and natural lighting) must be taken into account [1]. There are two important parameters to reduce energy consumption in the building: the building envelope and system equipment (heating, cooling and DHW) [2-3].

Many studies were carried out on the use of heat pump and solar energy system to reduce the energy used in buildings. Lerch et al. (2015) compared a serial and parallel connection of solar and air source heat pumps for a single family house with a heating capacity of 5,36 kW and an annual heating load of 45 kWh/m2.a by using the TRNYS energy simulation software. They designed six different systems: a reference system without a solar collector and an interconnected system by five different connection types that had two different collector areas (14 and 30 m2). They concluded that the system performance of the non-solar assisted heat pump system increased from 2.55 to 3.70 with the use of solar energy. Moreover, they also found that serial connected heat pump system with the 14 m2 collector area was the most efficient system. The electricity consumption of the serial-connected solar assisted heat pump systems was decreased 1-2% compared to the parallel connected systems [4]. Wang et al. (2017) experimentally studied a multifunction solar-assisted heat pump system. They designed the system that could realize different functions by operating in different modes, such as heating in winter, cooling in summer, domestic water heating for a whole year, and part of household electricity demand. The system had 7 different modes and it could operate as air-source, water-source, air-water-source. They concluded that the water-source heat pump was efficient than the air-water source and air-source mode. Moreover, the average overall efficiency of solar collector was more than 50% for water heating mode when solar irradiance was sufficient [5]. Chargui et al. (2014) simulated the operation of a water source heat pump system for the residential building by using the TRNSYS energy simulation software. They studied the incidence solar radiation, temperature distribution, energy consumption, energy generation and air-conditioning load in rooms for the Tunisian climate. They concluded that the system may be satisfactorily used for residential building or greenhouse heating in the Mediterranean and region of Tunisia [6]. Mustafaraj et al. (2014) numerically examined the effect of underfloor heating and natural ventilation systems on building energy performance. They used a heat recovery system and solar assisted geothermal heat pump for underfloor-heating. They studied the building's energy performance by using the EnergyPlus software. They concluded that savings of 20% to 27% in monthly electricity consumption when heat pump was used [7]. Becchio et al. (2016) numerically worked on the reduction of energy consumption of an old industrial building in Ital. They used the EnergyPlus software to simulate 24 different energy efficiency measurements on the building envelope and the HVAC system. They concluded that using the condensing boiler and chiller was efficient for energy consumption than air-to-air heat pump [8]. Yuan at al. (2017) selected an office building located in Tianjin to analysed the GSHP system coupled with borehole free cooling. They used the DesignBuilder and TRNSYS energy simulation software to validate measured data. They concluded that free cooling with borehole water improves the average annual cooling efficiency of the GSHP system to 16.22%. They reported that the average annual energy consumption and operation cost can be decreased to 55.9% and 56.0%, respectively by this system [9]. Xia at al. (2017) carried out experimental tests to examine the performance of the GSHP system under the different ground loop, differential pressure set-points and different configurations of the ground heat exchangers. They concluded that for the GSHP tested, the coefficient of performance of the heat pump units increased while that of the whole GSHP system decreased with the increase of the ground loop differential pressure set-point [10]. In this study, numerical analysis was carried out to reduce the energy consumption of two-storey single-family houses in Turkey by using DesignBuilder energy simulation software. A reference heating and cooling system were determined by using a gas-fired condensing boiler for heating and DHW and a chiller was used for cooling. Firstly, the reference systems were replaced by GSHP to reduce energy consumption. Secondly, the solar-assisted GSHP was used for the further reduction of energy consumption. Thirdly, it was aimed at the building to generate energy in addition to its energy consumption. Therefore, PV

collectors were used for generating electricity. As a result, the primary energy consumption and generation of all the systems were calculated and their locations were displayed on the nZEB graph.

2 METHODS

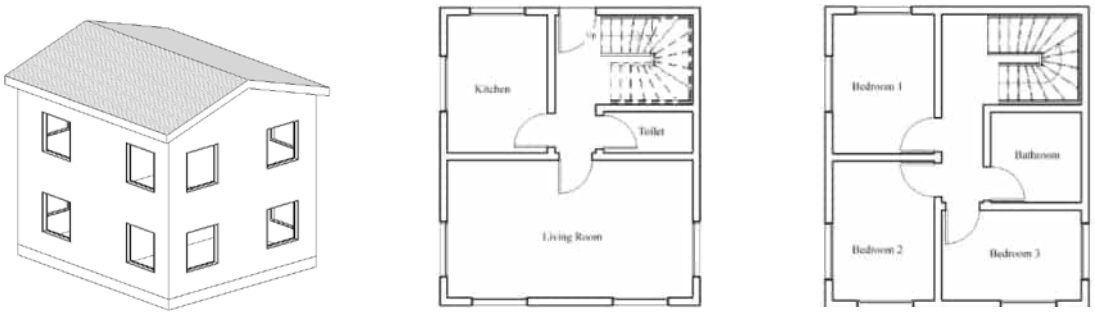
As the research setting, İzmir was chosen from Aegean Region because of its high temperature and solar radiation average (Table 1). A hypothetical single-family house in İzmir was simulated by using the DesignBuilder energy simulation software. The building construction, heating, cooling and DHW systems were determined and a reference system was established. After the reference system was established, alternative systems were developed. The annual energy consumption and generation capacities of the reference and alternative systems were compared and each system was displayed on the nZEB graph.

Table 1. The highest and lowest average temperature and sunshine duration for the Aegean Region [11]

AEGEAN REGION	İZMİR	MUĞLA	AYDIN	DENİZLİ	UŞAK	MANİSA	KÜTAHYA	AFYON K.
Avg. Temperature (°C)	17,8	15	17,7	16,3	12,5	16,9	10,8	11,3
Avg. Max. Temperature (°C)	22,6	21,2	24,5	22,4	18,4	22,9	16,9	17,3
Avg. Min. Temperature (°C)	13,4	9,6	11,9	10,6	6,8	10,9	4,8	5
Avg. Sunhine Duration (Hour)	94,5	88,5	83,2	88,1	90,1	79,9	70,4	80,2
Max. Temperature (°C)	43	42,1	44,6	44,4	40,2	45,5	39,5	39,8
Min. Temperature (°C)	-8,2	-12,6	-11	-11,4	-19,9	-17,5	-28,1	-27,2

2.1 Building Model

In this study, a two-storey family house was modeled by using the DesignBuilder energy simulation software. The house was used by a family and its sizes were 6.8x7.8 meters. According to the Turkey Statistical Institute's Population and Housing Survey results, 54% of families consist of a mother, father and two children [12]. Therefore, it was assumed that a family consists of four people. The building had eight thermal zones including three bedrooms, one bathroom, one kitchen, two circulation areas and one lounge area (Figure 1). Total available construction area was 90.90 m2. The materials used in the building were selected according to the heat transmittance coefficient (U) specified in the TS 825 Building Thermal Insulation Standards [13]. The model's dimension, geometry, weather data, occupancy profile and construction are given in Table 2.



(a) (b) (c)

Figure 1. Building appearance and floor plans (a) Perspective view (b) Ground floor (c) First floor

Table 2. Building characteristics

Main buildings dimensions					
Gross Length (N-S direction)	7.8 m		Gross Floor Area	90.90 m^2	
Gross Length (W-E direction)	6.8 m		Gross Volume	272.69 m^3	
Gross Height	7 m (2 floors)		Gross Roof Area	48.90 m^2	
Building geometry-residential					
	Total	North	East	South	West
Gross Wall Area (m^2)	168.48	40.68	43.56	40.68	43.56
Window Area (m^2)	27.5	4,5	5	9	9
Window-Wall Ratio (%)	16.32	11.06	11.48	22.12	20.66
Weather Data	ASHRAE İzmir IWEC		Number of zones	8 Thermal zones	
Environmental control					
	Heating (°C)	Heating set back (°C)	Cooling (°C)	Cooling set back (°C)	
Living Room	20	18	25	27	
Kitchen	20	18	25	27	
Hall	15	13	25	27	
Bedroom	20	18	25	27	
Occupancy Profile					
Weekdays	Unoccupied between 08.00-17.00		Weekend	Occupied all time	
Construction					
U_{wall}	0.612 W/m^2K		$U_{floor\ on\ the\ ground}$	0.535 W/m^2K	
$U_{ceeling\ (semi\text{-}exposed)}$	0.361 W/m^2K		$U_{windows}$	2.36 W/m^2K	
$U_{partition}$	1.665 W/m^2K		Infiltration	0.8 ac/h	

2.2 Heating, Cooling and DHW Systems

In addition to the reference heating, cooling and DHW systems used in the building, three different alternatives were created for the study. 4-pipe Fan Coil Unit (FCU) was selected for the inner units of heating and cooling systems. Zone heating sizing factor and zone cooling sizing factor were orderly chosen as 1.25 and 1.15 for determining the FCU heating and cooling capacities. FCU characteristics used in the reference and alternative systems for each zone are given in Table 3.

Table 3. FCU characteristics for zones

	Heating Capacity (W)	Cooling Capacity (W)
Kitchen	2990	2000
Circulation (Ground floor)	2990	2000
Lounge	4010	2710
Bedroom 1	2990	2000
Bedroom 2	2990	2000
Bedroom 3	2990	2000
Circulation (First floor)	2990	2000
Bathroom	2990	2000

In the scope of the study, the building's heating, cooling and DHW systems were changed and the building's approach to the nZEB was examined. For this purpose, three different heating, cooling and DHW system alternatives were created. FCU was used for the internal units of the heating and cooling systems in the reference and all alternative systems. The reference system consisted of the hot water loop (HW), domestic hot water loop (DHW) and chilled water loop (CHW). A gas-fired condensing boiler was used as an energy source for the HW loop and DHW loop. For the CHW loop, chiller (electricity) was used as an energy source. Heating, cooling and DHW system scheme for the reference system is given in Figure 2.

The building's design parameters were preserved and the heating, cooling and DHW systems, which affect energy consumption, were changed. Instead of natural gas and electricity-operated systems, GSHP (water-to-water) was used for create a first alternative system. This system consisted of the HW loop, DHW loop, CHW loop and Condenser loop. GSHP was used as an energy source for these loops. The heating, cooling and DHW system scheme for the first alternative system are given in Figure 3.

The hot water preparation system using solar energy (solar loop) was added to the first alternative system and a second alternative system was established used solar assisted GSHP. The Solar loop was taken its energy from the thermal solar collector which was placed to the south of the roof and at the angle of the roof slope. The water returning from the FCUs in the zones were heated by solar energy and entered the heat pump. If the water temperature obtained from solar energy did not reach an adequate level, the water temperature could be increased by the heat pump. The heating, cooling and DHW system scheme for the second alternative system is given in Figure 4. It was the same as the second alternative systems and third alternative systems, however, it was aimed that the building was not only an energy consuming building but also an energy generating building at the same time. Therefore, PV solar collectors were located in the south of the roof and at the angle of the roof slope. Technical specifications of the devices used in the reference and alternative systems are given in Table 4.

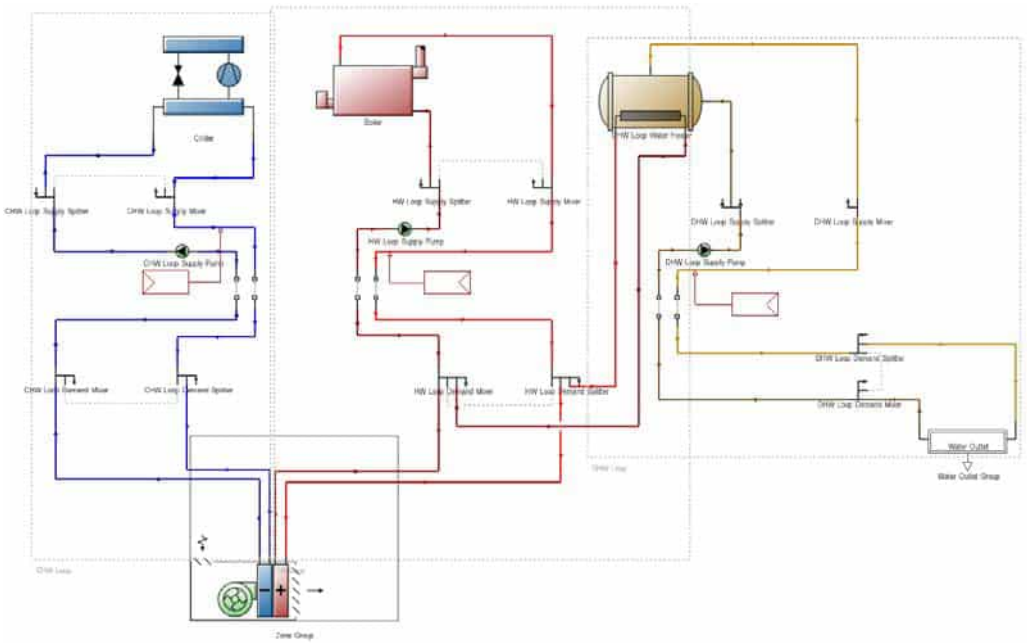


Figure 2. The heating, cooling and DHW system scheme for the reference system

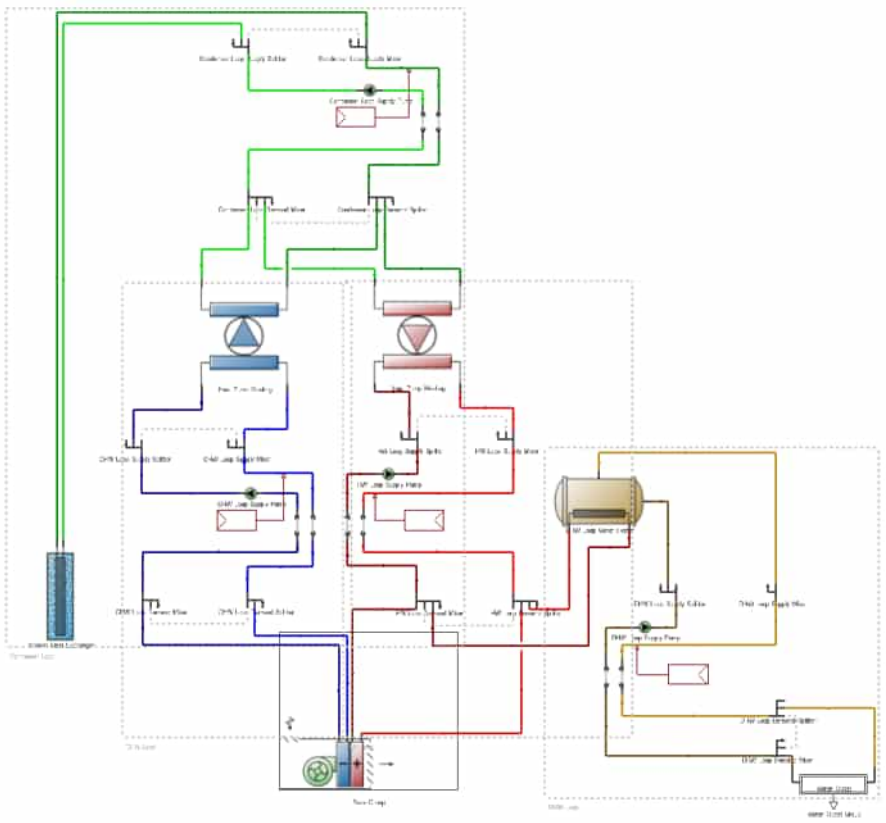


Figure 3. Heating, cooling and DHW system scheme for the first alternative system

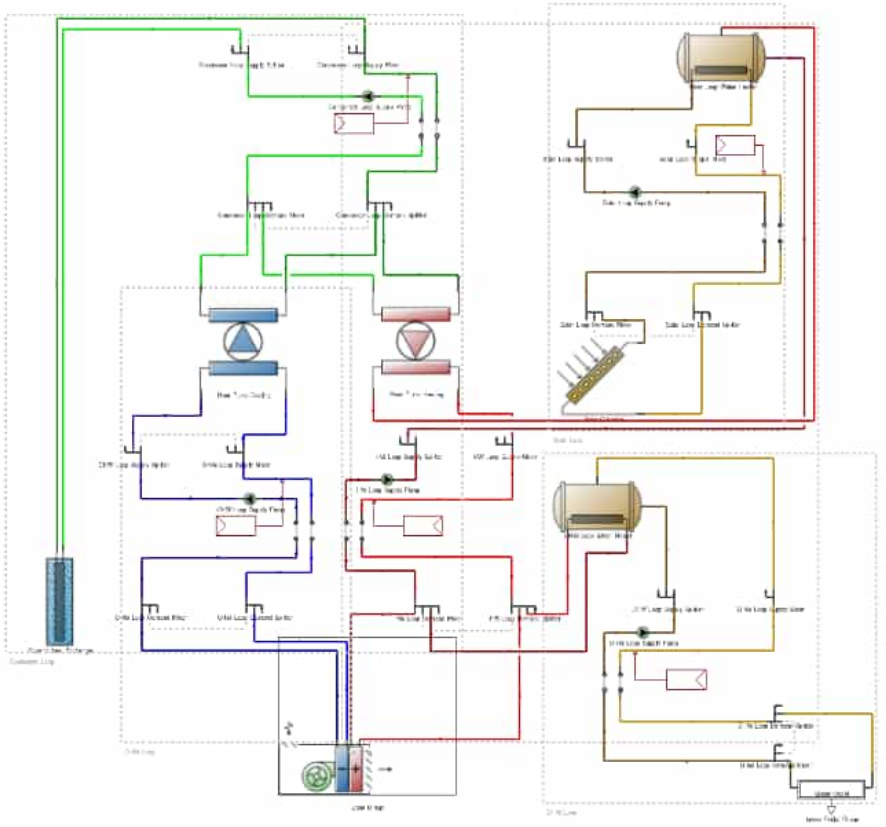


Figure 4. Heating, cooling and DHW system scheme for the second alternative system

Table 4. Technical specifications of devices used in the reference and alternative systems

REFERANCE	FCU; Boiler (Gas) + Chiller (Electricty)				
	Nominal Capacity	**Nominal Efficiency**	**Design Loop Exit Temperature**	**Loop Design Temperature Differance**	
Boiler	24 kW	0.89	70 ºC	10 ºC	
Chiller	11.6 kw	2.9	7 ºC	5 ºC	
Water tank	**Services**	**Tank Volume**	**Design Loop Exit Temperature**	**Loop Design Temperature Differance**	
	DHW loop	0.06 m^3	56 ºC	5 ºC	
Pump	**Services**	**Type**	**Head**	**Water Flow**	**Electric Power**
	DHW loop	Variable speed	20 kPa	0.0072 m^3/h	0.07 W
	HW loop	Variable speed	20 kPa	1.33 m^3/h	10.58 W
	CHW loop	Variable speed	20 kPa	1.62 m^3/h	12.85 W
1st ALTERNATIVE	FCU; GSHP (Heating & Cooling)				
GSHP		**Rated Capacity**	**Efficiency**		
	Heating	24 kW	4.30 (COP)		
	Cooling	21 kW	12.73 (EER)		
Water tank	**Services**	**Tank Volume**	**Design Loop Exit Temperature**	**Loop Design Temperature Differance**	

Table 4. cont.

	DHW loop	0.06 m^3	56 ºC	5 ºC	
Pump	**Services**	**Type**	**Head**	**Water Flow**	**Electric Power**
	DHW loop	Variable speed	20 kPa	0.0072 m^3/h	0.07 W
	CHW loop	Variable speed	20 kPa	1.48 m^3/h	11.70 W
	HW loop	Variable speed	20 kPa	1.37 m^3/h	10.83 W
	Condenser loop	Variable speed	20 kPa	159.12 m^3/h	125.93 W
In addition to the devices used in the 1st ALTERNATIVE, the devices in the 2nd ALTERNATIVES					
Water Tank	**Services**	**Tank Volume**	**Max. Temperature Limit**	**Deadband Temperature Differance**	
	Solar loop	1.6 m^3	80 ºC	5 ºC	
Pump	**Services**	**Type**	**Head**	**Water Flow**	**Electric Power**
	Solar loop	Variable speed	20 kPa	0.99 m^3/h	7.83 W
Thermal Solar Collector	**Area**	**Efficiency**	**Slope**		
	8 m^2	0.60	Equal to the roof slope*		
In addition to the devices used in the 2nd ALTERNATIVE, the device in the 3rd ALTERNATIVES					
Photovoltaic Solar Collector	**Area**	**Panel Efficiency**	**Cell Type**	**Slope**	
	7 m^2	0.15	Crystalline slicon	Equal to the roof slope*	
	Max. Power	**Max. Power Point Voltage**	**Max. Power Point Current**		

	100 Wp	37.6 V	2.75 A	*Roof Slope : 30%

3 RESULTS and DISCUSSION

The energy consumption of the devices used in the building was obtained from the simulation software. The energy consumption of the fans in the FCUs did not change in the reference and the alternative systems. In addition, energy consumption of lighting and other equipment did not change in the reference and the alternative systems. Monthly energy consumption of the fans, lighting and other equipment in the building are given in Figure 5. Monthly energy consumption of FCUs, lighting and other equipment does not change because it is constantly used in summer and winter seasons; however, monthly energy consumption varies according to the months because the number of days in the months is not equal.

In the reference system, the gas-fired condensing boiler was used for heating and DHW in winter, and for the only DHW in summer. Chiller was used for cooling in summer. Three circulation pumps were used for the HW loop, CHW loop and DHW loop in the reference system. The monthly electricity consumption of cooling and pumps, and the monthly natural gas consumption of heating and DHW are given in Figure 6.

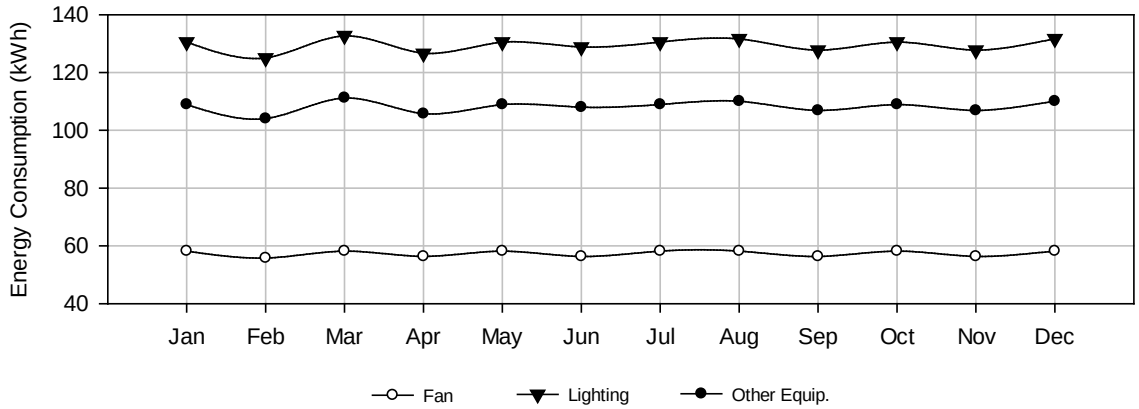


Figure 5. Monthly energy consumption of fans, lighting and other equipment

In the first alternative system, the building's design parameters were preserved and the heating, cooling and DHW systems were changed. In this system, GSHP was used instead of gas-fired boilers and chillers. GSHP was used for heating and DHW in winter, and for cooling and DHW in summer. Three circulation pumps were used for the HW loop, CHW loop and DHW loop in the first alternative system. The monthly electricity consumption of heating, cooling, DHW and pumps are given in Figure 7.

The solar loop was integrated to GSHP which used for heating and DHW in the first alternative system. So, a second alternative system was created. The solar assisted GSHP was used not only for heating but also DHW in winter. When the water temperature obtained from solar energy reach an adequate level in summer, it was directly used for DHW. If the water temperature obtained from solar energy did not reach an adequate level, the water temperature was increased by a heat pump. The cold water for CHW loop also was produced by GSHP in summer. Four circulation pumps were used for the HW loop, CHW loop, DHW loop and solar loop in the second alternative system. The monthly electricity consumption of heating, cooling, DHW and pumps are given in Figure 8.

In the third alternative system, the heating, cooling and DHW systems used in the second alternative system were exactly the same, only the PV solar collectors were located in the south of the roof. Electricity was generated by PV collectors for lighting, fans, pumps, GSHP and other equipment used in the building. The monthly electricity generation by PV collectors is given in Figure 9.

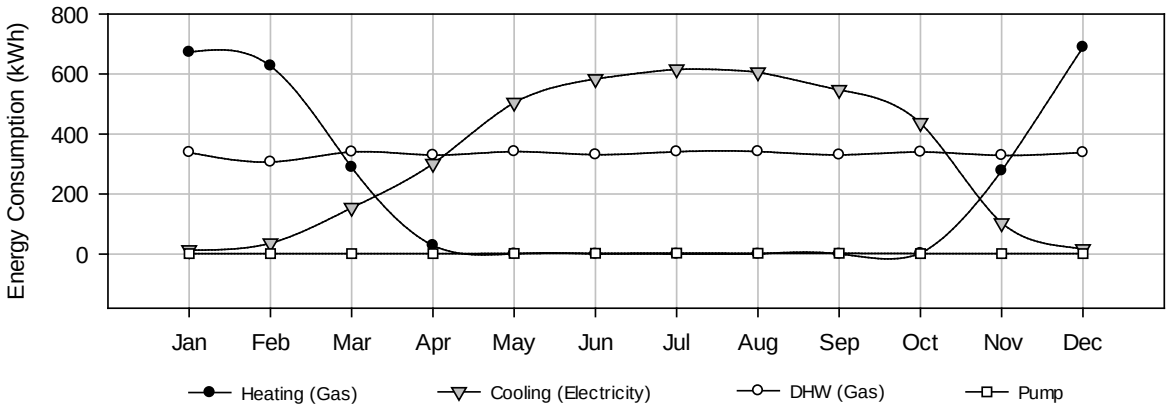


Figure 6. The monthly natural gas and electricity consumption of heating, cooling, DHW and pumps in the reference system

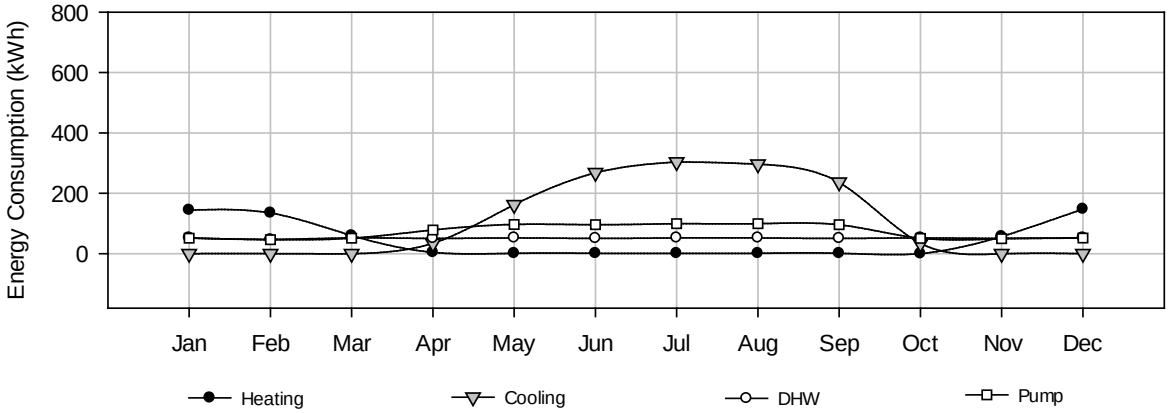


Figure 7. The monthly electricity consumption of heating, cooling, DHW and pumps in the first alternative system

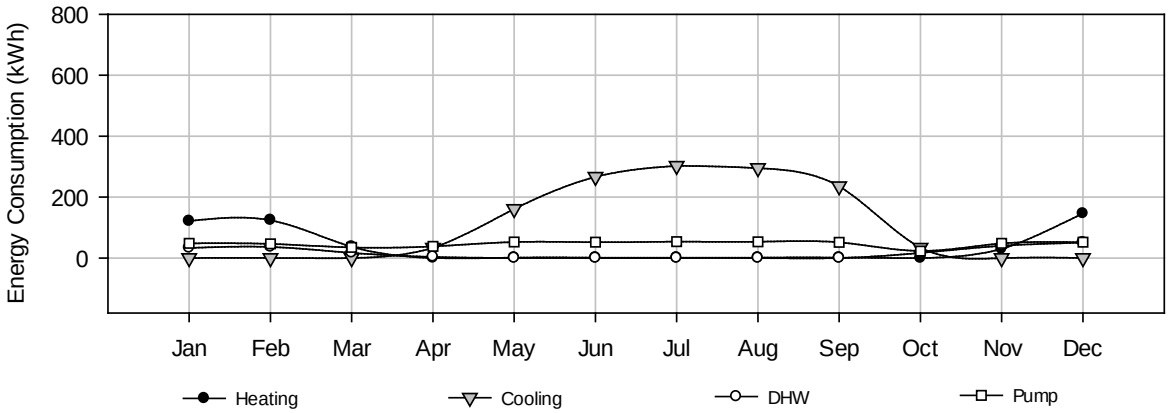


Figure 8. The monthly electricity consumption of heating, cooling, DHW and pumps in the second alternative system

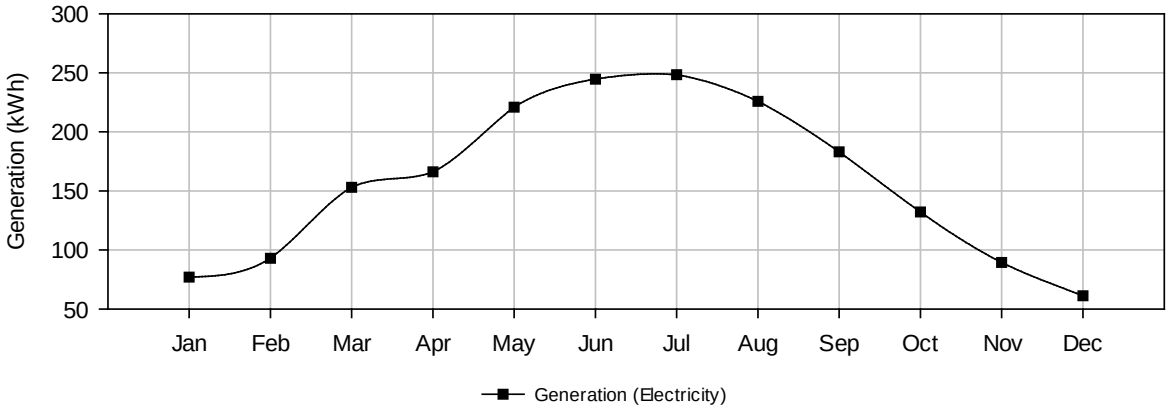


Figure 9. The monthly electricity generation by PV collectors

The annual energy consumption and generation per square meter of all equipment used in the reference and alternative systems are given in Table 5. The comparisons were made based on the primary energy consumption because the reference system used natural gas and electricity, and other alternatives used only electricity. The primary energy conversion factor was taken 2.36 for electricity and 1 for natural gas 14]. The annual primary energy consumption of heating, cooling, fans, pumps, lighting and other equipment in the reference and alternative systems are given in Figure 10.

Table 5. Annual energy consumption and generation of reference and alternative systems

	Referance		1st Alternative	2nd Alternative	3rd Alternative
	Natural Gas (kWh/m²-a)	Electricity (kWh/m²-a)	Electricity (kWh/m²-a)	Electricity (kWh/m²-a)	Electricity (kWh/m²-a)
Heating	28.46	-	6.10	5.12	5.12
Cooling	-	43.08	14.31	14.24	14.24
DHW	44.05	-	6.78	2.17	2.17
Pump	-	0.21	9.56	6.08	6.08
Fan	-	7.54	7.54	7.54	7.54
Lighting	-	17.03	17.03	17.03	17.03
Other Equip.	-	14.23	14.23	14.23	14.23
Generation	-	-	-	-	20.85

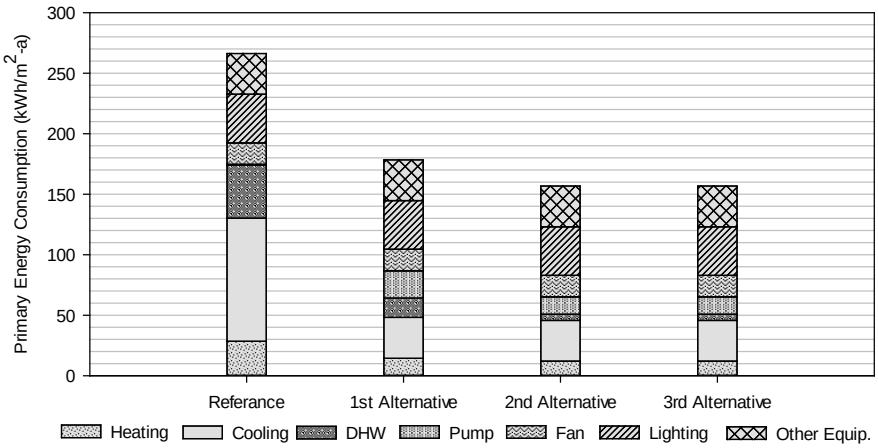


Figure 10. The primary energy consumption of the reference and alternative systems

The results show that the energy consumption of fans in the FCUs, lighting and other equipment did not change in the reference and the alternative systems. It was concluded that 49.5% energy saving for heating per square meter was achieved by replacing the reference system with the first alternative system. The second alternative system consumed 16% less energy for heating than the first one, and it consumed 57.5% less energy than the reference system. It was also concluded that 66.7% energy saving for cooling per square meter was achieved by replacing the reference system with the first alternative system. The energy consumption of cooling was the same in the first, second and third alternative systems since solar assisted GSHP was not used for cooling. 63.7% energy saving for DHW per square meter was achieved by replacing the reference system with the first alternative system. The second alternative system consumed approximately 67.9% less energy for DHW than the first one, and it consumed 88.4% less energy than the reference system. The total annual primary energy generation and consumption of the reference and alternative systems are given in Table 6. When examined Table 6; it was concluded that the first alternative system saved 33% energy compared to the reference system. The second alternative system saved 41% energy compared to the reference system.

Table 6. The total annual primary energy consumption and generation of the reference and alternative systems

	Referance (kWh/m²-a)	1st Alternative (kWh/m²-a)	2nd Alternative (kWh/m²-a)	3rd Alternative (kWh/m²-a)
Primary Energy Consumption	266.24	178.30	156.75	156.75
Primary Energy Generation	-	-	-	49.19

4 CONCLUSIONS

Buildings include a large share of total energy consumption. Thus, the use of renewable energy sources in buildings and the effect of these sources on energy consumption was studied. For this purpose, a hypothetical housing model was established in İzmir. In the reference system, the gas-fired condensing boiler was used for heating and DHW, and chiller was used for the cooling system. In the first alternative system, GSHP was used for heating, cooling and DHW. In the second alternative system, solar assisted GSHP was used for heating, cooling and DHW. It was the same as the second alternative system and the third alternative system. Moreover, it was aimed that the building was not only an energy consuming building but also an energy generating building at the same time. Therefore, PV solar collectors were located in the south of the roof. In addition to energy saving by replacing heating, cooling and DHW systems with different alternatives, it is possible to minimize the damage caused by fossil fuels to the environment by using renewable energy sources. In this study, PV collectors were used for generating a portion of the energy consumed by the building from renewable energy sources in addition to the reduction of building energy consumption. The locations of the reference and the alternative systems on the nZEB graph were determined according to the Net Zero Energy Building (NZEB) line in which the energy consumption and generation are equal. As a result, the third alternative system was found as the closest system to the NZEB line due to its minimum energy consumption and generation (Figure 11).

As a conclusion, the energy consumption can be reduced by the changes of heating, cooling and DHW systems of newly built or existing buildings. However, the approach rate to the NZEB line was low because the building's heating, cooling and DHW systems were changed. In order to get closer to the NZEB line, it is necessary to increase the thermal performance of the elements of the building envelope. In future, the heating, cooling and DHW systems will not only be replaced but also will be worked on upgrading the entire design parameters of buildings, including building envelope elements.

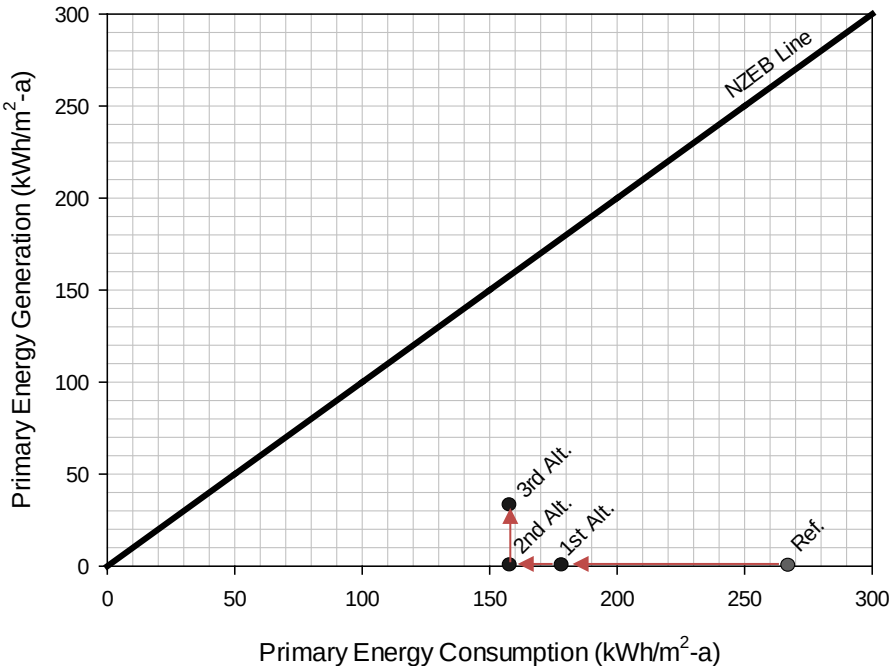


Figure 11. The locations of the primary energy consumption and generation for the reference and the alternative systems on the nZEB graph

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THE EFFECT OF TOPOGRAPHY ON BUILDING ENERGY PERFORMANCE

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Abstract

Today, approximately 50% of the world's population lives in cities and this rate is expected to reach 80% by 2030. The number of buildings increases as the population grows. Buildings in cities are responsible for a large share of total energy consumption. There are many different active and passive design strategies for reducing this energy consumption. These strategies vary from building scale to urban scale. In the literature, energy efficient measures were taken many studies at the building scale for decreasing energy consumption. On the other hand, there are few studies for reducing energy consumption in the building settlement scale. Thus, the energy performances of the buildings on different topographies were examined. Yıldızlı Mass Housing complex was constructed by the Republic of Turkey's Prime Ministry Housing Development Administration of Turkey Housing Development Administration (TOKİ) in Trabzon, was selected as the study area. The mass housing complex, which has twenty-two buildings, is located on the northern hillside of a mountain. It was accepted as the reference. The heating and cooling load, solar gains, and shadowing conditions of the buildings were numerically calculated by using the DesignBuilder energy simulation software. The existing settlement plan was preserved. It was assumed that the plan was located on different topographies that were hillside (south, S from now on), valley, plain and hill. The heating and cooling load, solar gains, and shadowing conditions of the buildings were obtained for each topography because the buildings in the settlement affect each other's shadowing on different topographies. As a result, it was concluded that the best cooling load was obtained on the hillside (N) while the best heating load and the highest solar energy gain were obtained on the hillside (S).

Keywords

Topography, building energy performance, shadowing, heating load, cooling load, solar gains.

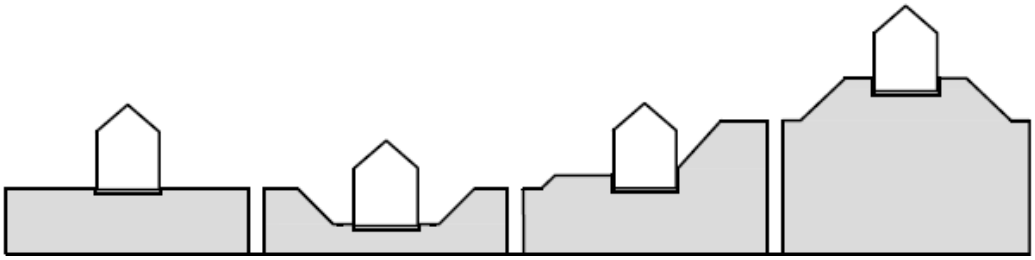
1 Introduction

Architects and urban planners have conducted studied on the relation between energy consumption of buildings and their environment since the 19th century [1]. They concluded that the energy behaviours are variable when buildings are designed as the mass housing vs. a single design in one location. The locations of buildings on topographies and form of buildings affect each other in the case of solar irradiance [2-3-4]. The amount of solar irradiance reaching the building depends on a number of factors, such as building direction, shadowing of the building, building shape, density within a site and settlement [5]. It should be taken into account that the relationship between the buildings and their surroundings for reducing the energy consumption of buildings at the early-stage design of buildings [6].Sanaieian et al. (2014) research of the impact of urban block forms on the environmental performance of buildings. They categorized their research as follows: thermal behaviour inside and outside the building, solar access inside and outside the building, indoor and outdoor natural ventilation [6]. Kocagil and Oral (2015) investigated the effect of building form and settlement texture on heating and cooling load in the hot dry climate. They selected the traditional houses of the region as the study area. The thermal performance of building forms and settlement texture were numerically calculated by using the DesignBuilder energy simulation software [7]. Tereci (2012) studied an energy benchmarking method for urban quarters in order to design or manage the energy efficiently at the urban scale. The urban generic forms and residential building types were combined to determine the thermal properties data of building stock by using the EnergyPlus energy simulation software [8]. Littlefair (1998) studied a site settlement where buildings blocked the sunlight for the other one. He drew the sun path diagrams and calculated the solar energy gain by using a software. He concluded that it should be taken into account that the effect of sunlight on buildings [9]. Quan at al. (2016) calculated the impact of the urban residential form on the energy performance of the building in Shanghai by using energy simulation software. They studied by selecting three areas from different historical residential settlements as study area [10]. By using the DesignBuilder energy simulation software, this study investigated the energy performances of the buildings on different topographies located in moderate-humid climate regions of Turkey. The heating and cooling load, solar gains, and shadowing conditions of the buildings were obtained for different topographies because the buildings in the settlement affect each others shadowing on different topographies.

2 Method

Yıldızlı Mass Housing complex was constructed by TOKİ on the northern hillside of a mountain in Trabzon. The mass housing complex has 22 buildings that were modelled by using the DesignBuilder energy simulation software. The heating and cooling load, solar gains and shadowing of buildings were calculated and analysed. The existing settlement plan was preserved. It was assumed that the plan was located on different topographies that were hillside (S), valley, plain and hill. The heating and cooling load, solar gains and shadowing of buildings were analysed in the case of different topographies. The locations of the buildings

on topographies are different from each other (such as hillside, plain, valley, foot, mountain, hill, plain etc.) [11]. Plain, valley, hillside and hill topographies were used for this study (Figure 1).



(a) (b) (c) (d)

Figure 1. The location of the building on different topographies (a) Plain, (b) Valley, (c) Hillside, (d) Hill [12].

2.1 Meteorological data

Yıldızlı Mass Housing is located in Trabzon (39.72°N, 41°E), in Climate Region II, representing a moderate-humid climate of Turkey [13]. Meteorological data of Trabzon is given in Table 1.

Table 1. Meteorological data for Trabzon [14]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Outside dry bulb temperature (°C)	7,5	7,5	9,3	11,2	15,7	20,2	23,9	24,7	21,0	17,6	12,7	9,2
Dew-point temperature (°C)	1,21	1,6	3,9	7,6	12,3	16,0	18,9	19,6	16,3	12,9	7,2	3,1
Wind speed (m^2/s)	2,8	3,0	2,9	2,5	2,2	2,4	2,5	2,5	2,7	2,5	2,7	2,8
Wind direction (°)	176,8	178,0	166,2	174,6	175,2	180,2	174,1	183,5	175,4	174,6	177,3	176,7
Atmospheric pressure (kPa)	100,8	100,8	100,9	100,9	100,8	100,9	100,9	100,9	100,8	100,9	100,8	100,9
Direct normal solar (kWh)	58,1	67,1	66,2	72,4	99,9	109,3	82,6	91,3	81,4	58,9	55,5	45,7
Diffuse Horizontal Solar (kWh)	28,7	34,4	63,7	71,8	78,7	86,0	87,5	79,2	59,9	48,8	29,8	27,9

2.2 Yıldızlı Mass Housing

Yıldızlı Mass Housing was constructed about 10 years ago by TOKİ on the northern hillside of a mountain in Trabzon. There are 1-2 storey residential buildings around the mass housing complex. There is a difference of about 45 meters between the lowest and the highest points of the land. The mass housing complex consists of 22 buildings in total. These buildings were constructed in 4 types (Figure 2). Type 1 is a twelve-storey buildings with forty-eight apartments; Type 2 is a nine-storey buildings with thirty-six apartments; Type 3 is a eight-storey buildings with thirty-two apartments; and Type 4 is a twelve-storey buildings with forty-eight apartments. There are eleven Type 1 buildings, six Type 2 buildings, three Type 3 buildings and two Type 4 buildings in the mass housing complex.

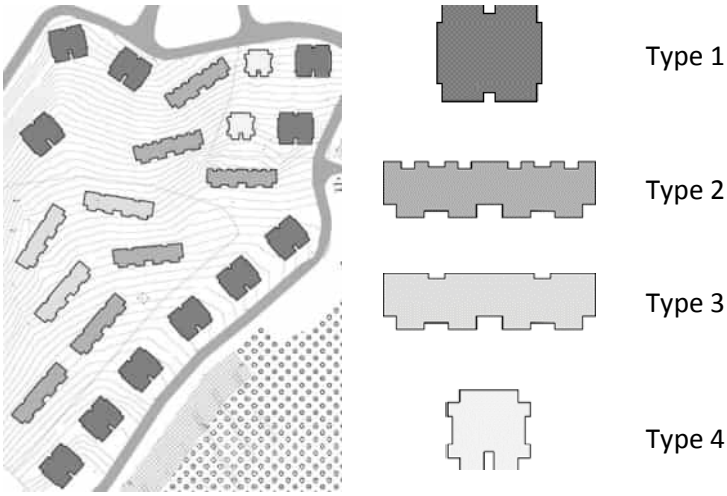


Figure 2. Yıldızlı Mass Housing schematic plan

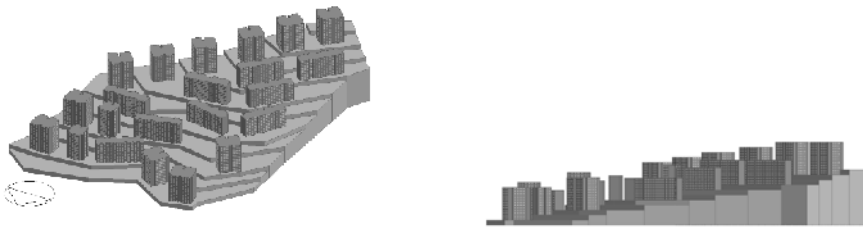
The properties of the buildings' materials used in the apartments, the heat transmittance coefficients (U-value), occupancy profiles are given in Table 2. Solid fuel boilers are used for the district heating system in the buildings. The apartments use electricity for their cooling and domestic hot water (DHW). There is no mechanical ventilation system in the apartments. According to Turkey Statistical Institute's the Population and Housing Survey, 54% of families consist of a mother, father and two children [15]. Therefore, it was assumed that a family consists of four people.

Table 2. Building characteristics

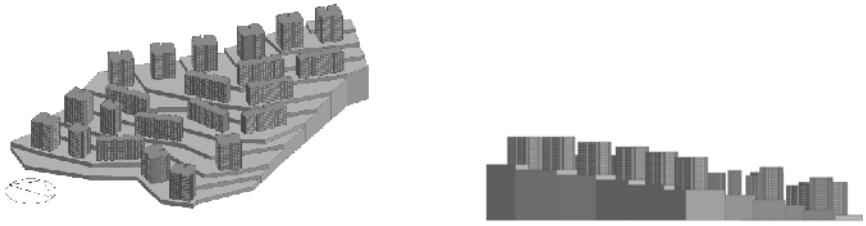
Main buildings dimensions			
Type 1		Type 2	
Gross width-length	23.1 m - 25.9 m	Gross Length	13.3 m - 51.8 m
Storey	12	Storey	9
Type 3		Type 4	
Gross width-length	13.3 m - 51.8 m	Gross width-length	19.4 m - 20.1m
Storey	8	Storey	12
Building geometry-residential			
Type 1		Type 2	
Gross Wall Area (m^2)	3712.86	Gross Wall Area (m^2)	3874.99
Window Area (m^2)	526.11	Window Area (m^2)	606.05
Window-Wall Ratio (%)	14.17	Window-Wall Ratio (%)	15.64
Type 3		Type 4	
Gross Wall Area (m^2)	3119.93	Gross Wall Area (m^2)	2965.97
Window Area (m^2)	536.31	Window Area (m^2)	420.87
Window-Wall Ratio (%)	17.19	Window-Wall Ratio (%)	14.19
Weather data	Meteonorm Trabzon IWEC		
Occupancy profile			
Weekdays	Unoccupied 08.00-17.00	Weekend	Occupied all time
Construction			
U_{wall}	0.530 (W/m^2K)	$U_{floor\ on\ the\ ground}$	0.456 W/m^2K
$U_{ceeling\ (semi\text{-}exposed)}$	0.361 W/m^2K	$U_{windows}$	2.36 W/m^2K
$U_{partition}$	1.665 W/m^2K	Infiltration	0.8 ac/h

2.3 Topography scenarios

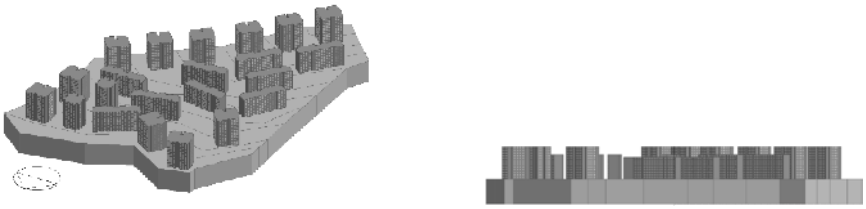
Within the scope of the study, Yıldızlı Mass Housing, which is located on the northern hillside of a mountain in the existing case, was accepted as the reference. The existing settlement plan was preserved. It was assumed that the plan was modelled and simulated for locating on different topographies that were hillside (south), valley, plain and hill (Figure 3).



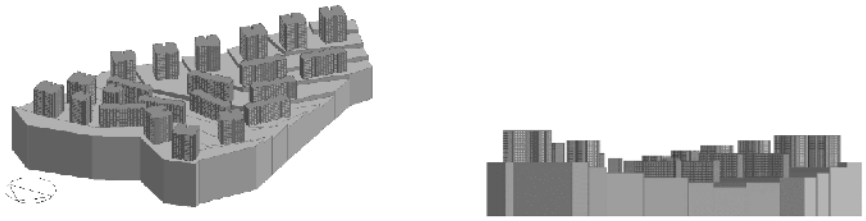
Hillside (N) perspective (left), section (right)



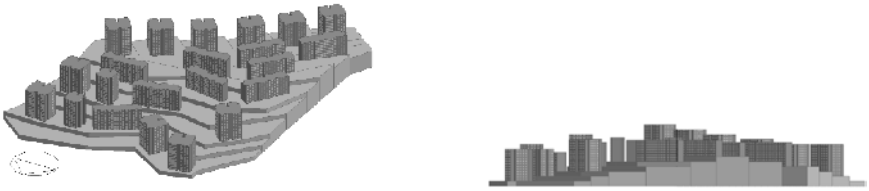
Hillside (S) perspective (left), section (right)



Plain perspective (left), section (right)



Valley perspective (left), section (right)



Hill perspective (left), section (right)

Figure 3. Perspective and section of different topographies

3 Results and Discussion

In the current study, there are two cases have been analysed and discussed. Firstly, the solar gains of the buildings for each topography and the shadowing of the buildings were analysed. Secondly, the total heating and cooling loads of the buildings were analysed according to the different topographies.

3.1 Solar gains and the shadowing of the buildings on different topographies

By preserving the plan of the buildings, changing their topography affects the shadowing. Therefore, solar gains of each building changed. The total annual solar gains of the buildings on different topographies are given in Figure 4.

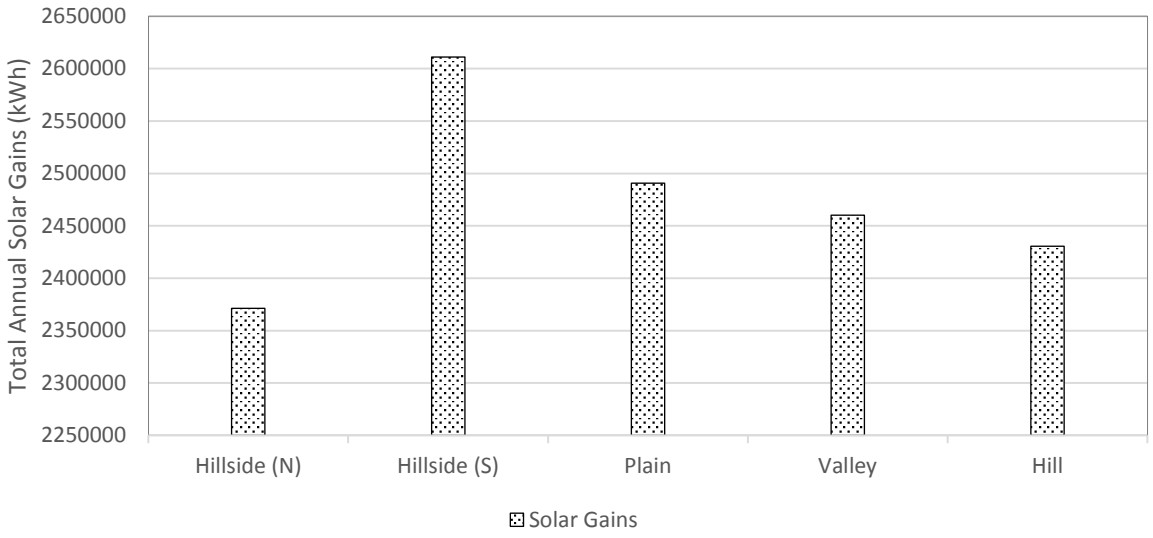


Figure 4. The annual solar gains of the buildings on different topographies

According to the simulation results, comparing to the reference, the annual solar gains of the buildings increased 5% on the plain area, 3.8% on the valley and 2.5% on the hill. In addition, the best solar gain (a 10.1% increase) was achieved by locating them on the southern hillside.

In order to examine the shadowing of the buildings, the winter and summer design days were selected as January 21 and July 21. The shadowing analyses were done for 9 am and 2 pm when the sun angles were low. The shadows of the buildings on different topographies for 4 different times are given in Figure 5.

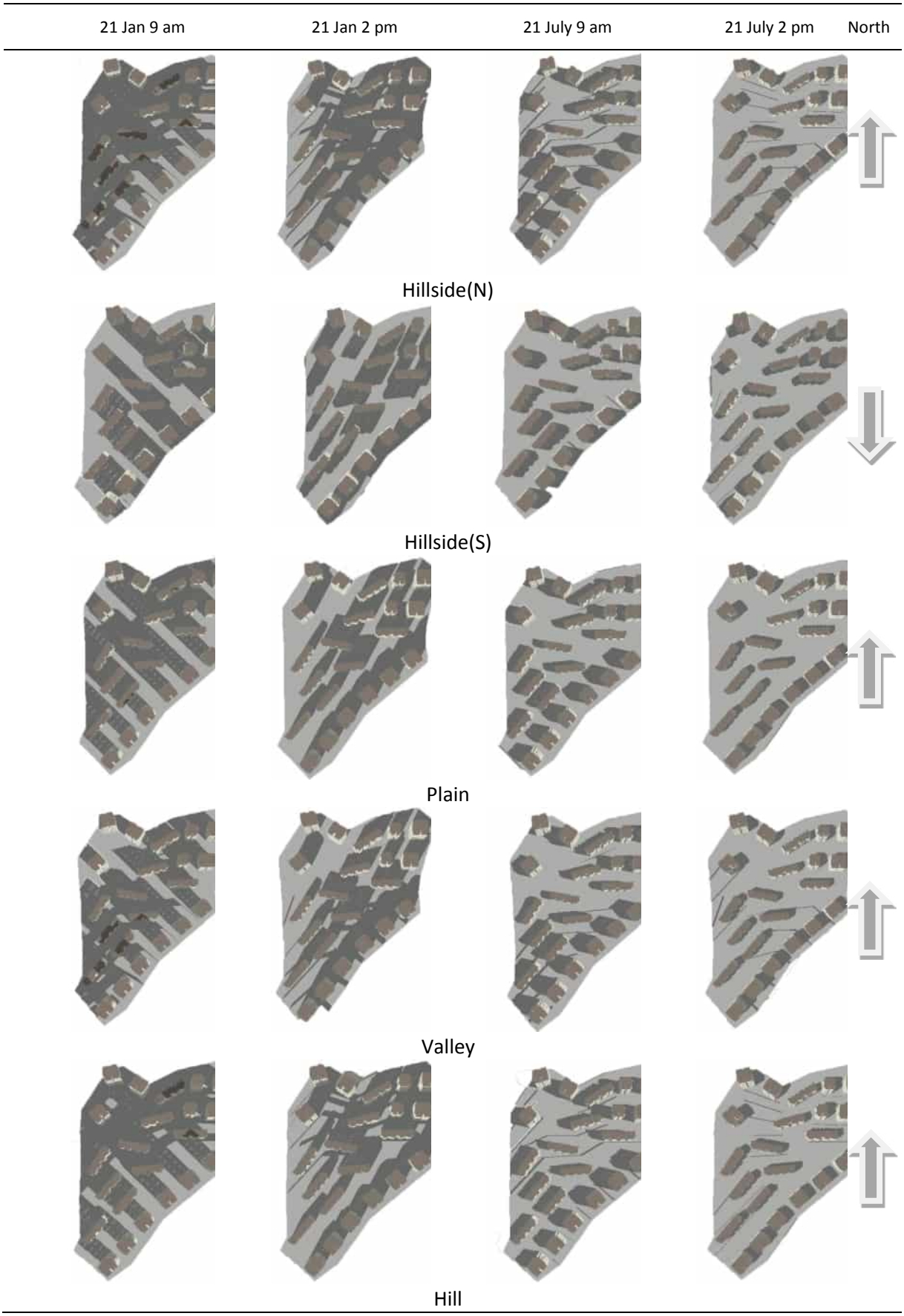


Figure 5. The shadows of the buildings on different topographies for 4 different times

When the shadows for the winter months were examined for 9 pm, it was seen that the hillside (N) topography buildings shadow each other most at that time. Later, on different topographies, the shadows of the buildings were orderly lined up to that time: hill, plain, valley and hillside (S). When the shadows were examined at 2 pm, the hillside (N), hill, plain, valley and hillside (S) are orderly lined up. When the shadows were examined for the summer months, it was concluded that the shadows were closer to each other because the sunshine comes at a more vertical angle compared to the winter months. Thus, the buildings shadowed less on each other.

3.2 Heating and cooling loads of the buildings on different topographies

Yıldızlı Mass Housing, having 22 buildings, uses solid fuel boiler for the heating system of the buildings. The apartments in the buildings use electricity for their cooling and DHW. The HVAC system of the buildings were identified to the DesignBuilder program, then, the annual heating and cooling loads were obtained. While the buildings were modelled on different topographies, the average height of the land was maintained so that the effect of height on heating and cooling load were not considered as a parameter. Thus, it was ensured that the heating and cooling loads of the buildings on each topography were examined at the same conditions. The total annual heating and cooling loads of the buildings on different topographies are given in Figure 6.

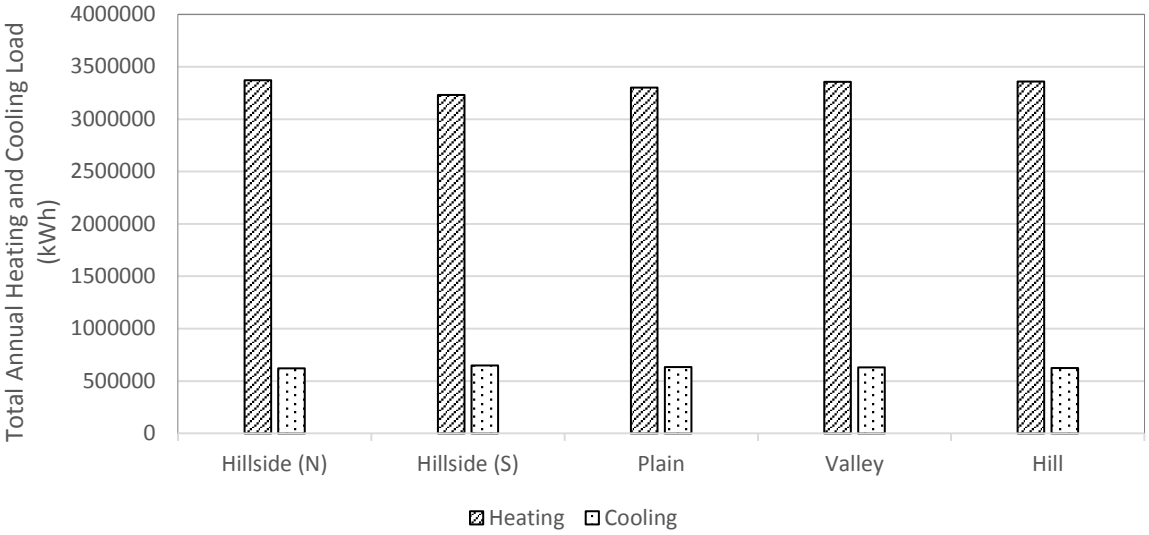


Figure 6. The total annual heating and cooling loads of the buildings on different topographies

The solar gains and shadowing of buildings varied according to the topographies. As a result, the heating and cooling loads also changed. When the changes in total annual heating loads of the buildings were analysed, comparing to the reference, the total annual heating loads of the buildings decreased 4.2% on the hillside (S), 2.2% on the plain, 0.5% on the valley and 0.4% on the hill. When the changes in total annual cooling loads of the buildings were analysed, compared to the reference, the total annual cooling loads of the buildings increased 4.5% on the hillside(S), 2.4% on the plain, 1.8% on the valley and 0.9% on the hill. Because the average height of the land was maintained, the effect of height on heating and cooling loads were not considered as a parameter. Therefore, it was determined that the change in heating and cooling loads was caused by solar gains, and the changes were parallel with the solar gains.

4 Conclusions

In this study, Yıldızlı Mass Housing was selected for the analysis in the case of different topographies. The existing plan was preserved. It was assumed that the plan was located on different topographies that were hillside (S), valley, plain and hill by using the DesignBuilder energy simulation software. Then, the heating and cooling loads, solar gains and shadowing of buildings were analysed in the case of different topographies. The annual heating and cooling loads and solar gains of the buildings on the different topographies are shown in Table 3.

Table 3. The annual heating and cooling loads and solar gains of the buildings on different topographies

	Hillside (N)	Hillside (S)	Plain	Valley	Hill
Heating Load	■■■■■	■	■■	■■■	■■■■
Cooling Load	■	■■■■■	■■■■	■■■	■■
Solar Gains	■	■■■■■	■■■■	■■■	■■

In the five cases investigated in the study, the settlement on the southern hillside of a mountain was determined as the most advantageous in the case of the heating load because the southern hillside gets more sunshine. Later on, it was orderly listed as plain, valley, hill and hillside (N). On the other hand, the most advantageous situation for reducing the cooling loads was determined as the settlement on the northern hillside of a mountain. This is followed by the settlement on the hill, valley, plain and southern hillside of a mountain. When the shadowing of the buildings was examined for winter months; it was concluded that, the reference had the lowest value in the case of sunshine obtained for 9 am and 2 pm on the 21st of January. The reference also had the lowest solar gain compared to the others. The heating load is greater than the cooling load in a moderate-humid climate. Thus, the settlement on the southern hillside of a mountain in Trabzon reduces the heating load.

The simulation results showed that it is important to decrease the energy consumption in the buildings on different topographies at the early-stage design of buildings. Architects and urban planners have to take into account for the impact of different topographies on energy consumption to save energy. In future work, the optimum topography for the heating and cooling load of buildings will be determined in the different climates.

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IMPLEMENTATION OF RENEWABLE ENERGY IN THE DESIGN OF NON-LEVEL PATHWAYS AND ITS ROLE IN SUSTAINABLE URBAN TRANSPORT WITH ENVIRONMENTAL SUSTAINABILITY APPROACH

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Abstract

By considering the necessity of sustainable environmental development and its increasing importance in urban affairs, implementation of renewable energy in the design of non-level pathways is becoming more attractive since the environmental preservation and energy conservation, which are the key parameters in sustainable development, is highly depended on the design of urban transportation system. In developing countries although a significant budget is devoted for developing main roads and cross roads, developing pedestrians and bikeways has less priority. This paper addresses the strategies, which lead to introduce the ways in the design of pedestrian and bikeway to protect the environment in an efficient and cost effective ways. Also, introducing solutions to save energy in these roads is studied.

The use of optical fibres to save solar energy and create foaming effects to convert people's mechanical energy to electrical energy is considered and studied as a practical way to protect the environment and minimize the use of fossil fuels in urban transportation.

Keywords

Non-level Pathways, Sustainable Urban Transport, Environmental Sustainability, Renewable Energy

1 Introduction

In the literature review, the relationship between transport and environment has been widely discussed. While a diverse range of transport-related effects has been investigated, but still, most sources are particularly related to air pollution. This emphasis has led to the presentation of plans in which measures have been taken to control pollution or reduce traffic congestion [1]. Implementation of one-dimensional and incomplete planning and unhealthy consumption of natural resources has resulted in destruction of human

environment and endangers lives of future generations. This trend, and consequently the need for exiting from above-mentioned crises, has led to the emergence of a fundamental issue in the world, which is called sustainable development [2].

Le Corbusier began to address the needs of the 1930s in its brilliant city, and modernizing the emphasis and suggestion of the division of traffic into three levels; subway, pedestrian and carriageway levels. But, according to Jacobs, "he, alike the city garden planners, removed people from streets and deported them to parks [3]. In the middle of 20th century, Kenzo tangier also emphasized the expansion of urban transport. According to Tangier, urban spaces as a basis for establishing communication should be further integrated with the development of transport systems. And that "the underlying theme of urban design is, at the moment, to think of a spatial arrangement as a network of communications, and as a constituent of concomitant growth [4]. Sustainable urban design, as a young science in the area of everyday life in urban space can play a fundamental role in promoting the health of citizens. Health and hygiene has been the subject of human history since ancient times as a topic that societies have always been interacting with. Consequently, the health and welfare of a city's population is an important indicator of the success rate of sustainable development policies in that city [5]. In this regard, one of the spaces that witnesses high presence of people and their physical activities in cities is urban roads, which are an integral part of streets and have made human interaction possible alongside its buildings, that is, automobiles. The point to consider here is that the health of pedestrians is not limited to physical aspects and in relation to the risks and disadvantages caused by cars, but also many other factors in the pedestrian environment can affect the health of pedestrians. Urban development has caused a lot of demand for infrastructure activities such as transportation and energy consumption. In comparison to year 2000, energy consumption growth is predicted to be doubled by year 2025 because of the transport energy consumption and greenhouse gas [2]. In the latest comments from the Canadian Science Forums, estimated oil and gas resources will drop sharply by the year 2030 and will end [6]. As a result of this, another important point is the following: the use of solar energy and its role in the urban transport system and the replacement of electric vehicles instead of fossil fuels and gas fueled vehicles can be an appropriate solution for achieving the sustainability of reserves Oil and renewable energy production. Meanwhile, changing these priorities has a close relationship with environmental sustainability. On this basis, after a brief explanation of the relevant definitions, we look at the environmental sustainability indicators as well as the sustainability of the energy sector.

2 Side-walk

Jane Jacobs sees the sidewalks as the general and primary space of the city as well as the most vital and the most important of its members [7]. Walking in the public space of the city can strengthen the social and spiritual relations of the citizens. But in most cases, due to the lack of allocation of facilities and lack of attention to standards, as well as the lack of education and awareness of people about the laws of movement, people do not know their rights in a way that they have abandoned their rights. So that the share of these activities in the transportation system in recent decades has been dimmed according to the automobile life and many other barriers. In recent decades, in order to solve such problems and to

restore vitality and vitality to social life, in many countries, the development and design of sidewalks are on the agenda of many urban managers [5].

3 Sustainable Development

In authoritative sources, there are many definitions of sustainable development that has stem from the broad concept of sustainable development in the social, economic and environmental spheres. Here are some of them:

Gilpin: Development that sustains social, economic, and environmental interests over a long period of time with respect to the future and existing generation [8].

Bratland: An expansion that meets the needs of the present world without compromising the ability of future generations [9].

Tilba: A development that has self-sufficient, self-reliance, environmentally friendly features. It's cost-effective, without waste, to protect the health and safety of people and poverty [9].

Bratland Commission: In the definition of sustainable development at the Committees of Bratland in 1987, sustainable development refers to the need to meet today's needs without reducing the ability of the forerunners to meet their needs [10].

4 Transportation

In metropolises such as Tehran, transportation problems have left many citizens in trouble. For example, the concentration of a large number of offices and business centers in the central city area attracts most of the trips produced [11].

Many definitions of urban transport are provided, but simply the idea is "to meet current transportation needs without compromising the power of estimating the needs of the next generation" [12] in general, sustainable transportation base on the World bank statement (1996) has three economic, environmental and social dimensions.

Economic and financial dimensions include the appropriateness of organizational structure, actions and investments for transport infrastructure.

Environment and ecology, which includes the study of how to invest in transportation and the choice of transportation forms that affect the reduction of energy consumption and emissions of pollutants.

A social dimension is emphasizing the adequacy of access to transportation services for all segments of society [11]. Therefore, it can be concluded that sustainability in transport is not achieved by changing design, use patterns and vehicle management, but also changes in the way of thinking about identifying and evaluating possible solutions to the problems of transportation. A sustainable transport system requires more activities than air pollution, traffic or fuel consumption. Sustainable urban transport development contributes to reducing environmental impacts, increasing the efficiency of the transportation system and improving social life without reorganizing strategies, policies and programs [13].

4.1 Sustainable Economic Transport Indicator

Sustainable economic transport indicators should reflect the costs and benefits of using motor vehicles and that the increased use of motor vehicles instead of increasing social welfare will reduce the overall availability of individuals and the variety of transportation modes.

Indeed, increasing the possibility of a move that leads to less profit or negative net profits will reduce sustainability. In contrast, policies that increase net profits from any transport sector will increase sustainability.

Despite the dangers of motor transport, such as environmental damage and losses, and the reduction of fuel consumption, this is commonplace among the general public, with the increase in the level of motor transport due to the economic and consumer benefits of technological advancement and/or the development of technology in vehicles and the streets increase sustainability.

Policies that reduce the tendency to transport motor vehicles tend to be close to sustainable transport development such as increasing the share of non-motor transport (pedestrians and cyclists), reducing daily travel of people, sharing the use of vehicles, constructing densely populated metropolitan areas with access to facilities and services at close range, receiving parking fees or using street expenses and limiting private car.

4.2 Sustainable Transport Social Indicator

Social justice is a category that can be studied in different aspects and needs to compare the different forms of transportation, the quality of services and their effects in various social groups, especially the vulnerable in terms of economic, social and physical health.

Transport impacts on human health include injuries caused by accidents, airborne diseases, and physical problems due to inadequate mobility. Measures that increase pedestrian and cycling and increase the use of transportation forms non-motorized, in addition to improving the mobility of vulnerable populations, will improve health and support for sustainable transport plans.

4.3 Sustainable Environmental Sustainability Indicator

Environmental impacts of transportation include various types of air pollution, noise pollution, water pollution, non-renewable resources, and landscape degradation such as ecological damage, effects of thermal islands and the destruction of wildlife habitats.

Different methods are used to measure these effects and to calculate its human and ecological costs [19].

In Table 1, several theories related to urban transport have been raised since 1980.

Table 1. Theories related to urban transport from 1980 to the present

Period of presentation of theory	**Theorist**	**Title/Description of theory**	**Idea/original compilation**	**The most important actions and related suggestions**
1990-1969	Nik De Boer	Traffic calming	Establishing interconnection between the pedestrians and the car in the neighboring streets by limiting the speed and how the vehicles move	The maximum speed of ordinary cars is 12-15 km/h and emergency vehicles 25 km/h Prediction of car park locations Children's playground and pedestrian walkway across the street
1985-1995	Peter Calthorpe and Shelly Bouticha	Development of public transportation (TRD)	"American Metropolis Dimension" Compiled by Calthorpe and Bouticha Develop around public transit stations in order to maximize economic recovery	- Establishing the boundaries of the automobile circuit around public transport stations - The centralization of investment and construction of commercial and administrative uses (not mixed) by the government and transport agencies around public transport stations
1990-2000	Organization for Economic Cooperation and Development (OECD)	Sustained transportation (SD)	- Traffic that does not Endanger public health or biological systems and accommodates the need for relocation, including less use of renewable, nonrenewable sources.	Sustainable transport includes public transportation, co-signing, walking, cycling, electric and double-burning electric vehicles, a diesel engine, fast public transport and other types of green transportation.
1990-2000	Andres Duany and Stephan Yeldon	Smart growth (SG)	-Development based on mass transport and limited environmental impacts -Based on the	-Establishing pedestrian neighborhoods, providing a variety of transportation options -Development to existing communities

			concept of sustainable development	
1995-2005	Micheal Bernick Robert Cervero	Transit villages	"21st Century Transport Villages" (1996) Terminology of Urban Design Principles, Transportation of the Economy by Establishing a Compressive Social City around a Public Transportation Station	- The link between two approaches and new rail systems in the United States - Four principles; distance of 500 meters from the terminal, public spaces around the center of the station, the terminal facilitates communication with other areas, the city center, the public spaces around have a major role in gathering and holding the ceremony
2000-2010	Peter Calthorpe Hank Dittmar Gloria Ohland	Universal transport development (TOD)	The book "New Transportation Town" (2003) Creating composite centralized walking around high-guality rail systems	Rail terminals feature the downtown with the maximum pedestrian priority -Supplementary transport support (Handlebar, Tramway, etc.) Parking spaces are reduced and managed in the pedestrian ring around the terminals

Scientists believe that in the last decades of the last century there has been a re-approach to the expansion of public transportation networks, the increase of related facilities and, at the same time, modifications to the movement of motor vehicles, and this is the main strategy and guiding indicator All urban transportation plans were introduced. Also, on the eve of the third millennium, commuting modes consistent with public transportation, especially walking and cycling, also emphasize the combination of public transport development with urban design principles as the main means of tackling increasing traffic in cities [20].

5 Renewable Energy

According to various definitions concerning the renewable energy sources from the perspective of the transport industry by the organizations and industry leaders, it can be

seen that renewable energies are sustainable energies that are capable of being replaced in the short run. Below are some of these definitions:

1. 2004-Bonn Conference: Energy generating clean energy with no environmental pollution or greenhouse gases [14].

2. Iran's New Energy Organization (SANA): Those energy sources that are continually replaced by nature [15].

3. Stanford University School of Biological Sciences: Resources derived from the Sun or other natural processes that are capable of being replaced in the short term [16].

4. Iran's Solar Energy Organization: Sustainable energies that can be reused [17].

In the following, we will introduce renewable energies and their role in urban transport. Finally, the use of these energies by using walkways and converting them into electrical energy for urban transportation will be investigated.

5.1 Solar Energy

At present, the supply of photovoltaic energy to more than 160,000 villages around the world is responsible for solar energy. The energy consumption of this energy with 0,686 kJ of BTU is about 1% of renewable energy [13]. Throughout the whole year, if all of the fossil fuels are burned at once, the energy generated is equivalent to four days of sun-to-earth radiation [15]. In continue, by producing electricity and developing the technology of photovoltaic cells, the following solutions are suggested:

• Use of cars with solar energy source;

• Solar Fenicular (In this system, the solar generator is predicted to provide its energy. There is also a network that can store solar energy and use it in the winter [13].

5.2 Muscle and Muscle Energy

Human and animal muscle and muscle energy as the first known energy of mankind have come to serve its needs. Today, it is used in short trips with different aspects of human use, but it is a kind of it. In order to reduce trips urban shortening and saving on expensive energy as a general policy-development of cycling and walking in urban areas is recommended.

In order to encourage these and eliminate the obstacles, it is necessary to develop bicycles and electric cars. An electric bike is identified as a powered human-powered vehicle. These bikes can store and use muscle energy [18]. These low-noise, non-polluting, low-cost, high-efficiency, and high-efficiency devices and electric footpaths are designed in crowded trails to eliminate pedestrian constraints and create diversity and motivation along pathways can be effective in expanding pedestrians in urban communities.

5.3 Energy Generated by Movement of Objects

The energy generated by the movement of objects, which has recently undergone initial testing and research, enters the scene of renewable energy. The energy of this kind is in the

middle of the powerful sensors. On roads and footpaths crowded and by moving the moving objects, it absorbs the mechanical energy generated by traffic and stores electricity. By generating electricity from these systems, electricity can be used to illuminate streets, traffic control equipment and constant vehicles of the range, such as electric buses or electric taxis [13].

6 Conclusion

Urban transport has grown from a long time to the present day, and has grown so poorly after the industrial revolution. Environmental pollution caused by pollutants on the one hand and the destruction of oil and fossil fuels on the other hand has caused Developed countries will pay more attention to the use of power in urban transport and the production of electric vehicles. On the other hand, technological advancement and population growth have been shaped so that the position of sidewalks in urban design is less attractive so that with the advancement of the automobile industry and the increasing production of cars, the maximum urban spaces are allocated to streets and highways. Today, designing sidewalks is essential for the well-being of the citizens and for creating a sense of their interest in sports as well as creating more and more social interactions among different sections of society. Considering that the design of these sidewalks, bypassing the roadside and carriageways, can be a safe and secure space for more and more citizens to reduce the amount of noise pollution and environmental pollution from pollutants and fossil fuels, can It is a place to save solar energy and generate electricity in different ways, and even convert human energy and motor power to electricity. Now, taking into account the issues discussed in this article, we will present a plan that will create non-level pathways to carry urban, taxi and sidewalks can be reached at upper levels the pedestrian design is done in such a way that it generates power and solar energy, and at a low level an urban transportation with electricity energy caused by the movement of pedestrians and solar panels. It is expected that the design of this space for sport and social interactions will eliminate the noise pollution and pollutants from fuel vehicles and pleasant environments for the well-being of the citizens, as well as the development of oil reserves and the reduction of fossil fuel consumption in development cities.

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„ENERGIEAUTONOM +“

First energy autonomous revitalisation of an urban sales quarter with the standard type of passive house to reduce primary energy

(max. 100 kWh/m² effective area per year)

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Abstract

A former urban industrial accommodation is rehabilitated, existing "real" is revitalised expertly and historically faithful, however energy-efficient. The urban location is spatially renewed as well as developed with highly efficient resources fed from renewable energy "energy-autonomous" and to the „global distribution area“ for Fronius International. The "AktivEnergieTower" with PV integrated facades becomes CI of the new distribution area for Fronius and landmark nearby the railway station of Wels.

Keywords

First energy autonomous revitalization of an urban former industry quarter with the standard type of „Passive-House“ to reduce primary energy max 100 kWh/m2 nua per year

- Conversion of modern architecture in the passive house standard to PHPP to an „Active energy tower”
- Energy saving up to the factor 10 compared with the present situation
- Realisation of an well designed modern architecture in passive house standard according PHPP considering the existing structural fabric.
- Profit energy concept for the room conditioning for service building under exploitation of local renewable resources
- new development of transparent sun protection – glass lamella
- precast energy photovoltaic facade – ActiveEnergyTower

1 Introduction

Fronius International acquired the former industrial production location in the centre of Wels nearby the main railway station in the early 90´s and developed successive into a distribution area.

Figure 1. historic stock

Figure 2. historic stock

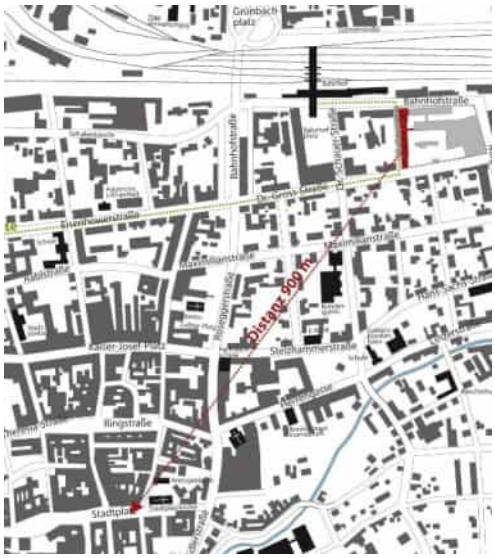

Figure 3. site plan

Figure 4. stock before refurbishment

Figure 5. court before refurbishment

To renew and redesign this traditional industrial location Fronius carried out an international architecture competition in 2006. The entry of architect Heinz Plöderl, CEO of PAUAT architects, convinced the management of Fronius and the jury with his concept to renew the existing urban location, to rehabilitate the building continuance with an energy efficient building chain and to revitalise the historical brickbuilding in the content of realisation as well as well designed modern architecture in passive-house standard considering the existing structural building units with a new landmark covered with PV-cells.

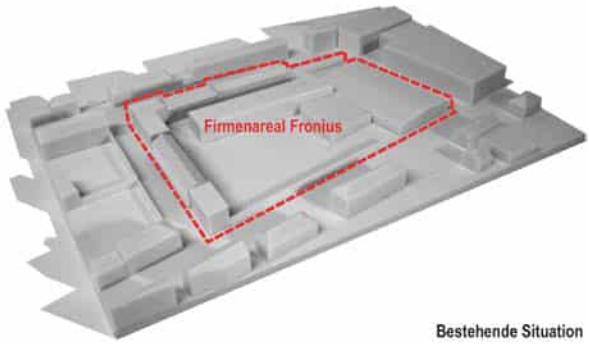

Figure 6. existing area

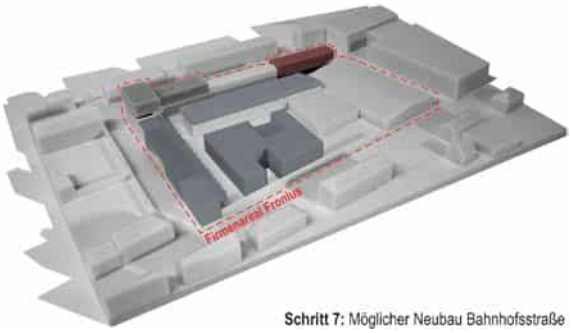

Figure 7. urban development

A profit energy concept for room conditioning in service buildings under exploration of renewable resources and passive chill strategy for buildings on the basics of office use complemented the urban and functional concept for modern sales headquarter with identity for Fronius.

2 From an idea to reality

The interesting concept of combining architecture with a mostly energy autonomous revitalization (rehabilitation, reconstruction and renewal) in the standard of passive house offers for Fronius a chance to realize and develop a best practice project as a good basis for the improvement of promotions to an urban energy efficient factor 10+ renovation.

Figure 8. corner Bahnhof/Froniusstrasse before refurbishment

An essential landmark for the rehabilitation, revitalisation and spatial renewal of this area was absolutely the faithful and highly energy-efficient renovation of the two existing brick buildings, in combination with the new building at Froniusstrasse and the „AktiveEnergyTower“at the corner to Wels railway main station.

Figure 9. corner Bahnhof/Froniusstrasse concept for refurbishment

Essential items within the methodical procedure was an integral planning based on simulation of structural measures for rehabilitation, an enhancement of building substance because of capacious, energy-efficient rehabilitation considering the use of primary energy of the used building elements and an essential advancement of space and functional quality of the building by rearrangement of building layouts. An amelioration of workplace convenience is achieved by room conditioning via innovative technologies. A management of natural light and artificial light is applied. Running costs can be reduced by the implementation of the "Standard Energy Plus" for room conditioning.

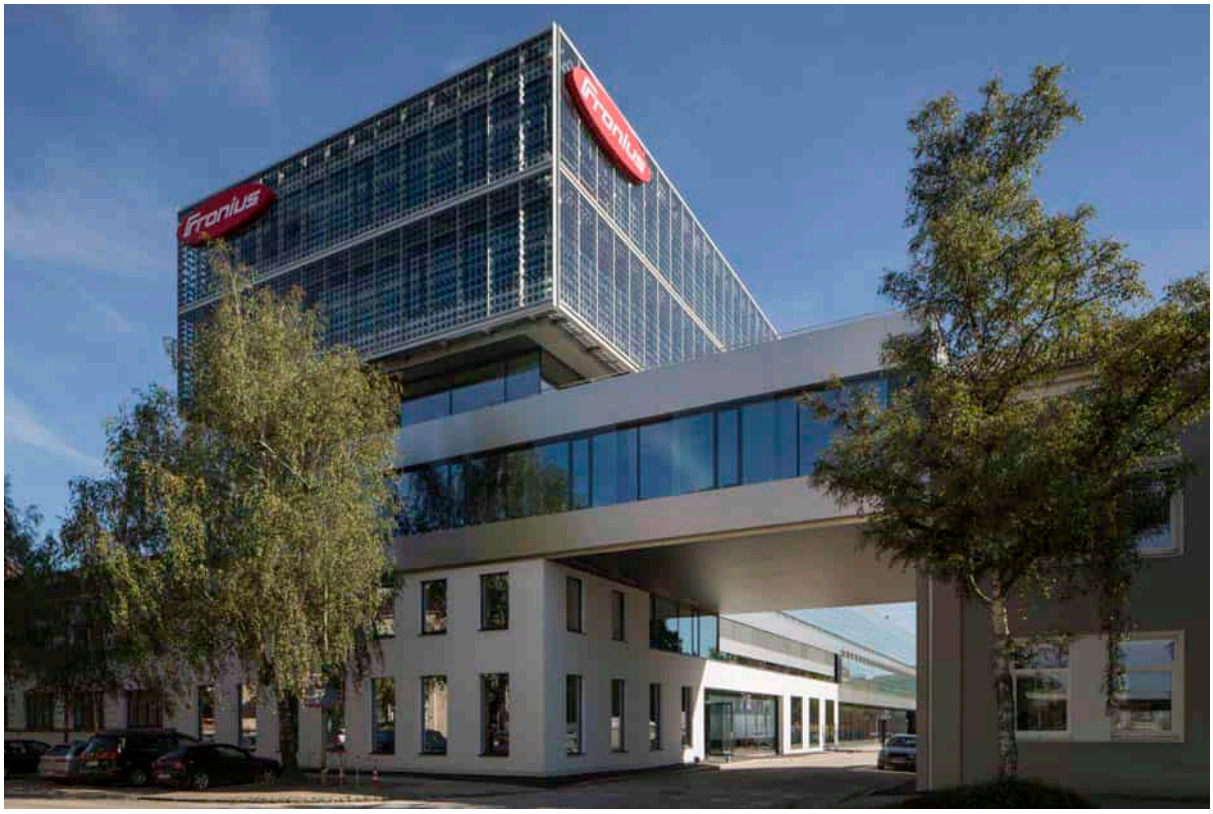

Figure 10. corner Bahnhof/Froniusstrasse after refurbishment

Among consequent improvement and reduction of primary energy to 100 kWh/m^{2}ea per year and energy saving factor of 10 compared with the present situation is arranged to this rehabilitation. The project goal to conserve the existing buildings and to rehabilitate them with high-energy efficiency and connect them with bridges to the linear consisting building structure create a centre within the building layouts. A durable façade in “Standard Passive House" has to be developed with using Vacuum-insulating in the street lining-up and in problem zones of the enlargement and rehabilitation. Altogether, an increase of comfort should be attaint.

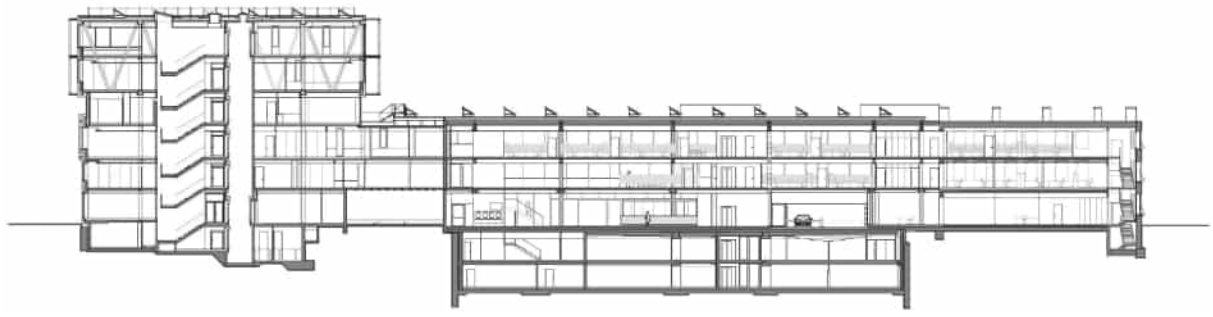

Figure 11. cross section

To develop the office and administrations buildings energy efficient, it was necessary to optimise orientation, volumetric, building cover, memory mass and solar protection with the help of the components of anti-dazzle device, day and art light management as well as new forms and concepts for glazing and transparent sun protections. In spite of the huge warmth in the buildings anyway resulting of people, computers, lighting and electronic devices, the

energy consumption for cooling and heating can be covered with the use of geothermal energy and photovoltaics.

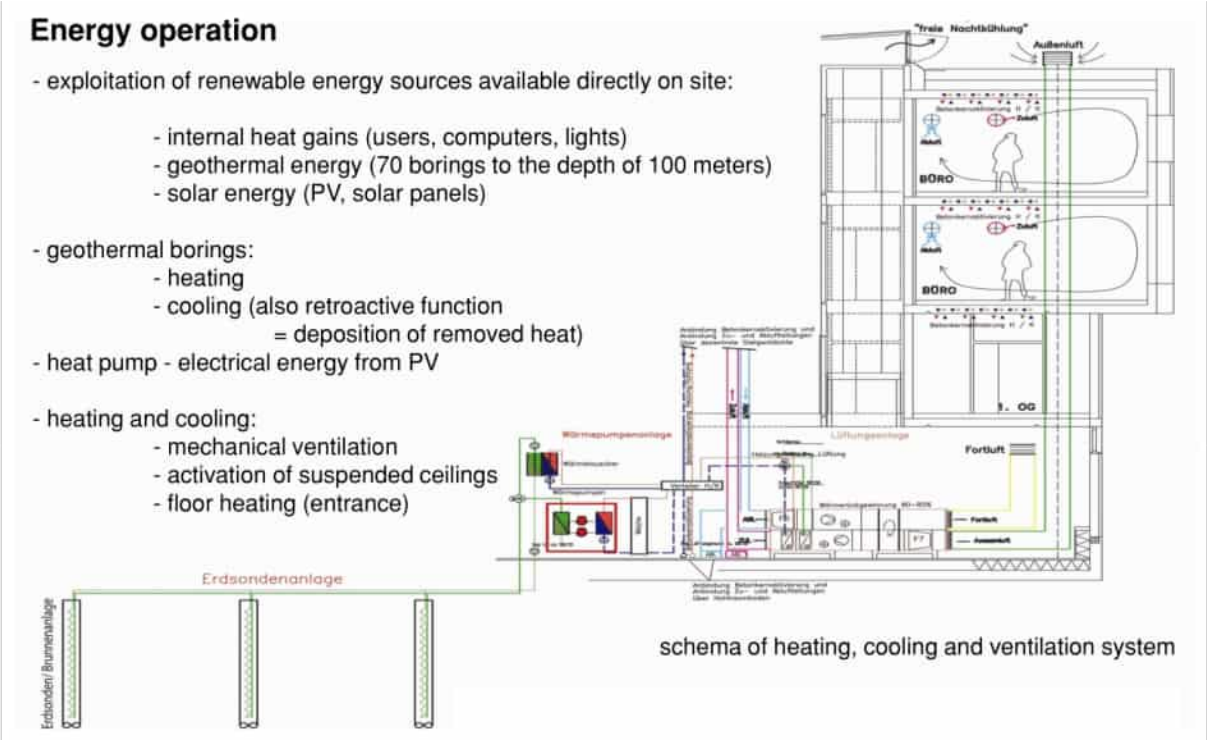

Figure 12. heating, cooling and ventilation scheme

The energy concept is supported by the extreme facade layer of „glass lamellae“ in the west facade (Froniusstrasse) as well as a „green planted“ screen in the east facade (court). On the one hand this design attracts and becomes the business card of the building, on the other hand the silk screen printed levels of glass lamellae to the solar state can be postled within the use of solar protection in summer, the passive solar energy use in winter und of the all-year weather protection for the behind situated windows of 3 discs of insulated glasses.

Figure 13. detail - planted screen

Figure 14.planted screen in winter

Solar protection coating of the windows in the change with the energy efficient isolated balustrades that are dressed up with silver gleaming Alucobond records.

Figure 15. material and extract of facade

2.1 New buildings and connections

In one of the new buildings the main entrance with receipt, exhibition, - and welcome zone in a 2-storey high foyer becomes through the floating video conference space above, the open stairs rising up and the view relations with the spatial experiences is the key to Fronius world in Wels. A crossing – crossing "Energybridge", which connects this building with the former intelligently energy-efficient cleaned industrial brick building –top off the spatial sequences of the entrance zone.

Figure 16. court after refurbishment

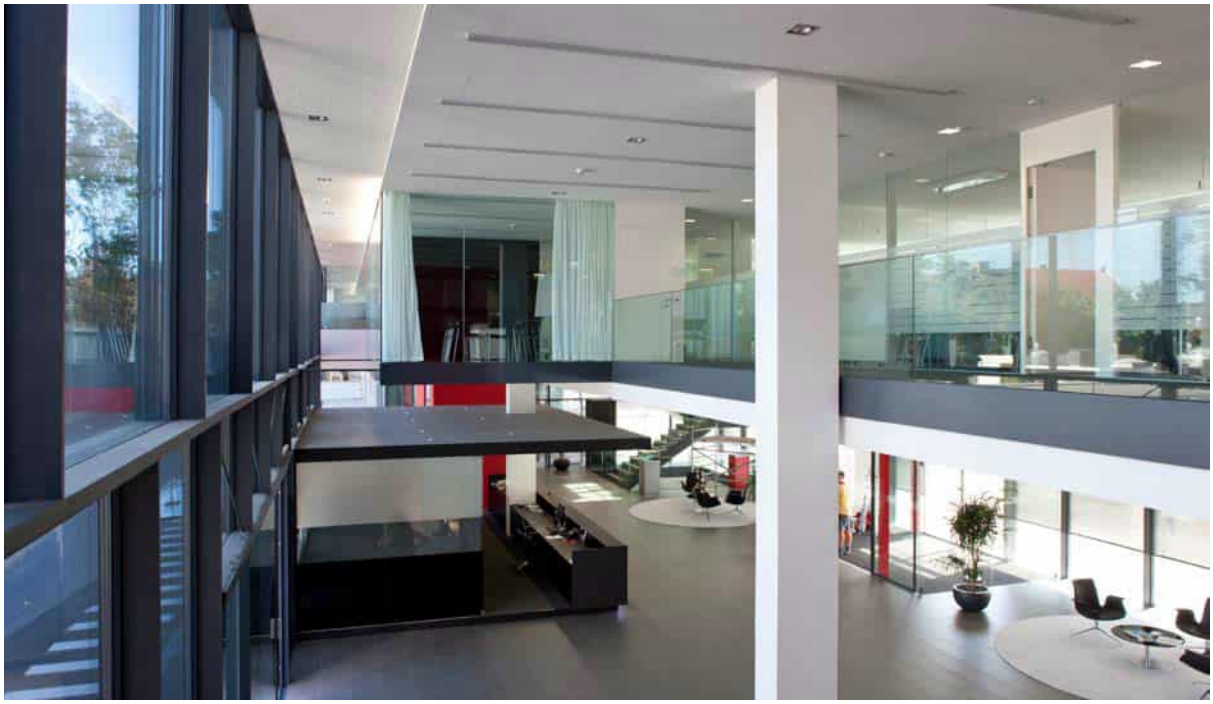

Figure 17. entrance and foyer

The crossing section between the main exhibition of the 3 sections of Fronius –welding, solar systems and battery charging and the „GreenVerticalGarden“ in cooperation with the French garden artist Patrick Blanc leads to the presentation and conference of solar world „Fronius 24 hours sun“. From this point of view 2 elevators bring you up to the 3 storey high „ActiveEnergyTower“ situated on 4 concrete columns over the existing corner building.

Figure 18. welcome and indoor vertical green garden

Different arrangements of offices in form of team working spaces offers optimum expiries and interior transparencies and allow new working forms with freely linkable up jobs. Communication zones, seminar rooms, meeting points as well as the open space workstations complete the varied space offers and attractive terms of employment, the work atmosphere and create Efficiency – promote and flexibility in use.

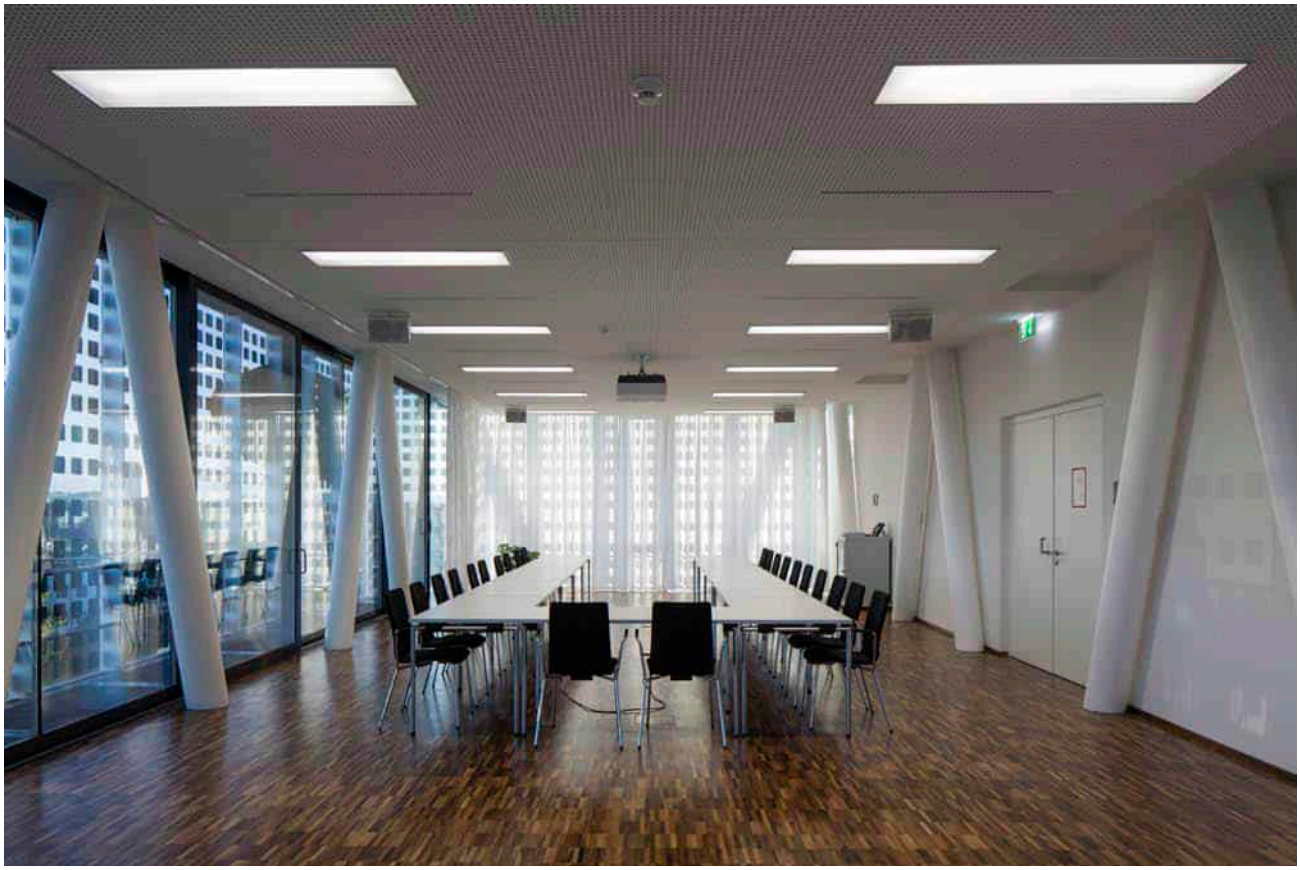

Figure 19. working and meeting space

2.2 Material concept with aesthetic and environmental-friendly main focus

Beside the identity values the grey energy and environmental compatibility are criteria as well as aesthetics, conformance of utilisation, warm storage, fire behaviour and economic efficiency decisively in the development of the colour draught and material draught. The colours reserved in the principle and corresponds to the respective material colours – with exception of the representative Fronius colour red in public rooms as in the foyer.

Aspects of the lastingness and identity of Fronius go to more exemplary internationally and adequate forms of architectural and technical measures to move itself to the borders of the feasibles.

Figure 20. extract brick stone building

Figure 21. energybridge

The former urban industrial accommodation is rehabilitated and spatially renewed in passive house standard at Froniusstrasse.

The simple construction bodies mark a counterpoint to the „horizontal glass lamellae“ and the external facade cover occupied with PV cells of the heightening of the corner building

In addition, the new buildings connect the existing highly energy-efficient cleaned brick building in the southern End of the building arrangement (Froniusstrasse / corner Dr. Gross-Strasse).

2.3 Glass lamellae

With the Fronius stroke as a silk screen grid provided glass lamellae of solar protection glasses are an aesthetically innovative substitute of venetian blinds and optimise the daylight sequences and transparency in the offices behind. They prevent one glare during the summer months and optimise the light situation about the winter months. By the reflexion in the lamellae, it comes to a light entry over them.

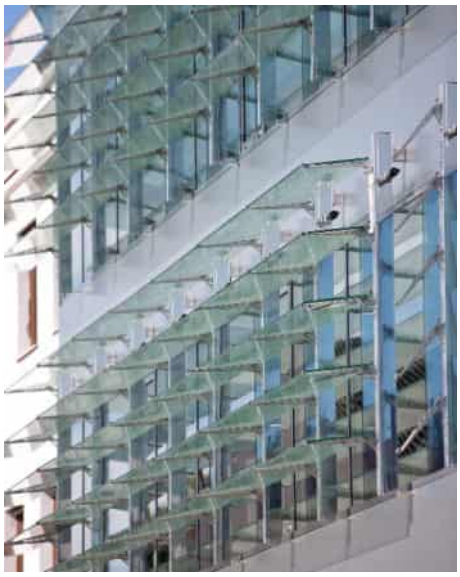

Figure 22. detail lamellae

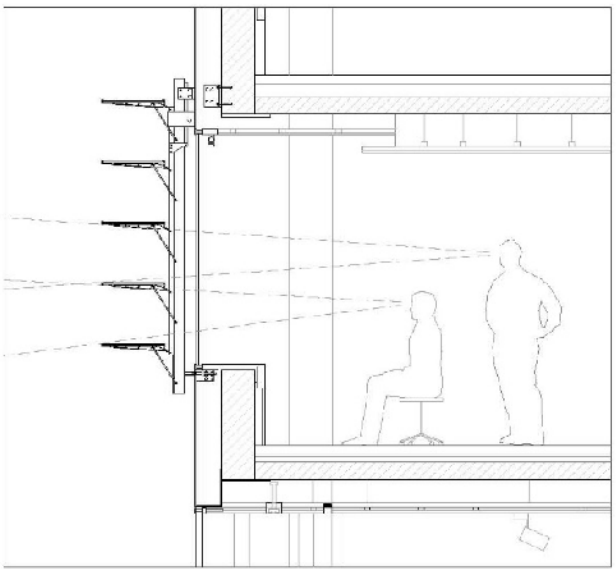

Figure 23. section lamellae

This space cover not only rises the light quality in the offices but also the depth of the space exposure. This optimised light situation also works, by the decreased one application of art light, primarily positively on the working surroundings from and diminished in other result of the long term the energy consumption of the house.

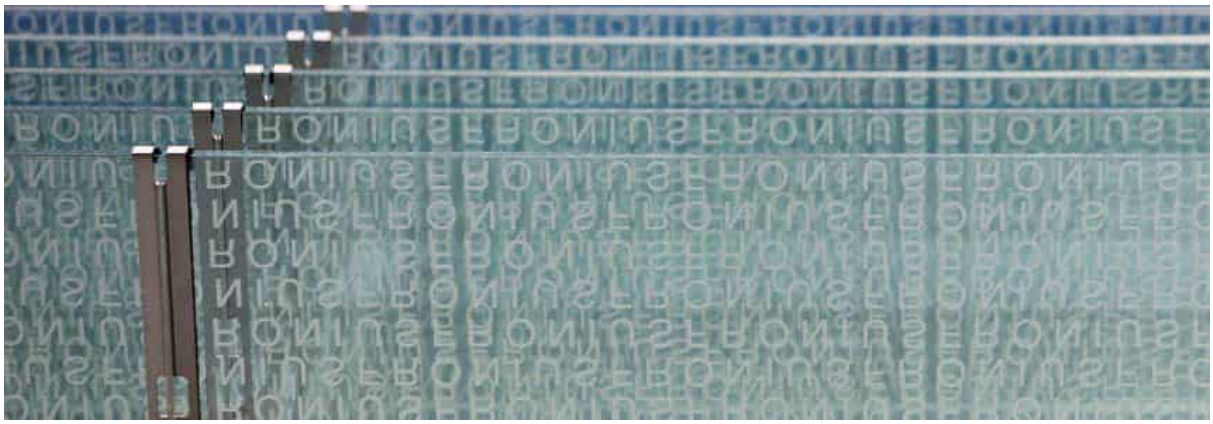

Figure 24. image lamellae

2.4 AktivEnergyTower – PV façade a landmark for the company

The aspect of the profit optimisation became with the facade creation the best respected possible light quality in the interior. That is the way, why the grid of the modules with generous space make a mistake; therefore all in view area raise further. According to Austrian building code, the natural exposure from 6 m depth space has to go about 12% of the floor space amount. In the project AktivEnergyTower it would be at 16.54-m² office floor 1.99 m² windows. This regulation is fulfilled more than necessary with actual 3.63 m² of window surface per office.

Figure 25. AktiveEnergyTower

2.5 Outdoor vertical green garden

To improve the climate in the inner courtyard and welcome zone the French botanist and sketched garden planner Patrick Blanc designed with Heinz Plöderl the first „VerticalGreenGarden realised in Austrian guards “. The vertical planting of plants carries in addition to the concentration CO^2 a decrease of any summery overheating.

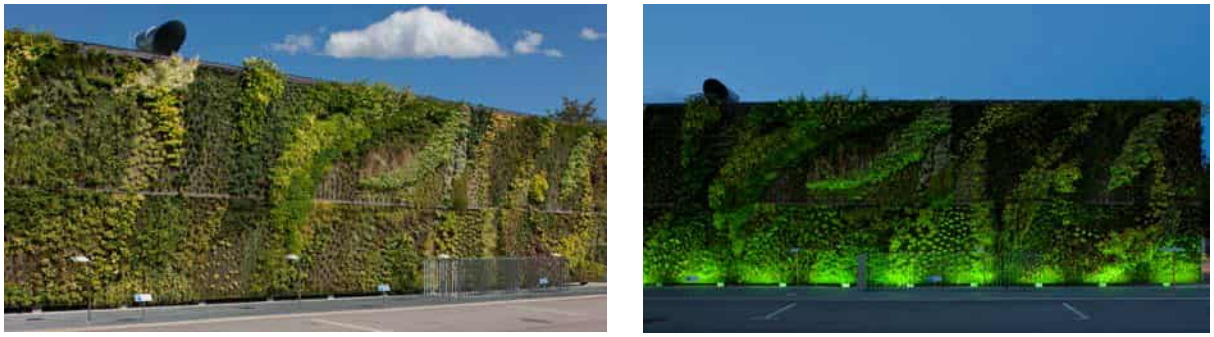

Figure 26./27. VerticalGreenGarden – Patrick Blanc

3 Content of the project

First energy autonomous revitalization of an urban former industry quarter with the standard type of passive house to reduce primary energy to max 100 kWh/m2 ea per year

- Energy saving up to the factor 10 compared with the present situation.

- Interchangeability of vacuum-insulation during in the street building line or in problem zones of the enlargement and reorganisation

- Development of a solid, durable facade – standard passive house

- Comfort profit and increase of the comfort content of the project: -

- Conversion of modern architecture in the passive house standard to PHPP to an „AktivEnergyTower”

- Realisation of warm bridge conditions and unsteady warm transport and humid transport

- Realisation of a well designed modern architecture in passive-house standard” according PHPP considering the existing structural fabric.

- Profit energy concept for the room conditioning for service building under exploitation of local renewable resources

- implementing of passive chill strategies for service building in the inventory on the basis of office use

- optimising operation more than 2 years and accompanying profit monitoring - high-class monitoring

The first autonomous revitalization – (rehabilitation, reconstruction and spatial renewal) in the standard of passive house offers a chance for the huge amount of housing from the 20th century to realise best practice objects. This could be a good basis for the improvement of promotions to urban energy efficient factor 10+ renovations.

3.1 Developments and applications

- Application of several systems for new developments of facades in passive-house standard

- Precast energy Photovoltaic facade – active energy tower

- Peripheral comfort ventilation with high efficient heat recovery

- insulation to the minimisation of the warm bridge – especially in the street line facades

- Implementing of passive “cooling” strategies for office buildings

- Conditioning for service building under renewable resources – local use

- Building - interesting modern architecture in passive house standard for sustainable architecture

Figure 28. brick stone building connected

Figure 29. Extract court

4 Results

- before renovation: approx. 225 kWh / m² effective area

- after renovation: Energy autonomy for heating and cooling

- reduction of the energy demand for heating to 90%

- reduction of CO2 emissions for heating and cooling to 95 %

- increase of user comfort compared with standard houses – fresh air and no mouldy rooms

- Impulse to the Austrian economy for revitalization with components in passive-house standards and locally usable renewable energy, as photovoltaic, earth solar field.

- Airtightness n50 from LWZ 4,2 to LWZ 0,5

- quality management with blower door measuring with leak finding under use of

thermocamera

Innovation and impulses for Austrian economy for revitalisation of a urban accommodations with passive house components and locally of usable renewable energy sources as solar irradiation and earth probe fields.

Protecting the environment and conserving resources are extremely important to Fronius. Relevant structural measures at all the company's sites ensure that we can always put our ideas of sustainability and ecology into practice. We have redeveloped the former industrial district surrounding the railway station in Wels to take on a new guise as the Fronius global sales hub. By combining geothermal energy with solar power, Fronius has achieved energy autonomy for heating and cooling.

On route of becoming the “Worldwide N° 1”, Fronius is revitalising its Wels site. Scheduled for completion the first step of refurbishment by 2013, the new international Sales Headquarters will act as Fronius’ gateway to the world. The overall energy concept, comprising deep-penetration boreholes and advanced photovoltaic systems, results in a low-CO2-emission solution. Large-scale windows, domed roof-lights and two-storey high light-shafts let daylight flood into the very last corner of the employees’ workplaces. The offices in the distinctive new brick building on Froniusstrasse have been home to the entire Welding Technology Division since the end of July 2010. With an underground car-park, with 275 spaces for cars and 27 for motorbikes. The Wels project team is now hard at work once again on the preparations for the next phases of construction and further refurbishment and developing of the headquarter.

If we want to leave behind an intact, ecological, social and economic structure for future generations, it is necessary to build a sustainable economy. With this in mind, Fronius commits to an environmental policy that is based on sustainability, and is regularly reviewed and updated. This is the management board’s responsibility, and is firmly entrenched in our values under corporate social responsibility.

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TEACHING MATERIALS THROUGH THE FRAMEWORK OF EMBODIED ENERGY

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Abstract

Principles of environmental responsibility have radically transformed the context of teaching materials to students of architecture and interior design. While learning about material issues in a comprehensive academic course introduces students to a wide range of design issues, including performance and aesthetic properties and questions of expressiveness and character, the focus of this paper is to consider how the framework of embodied energy affects the pedagogy of teaching material resources. While understanding and applying material properties involves critical issues beyond total energy consumption, it is the environmental concerns about materials that provide students with an integrated, comparable, and ethical context. An emphasis on the embodied energy of finish materials results in useful and comparable data, critical assessments beyond superficial attributes, caution in the face of misleading promotional material, and project conception beyond local place and initial timeframe. When the student learns where materials come from and the resources that are used to deploy them, a door is opened to the broader implications of their designs and their own relationship to humanity and nature.

Keywords

Embodied Energy, Materials, Education, Interior Design, Construction Materials

The traditional academic study of building materials emphasizes important selection criteria but lacks a comprehensive and holistic context [1]. While establishing aesthetic and performance criteria for appropriate material selection is a key pedagogic goal for a young designer, being able to compare materials that behave and look similar requires a broader context. Making environmental issues central to the understanding of material knowledge not only provides rational comparable criteria but an ethical and inter-connected context for material allocation.

This paper does not address how to teach principles of environmental impact and responsibility *per se* – that is a much broader topic. Instead, the central concern of this study is how to teach materials, in particular finish materials, to young designers. Emphasizing the

broader environmental impact of their material selection allows students to understand that the choices that they make have important consequences and gives them information and agency to assess why one material may be preferable to another. Besides the actionable knowledge that can instrumentally inform material selection, this approach to material studies presents a unique set of pedagogic opportunities: seeing the big picture, useful metrics, criticality, comparability.

The embodied energy of individual materials offers a critical tool for making informed and comparable material selections. Embodied energy is the the total amount of energy that is used to procure, process, manufacture, transport and install a particular material [2]. It is energy that is stored in a material that it comes to the job site with, carries inside it while it is used and continues to contain when it is reused or is discarded. The measurement records the collective effort that distinguishes that material. This embodiment is to be contrasted with other measurements of energy used in buildings such as operational energy, which is the energy needed to run a building – heating, cooling, and lighting, for example [3]. While efficiencies in building systems can optimize operational energy they do not address the energy that is embodied in material the building is made of. A net zero building that may consume zero operational energy is still made from materials that have varied embodied energies [4]. While comprehensive energy mapping of a building design may address the broader environmental footprint of a piece of architecture, embodied energy is a more precise tool for looking at the materials themselves.

This distinction from operational energy makes embodied energy a more useful tool for learning about finish materials in particular. While much scholarly work has been dedicated to assessments of the environmental impact of construction systems [5], little scholarly attention has been dedicated to the finish materials we actually surround ourselves with in interior spaces – where we spend 90% of our time [6]. Frank Duffy has shown us that, over the useful life of a building, finish interior materials are replaced more frequently than structural materials, and may constitute a larger aggregate capital investment than other components [7]. An academic course in material resources should consider the environmental impact both of structural material and of finish material.

There are many ways to measure the environmental impact of architecture and perhaps there are more effective measurements for overall building performance – total carbon footprint, global warming potential, lifecycle assessment, etc. These measurements may also be more usefully calculated at the earliest phases of the design process [8]. The advantage of a measurement like embodied energy for the academic study of material is that it focuses on a very specific measure of what it has taken to deploy individual material components. While buildings are made of inter-related parts and systems, an emphasis on embodied energy allows a student to focus on substantive differences between the different materials themselves.

A critical frame to emphasize for students is where materials come from and what consequences arise from their procurement. It comes as a revelation to many students that

there are, in fact, significant health and cultural impacts of common materials. It is new to them that we literally surround ourselves with toxins, particularly if we select materials according to aesthetics, performance criteria or first cost. Indexes of harmful materials used in the building industry, such as the International Living Future Institute's *Red List*, help to establish awareness of how many materials have truly negative impact [9]. Putting the selection and procurement of material resources in an ethical context is a critical framework for a design student, who may never have considered the broader consequences of material choices.

Material allocation is a global issue. But until the nineteenth century, all material consumption was local. Only in the twentieth century were raw materials distributed all over the world to be processed and consumed. Material extraction, consumption and depletion have an enormous effect on the ecology of global systems and we as designers have an instrumental responsibility to consider the implications of all this resource transportation and trade. On the first day of class, students need to be challenged to understand the global implications for human health and culture.

Case Study 1. Lara Almarcegui.

The broad themes of material allocation and its provenance can be introduced through poetry and art as well. The work of artist Lara Almarcegui arises from a critical awareness of what buildings are made of and where building materials come from. At her 2010 installation at the Vienna Secession as well as the Spanish Pavilion at the 2013 Venice Biennale, Almarcegui presents the disaggregated components of the exhibition hall itself [10]. She presents an analysis of the same materials in the same quantities as the building that contains them. She makes us consider where we are, but by separating building components in raw piles each finding their angle of repose, we are asked to consider the origin, the artifice, the energy that a built structure embodies. Her work gets us to consider what things are made of, where materials come from, and how raw materials are fused through alchemy into architecture.

These need to be the same concerns of our students. What are buildings made of? Where do building materials come from? How does one decide what material to make a building from? What consequences derive from our choices? What does it even mean to be responsibly sourced?

Design students are introduced to the palette of building materials in two principal ways: first, through technical courses dedicated to material properties and second, through their creative application in studio courses. The technical class on materials is the organic chemistry of the design curriculum: it is the place in the curriculum where we explore the unique performance and aesthetic properties of materials so that students learn to make informed decisions about how to use the appropriate material for their design intent. One of the fundamental lessons here is that students learn that material selection concerns much more than superficial aesthetic appeal. This is something that must be taught at many levels and the technical lessons introduced in a materials class need to be reinforced by application in studio projects.

In the technical courses, students learn to differentiate materials based on aesthetic and performative differences. They learn how to classify similar materials into useful categories that are particular to that material. Wood is understood by species and grain; stone is classified by geological origin and by chemical composition; textiles are classified by fiber content, yarn composition, construction technique and finish techniques. How can one compare unlike things? Embodied energy connects the finish product with its process of production by quantifying energy resources.

One of the virtues of embodied energy as a tool to understand material selection is that it is fundamentally relative. While the exact metrics vary according to methodology, it is only the relative value that matters for the student. Vinyl has a higher embodied energy than wood. A local limestone has a lower embodied energy than one imported from far away. Glass has a lower embodied energy than plastic for a similar transparent plane. The take-away is that material extraction, consumption and depletion have an enormous effect on the ecology of global systems and we designers have an instrumental responsibility to consider the implications of all this resource transportation and trade.

In studio classes, students apply this material knowledge in design projects that have multiple integrative pedagogic objectives. An understanding of the innate properties of a given material lets the student designer associate a material with its best application. Students learn to associate material selection with design intent. Using the most appropriate material for a given application is an inherently sustainable approach [11].

One generational challenge is that the digital methodology with which students learn to allocate materials in their designs - libraries of digital options – reinforces the most superficial physical properties of materials. In this widespread approach, all material choices seem similar like so much color and pattern. If they want something that is reflective or textural, they select a particular material from a CAD library and they use digital tools to flood de-materialized surfaces. This deeply entrenched methodology literally reinforces the most superficial understanding of materials – that materials are a visual effect that cover a surface. One can easily make materials do things in Photoshop without any knowledge of material properties. For the architecture or interior design student for whom all of this content is new, comprehensive and comparative criteria are useful to determine the appropriateness of one material choice over another. They need to learn to associate their earliest design selections with specific material choices, so they need to learn to have a rational basis for their comparisons.

Case Study 2. Kiel Moe

We see the comparative value of embodied energy in the example of what architect and educator Kiel Moe calls the Stackhaus. In Colorado in the United States, Moe built a small house of stacked 15 x 20cm solid wood spruce timbers and showed how the apparently inefficient use of solid wood outperforms the default American vernacular of stick

construction in a number of metrics [12]. While the standard American system of stick and plywood is cheap and unavoidable, Moe provides an analysis that seems counter-intuitive: a more massive material may be more efficient in terms of embodied energy, carbon sequestration and thermal conductivity [13]. The wood is grown and processed locally; transportation costs are low. The structural wall is the finish material as well so there is no additional cladding, inside or out. A critical takeaway is that local materials frequently have lower embodied energies. Renewable and harvested materials have lower embodied energies. Innovation in assemblies can have impact on geography, economies and climate.

As Kiel Moe's work demonstrates, one of the values of embodied energy is in its demonstrative comparative value. Especially for students, the absolute numbers matter less than the relative values. Others have demonstrated that a useful way to use embodied energy is to translate it into equivalent values, like comparing an all-timber tower of similar size to a steel tower through the absolute energy values in Joules [14].

Some have questioned the efficacy of using measurements of energy consumption as the best way to evaluate a material's environmental impact. These critics argue that a lifecycle assessment may be a more comprehensive tool, particularly for the whole building. Further, even if we are searching for a holistic and ethical evaluation of a particular material, we should have a better way than energy use to fairly judge the health effects on fabricators and the local environmental impact to air and water quality [15]. These critiques are effective only if embodied energy is used as the exclusive measurement and assessment of the material. Of course, supplemental information is essential.

An important case in point is concrete. Concrete generally has a fairly low embodied energy: its raw ingredients - sand, lime, water, gravel - are common, environmentally inert and found all over the globe. The ingredients for concrete usually do not have to travel far. But concrete presents a basic problem: the chemical reaction that creates cement releases vast amounts of carbon dioxide, possibly as much as 5% of all anthropogenic CO_2 emissions [16]. It is chemically impossible to covert limestone to calcium dioxide without producing carbon dioxide. A second problem is that the production of cement requires high temperatures and the combustion of large amounts of fossil fuels [17]. Alternate mixes that substitute magnesium oxides and silicates for calcium carbonates look to mitigate these issues. Clearly the low embodied energy of concrete alone does not tell the entire story.

So while embodied energy can be an effective tool, it should only be seen as a part of overall environmental assessment. It is important to develop methodologies to accurately assess both the carbon and energy footprints of material components [18].

Before knowing how to distinguish between the relative importance of one set of criteria over another, students need to understand the global context of material resource exploitation, waste in production and disposal, and the connection to broader environmental and ethical issues. There is a need for the big-picture broad introduction to environmental issues that

establishes the ethical context for this discussion. Only then will a discussion of the discrete properties of material resources make sense.

Writers who have addressed the relationship between finish material selection and the environment understand that the frame of environmental impact is a necessary but not a sufficient understanding of material properties. These writers aren't content with clichéd responses to use "green materials" and caution to be suspicious of "green branding" [19]. They embrace the creative challenge of responsible material selection. They fundamentally recommend an initial vetting process by which deleterious materials are plainly rejected and others are evaluated for overall environmental compliance [20].

This is a theme that many writers have usefully offered: that vetting "gateway questions" can act as preliminary filters for the environmental suitability of a material selection. These kinds of internal checklists allow us to be both informed and responsible [21]. Several available texts offer this vetting strategy. What big questions do we need to learn to ask before we can go on to the next step and specify specific material qualities?

In this way, we use environmental data about materials as a gateway evaluator for selection. It is a broader framework than embodied energy, but it includes it in the calculus. For example, is the material needed? Is there an equal available material from a local source? Is there any recycled content? Are there health consequences associated with it extraction, production or use? What is the relative embodied energy? Etcetera.

These gateway questions are important because there are no easy answers to the question of whether a particular material is environmentally responsible. For students, for whom this is new, it is not as easy as specifying products that are marketed as "green materials" or specifying according to green certifications, as helpful as these categories may be. The extraction, production, use and disposal of all materials consume energy and resources and there are consequences to our choices.

Case study 3: Corian

So we ask our students to consider this paradox with an exercise in critical thinking. We instruct the students: go to the DuPont website, for example. Answer the question: is Corian by DuPont a sustainable product? When the student goes to the website, under the heading "DuPont Corian is Green," she reads: "Corian is a durable, long-lasting and renewable surface material that fulfils the goal of sustainable design, reducing environmental footprint" [22]. Scroll down and she sees that one can earn LEED credits for using the product, that it has a percentage of recycled content, that its easy-to-clean surfaces help keep people healthy, that it exceeds guidelines for VOC emission. It is certified by Scientific Certification Systems (SCS) for stated recycled content, it is NGBS Green Certified. It even has a *Declare* label that answers where the product comes from, what it is made of and where it goes at the end of its life. At the bottom of the page, she sees that the DuPont corporate logo and the USGBC logo are both displayed with equal graphic authority.

When she reports these findings to her classmates, it is the discussion that is important. Did she find out what Corian is made from? (petrochemicals and aluminium trihydroxide) [23]. This suggests a very high embodied energy. Though it satisfies LEED credit 5.1 for Regional Materials because of the location of DuPont certified installers and the location of its final assembly, did she find out from where the material resources were extracted? (who knows? Probably Saudi Arabia or Venezuela, not where the material is "locally" installed). Did she consider what DuPont might mean when it uses a loaded term like "renewable"? (they don't mean you can grow more; they mean if you scratch it you can sand it down). What does she think they mean when they use the term "long-lasting"? (that it is a thermoset plastic and that when its current life is done it will sit in a landfill forever and ever). On the other hand, it is anti-microbial, it does not emit VOCs, it requires low maintenance, it produces little waste in manufacturing, in theory it could be reused for another purpose; there are clearly worse environmental choices. The calculus is complex: the answer is neither no nor yes; the lesson exceeds being able to get LEED credits or finding virtuous products through green specification programs.

The more important lesson is a broader strategic lesson in criticality: how to assess conflicting and sometimes misleading data. We live in a time when we have access to overwhelming amounts of information – and misinformation - and perhaps the critical insight is not which materials are green and which are not but what are the more incisive questions to ask. What questions should be asked of a material so interior designers and architects can responsibly act as gatekeepers? How can we teach young researchers to read between the cynical and misleading green-washing of market forces? How can the concerns of total energy footprint expand the student's inquiry across oceans and beyond initial costs? How can we move a students' understanding of materials from appearance to sustained performance?

One of the interesting consequences of using embodied energy as a tool for teaching materials is the way it addresses both the global scale of material acquisition as well as the local scale of use [24]. It also implicates timelines beyond initial installation by suggesting that the material embodies its energy even beyond the lifetime of the building in which it is installed. It helps to establish what the real cost of a material is.

Students need access to information about different materials beyond superficial appearance. A standard that is comprehensive and compares criteria helps to determine the appropriateness of one material choice over another. Embodied energy offers us that clarity.

While the traditional academic study of building material emphasizes important performance and aesthetic selection criteria, these lack a comprehensive, inter-connected, and responsible context. Performance and aesthetics alone describe an incomplete understanding of material selection. It is an unsustainable approach. As professionals and client groups demand changes from unmanageable patterns of consumption of natural resources, the context for academic

material studies has changed. The frame of embodied energy creates moral, contextual and critical lessons for students of design.

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'I LOVE NOT MAN THE LESS, BUT NATURE MORE' A CRITICAL PERSPECTIVE ON AN ECO-AESTHETICS FOR SUSTAINABLE ARCHITECTURE

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Abstract

Nature is not something we left behind in becoming civilized; the natural in us is not to be overcome. Nature affects us, it has been affecting us, and will continue to affect us. Human beings understand nature with their bodies and we recognize that we care about nature, because nature affects us. Nature is ahead of us. What really counts, then, at least according to the philosophy of Gernot Böhme, better known to architects for his theory of atmosphere than for his ecological aesthetics, is that human beings develop the consciousness that body is the nature that we ourselves are. However, this is a very different understanding of nature, and also of aesthetics, and in this paper, I examine this ecological aesthetic of nature ahead of us to ask from what perspective might it be possible for an ecological aesthetic in architecture to impact on our way of thinking about an environmentally responsible and socially just future?

Keywords

aesthetics, ecology, atmosphere, philosophy, co-existence.

1 Introduction

Nature lies before us. Art should make of this its theme. The work art makes, then, is to uncover a realm largely unknown to us: an experience long repressed [1]. Nature is not something we have left behind in our becoming civilized; the natural in us is not to be overcome. Nature affects us, it has been affecting us, and will continue to affect us. This really does not mean the preservation of nature, nor the return to nature, but the recognition of our feeling. These are the arguments of Gernot Böhme in his book *Die Natur vor uns* [Nature Before Us] and where he argues: 'The point is that nature itself cannot be taken as a pure fact, but as a multiplicity of possibilities that are opened up through

practices and exercises' [2]. Discussing Böhme's work, Kate Rigby further adds: 'It is for us to work out what kind of ''nature'' we actually want to inhabit collectively and to embody individually' [3]. From what perspective therefore, might it be possible for an ecological aesthetic to impact on our way of thinking about an environmentally responsible and socially just future? Or, in other words, how can rethinking aesthetics impact on architectural practices?

This paper thus has three parts: the first, a background to a conversation that diverts attention away from architectural aesthetics; the second, an investigation of how an ecological aesthetic is understood through the work of Böhme and a political aesthetic in the work of Jacques Rancière; and the third section, a discussion of design as mode of inquiry, where it is a new thinking about what it is to experience the natural, and the human, that is explored. The intention, in all these sections, is to think, in part, outside traditional and contemporary understandings of human freedom and social responsibility, and to reimagine how design, in its practices, could allow us to question bodies and environment. The title to this paper "I love the man not less but nature more," [4] raises however a secondary, and important concern implicit in this work about the importance of the environmental over the social within the context of sustainability and architecture.

2 Architectural Aesthetics and Ecological Thinking

For Böhme, an ecological aesthetic is a matter of changing how the human, how its nature, inner and outer, is understood. Criticism that a concern for Nature is backward looking operates itself, he argues, within a frame of existing indifference: within a way of thinking that has grown old [5]. The issue is not the preservation of nature as it has been given, as it has been already understood, but rather the production of nature as something new and the cultivation of a very different understanding of the natural state [6]. We feel nature, and our nature. However, what is at question in this ecological aesthetic is not only the aesthetic experience as such but also the emancipatory significance of the experience.

I felt like lying down by the side of the trail and remembering it all. The woods do that to you, they always look familiar, long lost, like the face of a long-dead relative, like an old dream, like a piece of forgotten song drifting across the water, most of all like golden eternities of past childhood or past manhood and all the living and the dying and the heartbreak that went on a million years ago and the clouds as they pass overhead seem to testify (by their own lonesome familiarity) to this feeling. [7]

The words are from the writer, Jack Kerouac, and the poetry thrills, new, different in its feeling; but what impact does this have? This poetic form has lost its environment and the significance of tone, and breath, in the poems performance.

Design critics and theorists often argue for the need to perceive the world differently, to find new ways to live, to create new values to replace the old: after all our habits of living, exploitative desires and expectations have irrevocably altered planetary conditions. Ethical questions are implicit: how not to exploit the other and how not to misunderstand ethical relations. Such arguments have also been seen as a reaction against a "technocist

supremacy." [8] What is common to the conversation, however, is the perspective that sustainable design can differ greatly in the interpretation of the cause of, and the answer to, unsustainability: While aspiration for a better future can be widely felt, it is poorly defined. It all makes for a context of competing, and contradictory, certainties, or as Simon Guy argues: '…divergent and mutually irreconcilable sets of convictions both about the environmental problems we face and the solutions that are available to us.' [9] To argue for the reevaluation of aesthetics may seem like an extravagance, but rethinking aesthetics positions the causes and solutions of sustainable design as human in cause and solution.

2.1 Atmosphere

In describing atmospheres, Böhme writes: 'Atmospheres can be produced consciously through objective arrangements, light, and music – here the art of the stage set is paradigmatic. But what they are, their character, must always be felt: by exposing oneself to them, one experiences the impression they make' [10]. This aesthetic of architecture as atmosphere is thus not about what something represents, but rather how it becomes present, how it is received.

Popular understanding of aesthetics makes a common distinction between frivolous and shameless aesthetics and practical or rational concern; and between the man of taste and the ordinary man. Aesthetics are understood as judgement more than experience. The sense of beauty is a form of judgement, Immanuel Kant argues: an aspect of the human condition, comparable to, but distinct from, that of practical, scientific or technical, understanding. Kant identified and distinguished the engagement of the human mind into three: theoretical, practical and aesthetic (understanding, practical reason, and judgement). These are distinctions that still impact on common understandings of architectural aesthetics.

Böhme's perspective, however, returns aesthetics to its original meaning, as a theory of perception, he argues. Moreover he understands aesthetics as co-creation between subject and environment. His approach promotes the importance of spatiality, in experiencing architecture and it expands the range of arts generally considered within aesthetics [11]. He writes: 'For all the talk of design, at stake are not the things and their form. Rather, the focus is on scenes, life spaces, charisma. Here, atmosphere is the explicit object and the goal of aesthetic action.' [12]

Nevertheless, British philosopher Roger Scruton, following Kant, argues in his *The Aesthetics of Architecture* that judgement is indeed naturally expressed very early in life, and is socially directed. But, for Scruton, aesthetic education also represents a return to learning rules and patterns from mostly the classical tradition. [13]

In a concern for how atmosphere is received in Böhme's work, the discourse of aesthetics is reoriented away from the thing and to the space between human and environment. As he writes: '…the object and goal of aesthetic work is literally nothing; i.e. that which lies "between," the space.' [14]

3 'Nature lies before us' An Ecological Aesthetics?

A flower blossoms, and aesthetics and practical concern, and aesthetics and social concern, or politics, are all too easily seen as distinct and opposing categories. Böhme's "The Art of the Stage Set' is one of the key texts to describe atmosphere, and to describe the aesthetics of atmosphere as that of concern for reception as opposed to production. Nevertheless, his ecological aesthetics is somewhat different to the aesthetics of architectural atmosphere.

Ecological aesthetics suggest knowing through the body – a carnal sort of knowing; heeding our bodily sensations. It suggests the cultivation of senses rather than a domination of feelings. It is the beginning of a nature ahead of us, and as Rigby writes: 'In order to answer the question as to what kind of nature we wish to inhabit and embody we need to begin by ascertaining what ''nature'' means to us from a non-instrumental perspective.' [15]

Attentive, then, to how one feels, sensing bodily existence in the presence of other people, of things and with thinking and feelings equalized: such aesthetics reconsider the inner and outer experience of the nature we ourselves are.

This revaluation of body and senses is at the heart of how Böhme conceives of an ecological aesthetics, and while we ourselves are not *usually* our body as nature, our task, the task assigned to us, is to discover our nature: 'to unfold one's being-a-self in such a way that one's own being-nature is admitted to it.' [16]

4 "I love the man not less but nature more" An architectural aesthetics?

Architects, in their practices, could recognize that one of their many roles are to create new sensibilities. The concerns of sustainability in architecture cannot remain narrowly focused: boarders and boundaries, marginalized communities and access to natural resources each impact on the discourse of architecture. Aesthetics could, nevertheless, despite the suppression of its consideration, illuminate shared experience: allowing people to internalize new values, intervening in and transforming, cultivating, and normalizing feelings. In this way aesthetics incorporated into architectural practices become shared and social activities

In his paper "The Aesthetic Revolution and Its Outcomes," Rancière starts his argument with the premise that we are only completely human in the aesthetic experience (and he uses the example of play). The aesthetic experience is one of both equality and heterogeneity, he argues [18]. The subject and object are caught up in a sensorium. This experience , he argues, holds the promise of both a world of artistic creation and a new life for the community. Thus, the aesthetic problem, for Rancière, is always a political one: it is a disruption in how we assign meaning, troubling our usual selves. This is in opposition to an understanding of aesthetics as that which attributes privilege to taste and suppresses the possibility of the art of everyday life or of "changing life". [19]

Such arguments have feminist parallels too and Luce Irigaray examines in her philosophy the discovery of a *sexuate* and ecological belonging, a criticism and cultural formation, which could also be described as a feminist political aesthetic. [20]

Each of these thinkers, Böhme Rancière, Irigaray, however, illuminates the difficulty of notions of the body, or lived body, and the value of sensory experience in contemporary life.

One of the "political" questions Böhme asks however, is whether knowledge gained through experience, or in everyday life, we can really continue to possess the kind of knowledge that enables us to cope with its demands and independent of the experts, and he means scientists. [21] His concern is that traditional ways of understanding what we know, through experience, lack the self-criticism to formulate alternatives to science. This sort of knowledge is considered inferior, he writes: 'knowledge of the life-world (*Lebenswelt*) has therefore hitherto been either simply seen as nonknowledge or as a less exact, softer, and dependent kind of knowledge [22] Discussing traditional midwifery, as example, he argues, what is implied in the traditional knowledge of the midwife is an entirely different approach to nature to that encountered by the science of obstetrics. [23] The midwife witnesses the unfolding of natural processes: and mother and midwife both partake. Nature is *physis* (growing and becoming). His arguments are not so much about childbirth, or the unfolding of life as such, but the problematic cultural demarcation of experiential knowledge from the privileged, scientific expertise.

The arguments I have proposed hold the potential to understand aesthetics in architecture, as an emancipatory practice of changing how we live, how we relate to the environment and to others; what we value in living. Ecological aesthetics emphasizes that problem of sustainable design is a human concern and adopting the philosophies of Ranciere and Bohme of freeing ourselves to a natural belonging within the current environmental and social contexts: a critical and active engagement in living. Ecological aesthetics are political and a design question.

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and music in its roar: | I love not man the less, but nature more,| From these our interviews, in which I steal | From all I may be, or have been before, | To mingle with the universe, and feel | What I can ne' er express, yet cannot all conceal." From the poem "Childe Harold's Pilgrimage".

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GET WEAVING – VARIABLE DENSITY CABLE MESH PATTERNING USING DIGITAL COMPUTATION TOOLS.

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Abstract

Addressing suicide risk within high-stress public buildings, such as universities, has become a pressing challenge in architectural practice. An increasing duty of care has led to greater balustrade height requirements, (as high as 2200mm) where balustrades become more like walls – closing in the very spaces architects seek to feel open. Stainless steel cable mesh is increasingly put forward as an effective balustrade alternative – but the resulting aesthetics feel more like what you might see in the correctional facilities in HBO's Oz television series, than a creative, freethinking home of scholarly pursuits.

In this paper, we define and test a method for the cost-effective documentation and production of custom, decorative stainless-steel cable mesh balustrade systems. We have developed and tested a computational process that enables flexible and efficient documentation and production of decorative balustrade systems with potential integration with CAM processes. The tool allows contractors to accommodate design-driven demands for custom meshes, whilst achieving documentation and constructability gains and accommodating rapid re-documentation of design refinements during tendering and construction stages.

Keywords

Computational tools, pattern, decoration, safety.

1 Introduction

1.1 Background - tension between open architecture, falls and suicide prevention

Balconies are an important architectural element of buildings providing direct and integrated access to open spaces, but it is important to consider that these spaces can also be extremely dangerous with over 5000 balcony related injuries including deaths each year in the US alone (1).

Balcony balustrades vary in height depending on local codes but are generally restricted to a minimum height of 1000mm (2). If the balustrade is designed with appropriately spaced gaps and is non-climbable (without footholds), this height is deemed effective in preventing 'typical' accidental falls by children or adults [1]. This height is, however, not effective if movable furniture is nearby. For example, a chair or other piece of furniture may be moved to a position close to a balustrade and a child may use it to climb and accidently fall [2,3].

Addressing suicide risk within high-stress public buildings, such as universities or courthouses, has also become a pressing challenge. Standard minimum height balustrades are not effective for prevention of suicide [4,5] and even when heights are increased to reduce this risk, again, movable furniture can be pushed against them suggesting that even greater height balustrades are needed.

In architectural practice, an increasing duty of care has led to greater balustrade height requirements, (as high as 2200mm) where balustrades become more like walls – closing in the very spaces architects seek to feel open.

1.2 Cable mesh approach

Stainless steel cable mesh is increasingly put forward as an effective balustrade alternative used as a safety measure in publicly accessible buildings and has been shown to be effective in this role [5].

The mesh is desirable from both design and safety points of view - it preserves the openness of the built environment, especially compared to rigid, opaque or impermeable materials such as glass, steel bars and plasterboard, while preventing access of potentially vulnerable or stressed people to dangerous areas. For example, in the four years after the installation of a safety net at the Muenster Terrace in Bern, Switzerland, there have been no suicides. Furthermore, the use of the net at this location is believed to have had the socially-beneficial flow-on effect of reducing suicides in the wider Bern area [5].

Architects have used wire mesh on buildings in a way that maintains openness [6] but the resulting aesthetics may appear more like what you might see in the correctional facilities in HBO's Oz television series, than a creative, freethinking home of scholarly pursuits.

Stainless steel cable mesh is manufactured using a combination of stainless steel cables and clamp swage sleeves referred to as ferrules. Varieties of this system are available from construction material suppliers such as Ronstan, Jakob and Fleximesh premade in with a diamond pattern [Figure 1]. A benefit of this supplied product is that the mesh aperture and cable diameter can be adjusted to order due to the manual manufacturing process currently

being used. The product is, however, limited in pattern variation with only uniform grid of diamond patterns available [7].

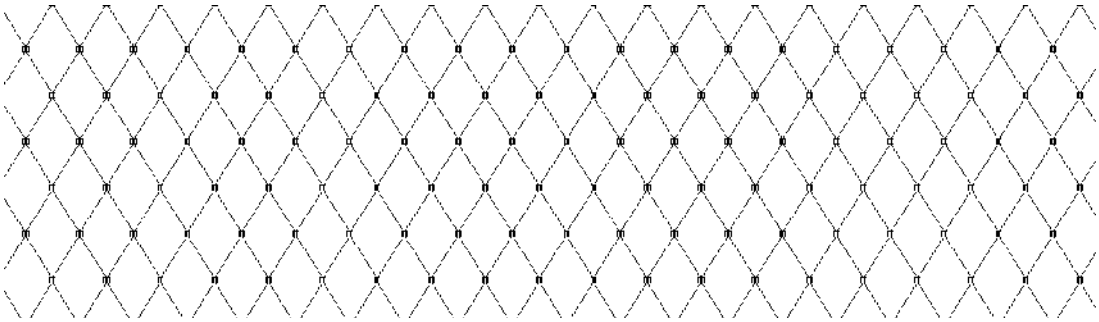

Figure 1: Basic diamond grid pattern fabrication layout of stainless steel cable mesh showing cable connections secured by ferrules to alternating sides.

There is a desire by architects for decorative patterned surfaces as evidenced by the proliferation of products such as 'Pic-Perf' and other customised perforated steel systems now common in the construction industry [8]. Though theoretically it has been possible to modify the simple repeating diamond pattern [Figure 1] the documentation of variation (beyond very simple banding) variation has been prohibitively time consuming.

An algorithmically generated customisable patterned 'woven' wire mesh, if quickly documentable and produced rapidly and without dramatic cost implications, could achieve similar construction industry market impact and allow for a variety of new and innovative uses.

1.3 Designing with cable mesh approach

Wire mesh design is constrained by the physical requirement that a) each wire in the mesh must connect to at least one neighbour at some points along its length and b) at those points of connection the neighbouring wire must be in the appropriate physical position so that a ferrule can be applied. For example, in Figure 1, which illustrates a diamond grid, each wire alternates connecting to its left and right neighbours.

These limitations cause difficulty when generating wire mesh patterns as the number of valid solutions is vastly reduced and applying modifications to a pattern during the design of the mesh can result in inconsistencies [Figure 2].

Figure 2: An inconsistency - the layout doesn't allow a wire to connect to its neighbour.

It is trivial to satisfy the constraints if using a simple, regular pattern such as a basic diamond-patterned grid [Figure 1]. It is this solution that is used as the common response for applying wire meshes in built environment design applications.

Similarly, elongated hexagon 'banded' patterns - those that vary in the direction of the wire stands - are straightforward to produce, and many such patterns are possible [Figure 3].

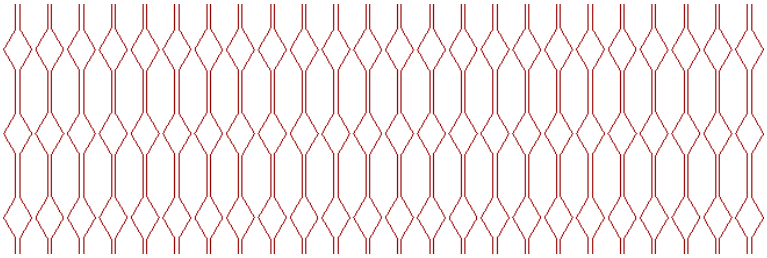

Figure 3: A simple elongated hexagon banded pattern.

For decorative design applications, it can be desirable to mix the basic diamond pattern with a banded elongated hexagon pattern and to produce accurate and detailed fabrication drawings of the designs for fabricators. Mixing these patterns is possible by a manual process in computer-aided design and drafting software tools such as AutoCAD, however this approach is laborious and does not easily accommodating change and increases the possibility of mistakes.

This latter point is notable as, like 'dropping a stitch' whilst knitting or a 'skipped stitch' whilst weaving, an error in a mesh design can have a flow on effect of invalidating large, and seemingly unrelated, sections of the mesh design. To illustrate, in the example in Figure 4 (figure of mesh error on left and 'propagated' fix on the right) the mesh on the left has an error in the central wire where the change to left-right sequence creates an angle in the wire without a corresponding connection to its neighbour at that point. The left-right sequences of the two rightmost strands accommodate the change to the central wire, and they in themselves are correct. However, correcting the error in the central wire leads to invalidation of the entire section in red in the mesh on the right of Figure 4. Such an error might only lead to an increase in tedious work if discovered prior to fabrication, however if discovered once fabrication had commenced, could lead to great cost increases and lengthy time delays.

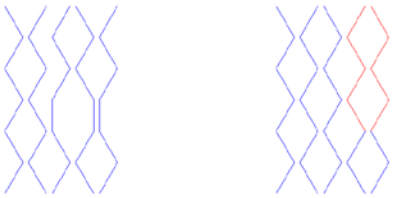

Figure 4: Error on left showing 'skipped stitch' and propagated fix on the right.

2 Aim

This research aims to address the limitations of predefined consistent diamond apertures in meshes and explore the potential for design-led demand for patterning of stainless steel cable mesh by developing a responsive algorithmic patterning computational workflow suitable for documentation and construction.

The workflow should be flexible to allow for visual compositional patterning, adjustable to meet code requirements such as regulations for minimum aperture sizes and maximum openings for 'toe-holds' [1], whilst allowing for rapid documentation and re-documentation by architects, contractors and fabricators.

3 Method

To achieve these aims and allow for image-based variation of mesh weave between regular diamonds and elongated hexagons, we developed an algorithmic approach using a custom Grasshopper within McNeal's Rhino 3D™.

The translation of the documentation was tested on physical prototypes. The approach was then applied on a built institutional project – The RMIT New Academic Street university building library balcony.

4 Mesh weaving algorithm

4.1 Image driven weave algorithm

To achieve the desired mesh variation, we used and image sampling approach. Variation to the basic diamond mesh pattern is guided by sampling for each ferrule location a black-and-white background bitmap (aligned to the mesh) [Figure 5]. Where the sampled raster bitmap is black, the basic diamond pattern is applied and where it is white, an elongated hexagon pattern is applied [Figure 6].

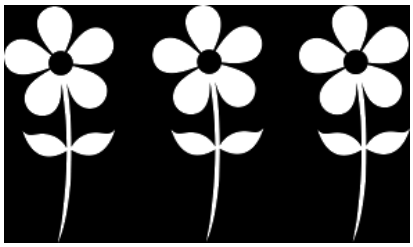

Figure 5: Example of black and white raster image suitable for use in decorative mesh pattern 'interference'.

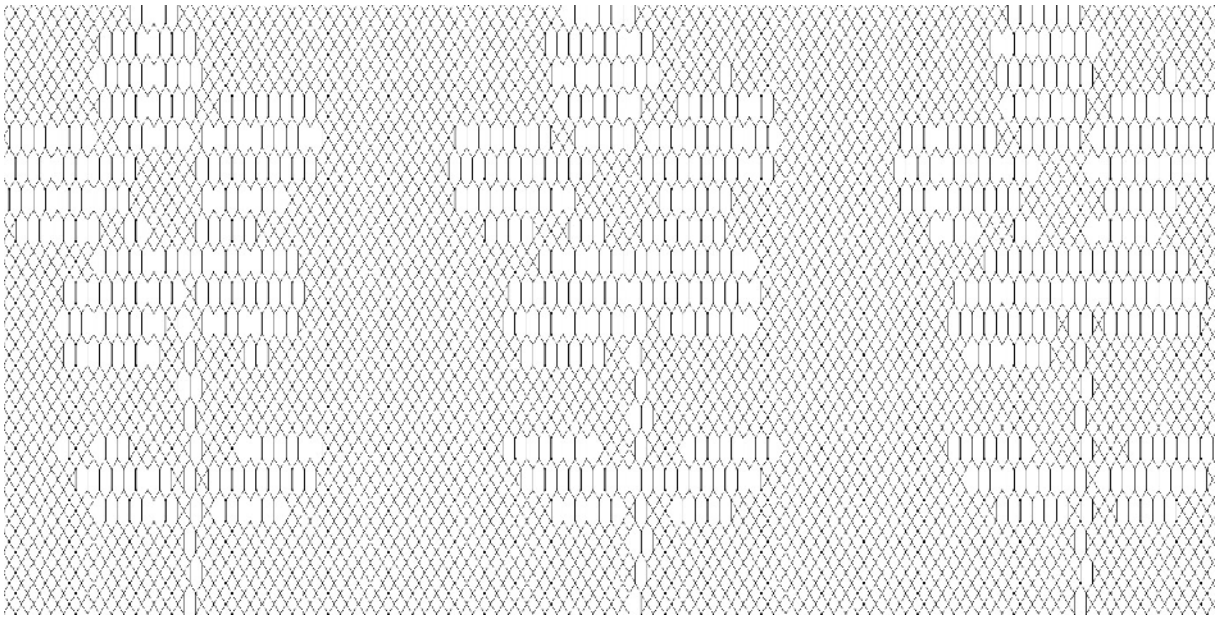

Figure 6: Fabrication layout of stainless steel cable mesh showing integration of image driven pattern mixing diamond and elongated hexagons.

The essence of our algorithm, the core logic of which is implemented in custom code in a C# Script component in Grasshopper within McNeal's Rhino 3D™, is to build up the mesh by taking a virtual 'weaving' approach [Figure 6 & Figure 8].

The application of the banded pattern when tracing a wire is subject to two constraints to ensure no inconsistencies. First, a current wire must connect to any ferrule on the existing wire to the left if that ferrule is a product of a right-deviation and is thus 'awaiting' a complementary connection. Second, a wire must not deviate to the left if at that position the existing wire to the left has no awaiting right-deviation ferrule. In other cases, the banded pattern may be applied.

The operation of the algorithm is to trace wires from the downwards from left to right [Figure 7] to create a mesh of the basic diamond pattern or the elongated hexagon pattern informed by a black and white bitmap image. In the default basic diamond pattern, each wire follows a simple zigzag sequence of deviations to the left and right of the centre line while the elongated hexagon has double length vertical segments, which conform to the centreline.

Figure 7: Order of computational 'weaving' and discrete segments.

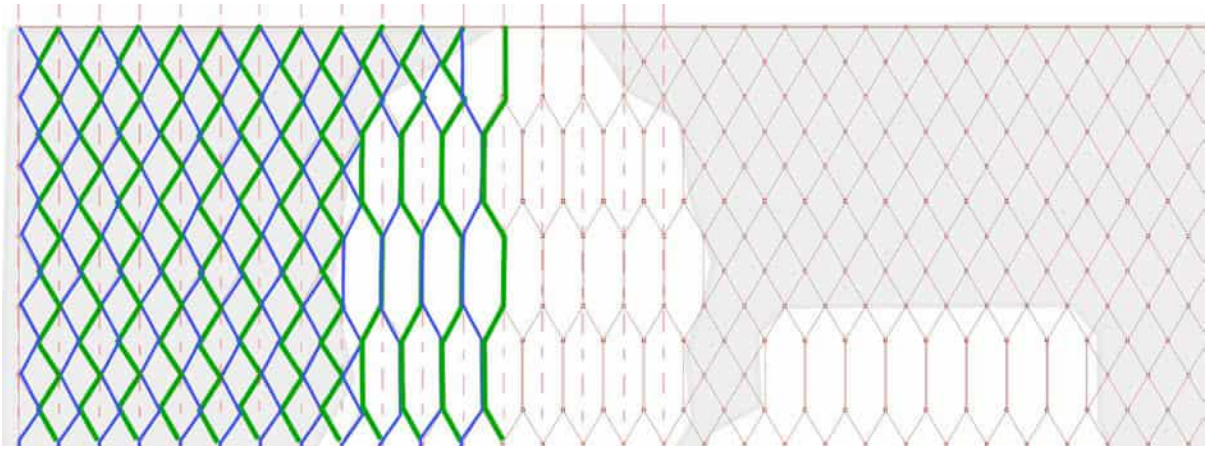

Figure 8: Sample computational 'weaving' pattern with algarithm applied to a black and white image. Centre lines are shown dashed and red, the left strands are coloured blue, right strands are coloured green.

The steps for the mesh weaving process are as follows:

A point-grid is set up factoring in the desired height and width dimensions suitable for a balustrade ensuring openings will not be too large (over 125mm).

Vertical centre lines are then drawn down alternating point-grids (shown pink) [Figure 8]. Two strands start adjacent each centre line – a left strand (shown green), and right strand (shown blue). At each change of direction, a fixing point occurs representing a stainless-steel ferrule.

Where the sampling area of the background bitmap image is black, standard diamond pattern is applied. The left strand (green) moves diagonally left and down one segment length, then

diagonally right and down one segment length back to the centre line. The inverse operation is then applied to the right (blue) strand, to make the simple diamond pattern.

When the background bitmap is white, the elongated hexagon pattern appears. This is done by querying the background image intensity on each grid point, then adjusting the flow of the wire based on that colour interference.

The left (green) first checks the background bitmap (black or white). If the image is white, the strand moves directly down two segment lengths, then moves diagonally back one segment length to the right to return to its centre line. From this point it, the image is sampled again. If the image is black the left (green) wire will return to the simple standard diamond flow. If, however the sample colour is white, the strand moves directly down two segment lengths, then moves diagonally back one segment length to the right to return to the centre line. This process is repeated from top to bottom for the left (green) strand.

The right (blue) strand behaves in similarly attempting to produce the standard zig-zag movement by alternating diagonally down right and left to its centre line but performs two additional checks. Before the right (blue) strand travels down diagonally to the left, it checks the background bitmap colour. If the colour is black, the wire proceeds (down diagonally left), if the background bitmap is white, the wire moves directly down two segments. A check is also run for an 'awaiting' ferrule complementary connection.

4.2 Prototyping

To test the effectiveness of the algorithm, the Grasshopper output was "baked", and printed as a 1:2 working template. This was used for a simple string prototype, [Figure 9 LHS] and then a 1:1 woven stainless-steel prototype [Figure 9 RHS]. The fabrication of the string prototype proved reasonably simple to follow and was achieved quickly. The translation to the full-scale prototype was also relatively straightforward once the fabricator FabMetal combined the 1:1 drawing printout with a perforated backing board with holes matching mesh grid size so as to be able to make temporary pinning to hold the wires in place for the ferrule clamping. The prototype also was used to assess the visual quality of the mesh and modifications to the algorithm were made to allow for slightly larger mesh spacing to reduce the visual prominence of the ferrules.

Figure 9: Photograph (LHS) showing initial 1:2 woven string prototype to test documentation method, and photograph (RHS) showing first full scale wire sample test.

5 Case Study – University library balcony

5.1 The New Academic Street Project

Our custom woven mesh approach was used in the New Academic Street project, applied to the library balconies on levels 5 and 6. Like many contemporary high-stress occupancy building briefs, the client and architects agreed that for these balconies, the standard 1 metre would not be high enough and that a mesh solution was more appropriate. We chose to run the mesh for the full height of the balcony. As this area of the balcony was also highly visible from the adjacent street, the small-added cost of a custom decorative pattern was justifiable. The pattern was generated based on a solar carving script that is discussed elsewhere [9,10] [Figure 10]. This pattern was deliberately keep relatively simple allowing for slight inaccuracies in the built pattern, as this was the first time the approach had been used at this scale.

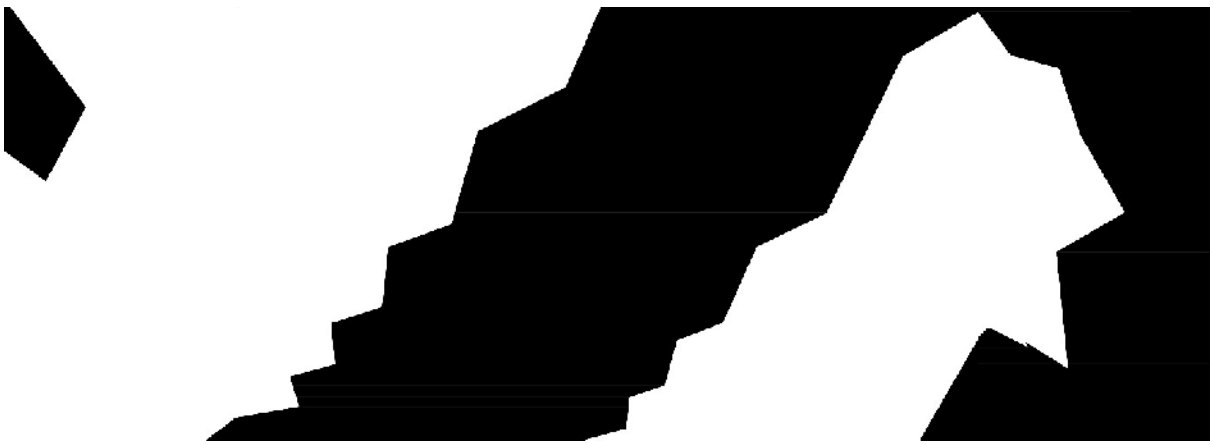

Figure 10: Simple bitmap pattern for driving weaving algorithm for balcony mesh.

The custom mesh was generated using the algorithm, documented and printed with drawings and CAD files supplied to the fabricator. The fabrication was done with the custom mesh pattern [Figure 11] and placed in prefabricated frames. The frames where then trucked to site and craned into place for final installation [Figure 12 & Figure 13].

Figure 11: Photograph (LHS) showing weaving on peforated sheet, and photograph (RHS) showing tensioned wire set in frame ready for instalation.

Figure 12. Photograph of built outcome for university library balcony showing full height decorative balustrade mesh detail.

Figure 13. Photograph of built outcome for university library balcony showing full height decorative balustrade mesh detail.

6 Discussion and conclusion

This paper outlines the process for creating custom patterned woven meshes suitable for use on balconies to have the open qualities of a low height balustrade, the safely of fully enclosed spaces, and with the ability to incorporate decorative patterns to reduce the 'prison' feel.

The workflow allowed for visual compositional patterning, and the scale of mesh apertures was adjustable to meet aesthetic and code requirements.

The documentation was extremely rapid and could be updated quickly when design changes occurred (for example the balcony dimensions changed numerous times during the design development and documentation stages).

We believe there to be great potential for further use and development of this approach. The mass-customised patterned response can increase its use in other complex mixed-use situations, the patterning of the mesh could be varied to respond to those areas with possibility of public access and those without. The custom mesh weaving approach could also be modified to suite vegetation and sun shading designs. For example, a thermal modelling of a building could be done to identify 'hot-spots' and the woven mesh could be adjusted to encourage a creeper to concentrate in that area.

This computational weaving approach lends itself to potential future robotic automation, where the algorithmic output could be used to control weaving and clamping robotic arms.

Finally, the built example shown in this paper was incorporated a relatively simple and 'forgiving; pattern, but based on the accurate translation, we suggest that more complex and intricate detailed patterning could be used in the design process.

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CERTAINTY AND RISK: DESCRIBING THE MATERIAL SURFACE AFTER DAVID PYE

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Abstract

The seminal writings of David Pye on and for a material theory have inspired and guided many artists, craftsman, and architects towards skilful work at the interstices of art and instinct, regulated craft and free workmanship.

Making demands that you learn from it, that you learn craft, purpose, logic, technique, and respect; making and remaking architecture facilitates the exchange of ideas, priorities, capacities and limits between the designer, the maker, and the material. For David Pye there were distinct agents and processes acting upon the surface: the *workmanship of certainty* and the *workmanship of risk*. He sought diversity in the surface, and across the scales of architecture as the outcome of free workmanship operating in the intervals of certainty. This paper presents evidence of Pye's certainty and risk in the text-based model of the architectural surface, the Descriptive Specification, and constructs a relationship between the contingent allowances made for risk in the model, and diversity as an enhancement to the form, composition and regulation of certainty in the outcome. It is argued that Description negotiates freedom and regulatory control of the surface, situating authorial intent in the conditions of realisation, making, and enables *design in the medium*.

This paper concludes that valuable, negotiated terms of intimacy and authorship are afforded to the designer, the maker (if indeed, the designer does not become the maker), and the material, in text-based modelling of the surface. Descriptive Specification as a framework for text-based modelling is demonstrated to determine the agency of and for David Pye's *free workmanship*. Descriptive specification, it is argued, forms a robust, relevant, and prioritised text-based model; a model in which the rigorous, ongoing description of architecture in qualitative terms of certainty and risk is demonstrated to be both unavoidable and essential.

Keywords

Materiality, specification, certainty, risk, workmanship.

Introduction

Making exists as an activity at the interstices between material parameters, and the potential of ideas. Making demands that you learn from it, that you learn craft, purpose, logic, technique, and respect; making and remaking architecture facilitates the exchange of ideas, priorities, capacities and limits between the designer, the maker, and the material.

In the first quarter of the twentieth century architects have faced a shift in the terms and currency of their material knowledge. In the era of Building Information Modelling[1], the stakeholders of construction projects are negotiating the protocols of and for data-rich modelling[i] in the design, delivery and maintenance of the built environment. The key drivers requiring new, collaborative legacy practice are value, cost, and carbon. In this paper, I am concerned principally with value, in the design sense, and specifically with the communication and translation of material quality from authorial intent to contextual artefact. In the data-rich model, the artefacts and enclosures of architecture are considered elementally to both ensure a closer a relationship is formed between the predictions for the theoretical model and the performance of the construction, and as is the focus of this paper, the relationship between the authorial intent of the designer and the phenomena of the space.

The architect, working as a designer-specifier will develop text-based descriptions of and for spatial design, situating the description in the material matters[2] of the authorial intent. These descriptions take many forms, including drawing annotation, briefing documents, design and access statements, maintenance strategies, contract administration, and project specifications, which are the principal subject of consideration in this paper. This paper seeks to evidence and reflect upon the material terms provided by David Pye, late Professor of Furniture Design at The Royal College of Art from 1964–1974, in the fabric of the built environment, and the documents which author material constructions at the interstices of art and instinct, regulated craft and free workmanship.[ii]

Spatial Phenomena as a Material Matter

David Pye discerned that an important aspect of an artist's work was to isolate and make explicit, "in a transmuted form"[iii] their singular discoveries; he suggested that the human

[1] [1] "BIM or Building Information Modelling is a process for creating and managing information on a construction project across the project lifecycle. One of the key outputs of this process is the Building Information Model, the digital description of every aspect of the built asset." National Building Specification (NBS).

[2] [2] Building upon the discourse constructed in the 2004 conference, *Material Matters: Materiality in Contemporary Architectural Practice and Theory* organized by Katie Lloyd-Thomas and in the subsequent edited book, *Material Matters: Architecture and Material Practice,* (2006) bringing together texts and work by theorists and practitioners.

response to artist's range and sensitivity[iv] was enabled by the medium, material (see Figure 1).

The idea of beauty in singularity[v] was explored in Pye's early written work, *The Nature of Aesthetics and Design* (1978), and defined a research trajectory, and a line of enquiry which links the *conception* of the surface, with the *role* of the surface for the architect. We may interpret the role of the surface in phenomenological terms, and consider the effect of the architectural surface as the medium for expressing the range and sensitivity of the authorial intent for the space. This situates descriptive writing, annotation, and specification situated in the pre-existing argument for designing spatial experience by the phenomenologists Jeffrey Kipnis[vi] and Juhani Pallasmaa; Pallasmaa explaining the question of *exploration* links design and text in interview by Indian Architect & Builder.[vii] As a framework for developing an architectural specification, the components of Pye's criteria for rendering the singular explicit are incredibly useful, "relations and qualities of shapes, colours and surfaces" [viii] become an exploratory framework on Pallasmaa's terms.

Figure 1, *Ether*, Rachel Whiteread (1990), Rachel Whiteread at the Tate, London (2017)

Specification

Specification is the act of describing your design's organisation and assemblage of materials. Architects develop descriptions of visual and functional design and prepare Project Specifications principally to set out a text-based model against which the constructed artefact may be measured. The primary modes of specification writing are that of Prescription, wherein the work is fully designed, Description, wherein contingency for specialist input and design completion is created, and Performance, wherein values are ascribed to the construction project's elements.

Historically, the specification of UK construction projects adopted a Common Arrangement of Work Sections (CAWS). This arrangement was best suited for specifying construction projects which were to be fully designed and specified by the architect, who would be writing the *prescription* for the work. This framework has become increasingly at odds with work of a specialist nature, comprising systems or assemblies; work which, in other words, is to be *described* (both qualitatively and quantitively) for the fabricator to respond to. Building Information Modelling calls for elemental thinking, as introduced above, and challenges the design team to describe inter-related assemblies, eg *Families* in Revit, forming a synthesised digital simulation, or product. The requirement for Building Information Modelling to provide linked description, or *specification* of these elements, is the opportunity to develop full, singular authorial intent for the element, and specifically, the material surface within a text-based model. Focussing upon Descriptive Specification allows consideration of design in the medium (See Figure 2), and the balanced negotiation of the inputs defined by David Pye in *The Nature and Art of Workmanship* as he describes the interplay and superimposition of authorship on the material surface: the designer's authorship; the maker's authorship; the material's authorship, situated in Andrea Deplazes' conditions of realisation.[ix]

Figure 2, Alterations and Renewal: Girona City Wall, Girona, Spain

In authoring The Importance of Material[x], Andrea Deplazes declared, "Architecture is always three-dimensional – even in a micro-thin layer of paint – and thus plastic and material." In the era of data-rich modelling, which shifts the terms of the model from abstract representation towards direct instructions for fabrication the designer-specifier is offered the opportunity for providing detailed, qualitative consideration of the surface in the design space. We can see this applying to the first entry points in BIM-compliant, Uniclass specifications; text fields requiring the description of singular surfaces and the prioritisation of visual, facing materials, and within the notation and fully-designed specification clauses of traditional, CAWS arrangements. These descriptions, translated to requirements within the Specification form the currency of the designer-specifier's material knowledge. This knowledge is developed

through the heuristic exploration of ideas; the communication of intentions and aims, to the annotation of project information, descriptions are offered, exchanged and developed in formal and informal critical situations. This text model must communicate form, space and order efficiently, and unambiguously, whilst facilitating multiple points of view, reflection and analysis in the translation of text-based instruction to the surfaces of the artefact.

Certainty and Risk in Translation

David Pye defined the Workmanship of Risk and the Workmanship of Certainty[xi] as distinct modes of making: the first unregulated, enabling contingent authorship[3], and the second, regulated, requiring authoritative intent (see Figure 3). Pye illustrated the theory in the practice of making glass jars with the precise, smooth geometry of the exterior moulded surface as the product of regulated work, and the delightful, light refracting, inner surface the product of unregulated work, and allowable risk.[xii]

Figure 3, *Nero*, 1000cc Vincent Special (early 1950s), The National Motorcycle Museum, Birmingham, UK

If we consider examples of descriptive specification writing, requiring and contractually bound to enable specialist design completion, across a range of materials, say, timber, concrete, and metal, we see inconsistencies in the designer-specifier's understanding of the regulated and the free. The misalignment is often most pronounced in the specification of timber and metal surfaces; timber may be described as fine sawn or planed, metal as brushed or polished. There

[3] [3] In Architecture Depends, Jeremy Till defines the "contingent construction presence" within the maker's authorship and completion of the design as a vital space outwith that which is prescribed in the theoretical model.

are exceptions, and of course these terms suit fully-designed work when they are completed with the prescription of certain workmanship, however, what we seek in descriptive specification writing is an authorial intent regulating the scale, range, and scope of free workmanship employed to bring nuanced diversity to the surface, and what we see is process regularly described in lieu of the desired outcome. The workmanship of risk here is undesirable, as without either the *education*[xiii] Pye defined, or the supervisory role to ensure the intended quality is arrived at, all an architect may do, and all they are responsible for, is inspect the undesirable surface. The descriptive specification document thus proves itself to be evidence of the relationship between the theory of educated workmanship and the surface: free work in these scenarios is uneducated. In contrast, we see a greater level of consistency in describing the surface quality of both glass and concrete at the outset. We see concrete tone, sheen, incidents of form, and allowable deviations (eg blowholes, in terms of size and density) each described in turn.

The Surface of the Material

"It is a common observation that a finished picture lacks the freshness of the sketch on which it was based. Free workmanship is essentially of the nature of a sketch."[xiv]

David Pye, *The Nature and Art of Workmanship*

The designer-specifier is closer to the fabrication of the space than ever before. Direct linkages between design and production are made via code in the medium of digital design and augmented reality and the agile, local methods of open access[xv], or from file to workshop with CNC cutting, milling, routing, and to the 3D printer with the fuse deposition modelling of additive layer manufacturing. In this regard, data-rich protocols are certainly challenging the status of the model as Mark Burry notes[xvi], shifting the definition of discrete prototypical, archetypal or simulation models to a material master.

This paradigm shift demands responsibility to the material. Making offers immediate access to the material currency of architecture, and its aesthetic and technical capacity. The rigorous, ongoing description of architecture in qualitative terms is therefore unavoidable and essential; we can see practitioners involved with making and crafting the space in a manner which was absent in the post-traditional procurement routes which required completion of the design by specialist disciplines[4]. Encouragingly, for stakeholders in the built environment,

[4] 4 In the UK, the Joint Contracts Tribunal [JCT] provide the dominant building procurement contract suite. This documentation has developed in parallel with industry trends, and offers both traditional, fully designed documentation framework, and various forms of design and build, which provide for specialist design completion. Design and build shifts the responsibility of design authorship and requires the negotiation of negotiable and non-negotiable aspects of construction.

and those seeking quality and craft in the fabric of place[5], we can see return to the notion of truth to materials as predicted by David Pye in the Nature and Art of Workmanship[xvii]. Firstly, the need is to develop respect for the medium [quality, grain, etc], and secondly the need is to develop an understanding that any given material can be made to take certain shapes easy or directly, "every material has, as a matter of objective fact, a specific set of inherent properties, which can be expressed or suppressed when it is used." As the author of spatial phenomena however, and not simply the author of rationalized construction methodology, the architect must embrace the full lesson offered by David Pye, "The truth is that what we want to do is, not to express the properties of materials, but to express their qualities. The properties of materials are objective and measurable. They are out there. The qualities on the other hand are subjective: they are in here: in our heads. They are ideas of ours."[xviii]

In his early work, David Pye wrote that surface quality was "the most noticeable mark of good workmanship"[xix]. This idea developed through the definition of variegated surfaces, qualities and adjacencies[xx], into the mature ideas of certainty, risk, and nuance in the output. Pye developed these ideas into a clear conceptual framework in *The Nature and Art of Workmanship* which came to accept and accommodate deviation and incidents in the surface, that "All workmanship is approximation [of certain ideas]"[xxi] and furthermore, "The designer is apt to imagine he has more control over workmanship than he has. Standards of workmanship become established in each kind of manufacture. The designer gets used to them, expects them, and comes finally to believe he is getting them because he asks for them."[xxii] He believed *educated*[xxiii] input improves upon design:

"Workmanship is the application of technique to making, by the exercise of care, judgment, and dexterity. As opposed to design, workmanship is what for practical purposes the designer cannot give effective instructions about by drawings or words, although he can envisage it perfectly well."[xxiv]

Reflecting upon these discrete definitions of *design* and *workmanship*, we see the Descriptive Specification must seek educated, informed contributions from designer, maker, and material, and define a balance of freedom and regulation appropriate to the work. The designer-specifier's descriptions as distinct, regulatory criteria must state full visual, formal, functional, and qualitative terms for the maker to respond to, and allow contingent design space for free workmanship of the kind which contributes to the qualities, to the form, composition and regulation of the artefact. A negotiated balance of free and regulated workmanship, or authorial intent and contingent agency must be struck.

Conclusions

Full Descriptive Specification must be clear, unequivocal and specific in the written description of qualities for the surface, the artefact, and the architectural proposition in the landscape, street, or urban setting. The full description of an architectural proposition demands curiosity,

[5] 5 A term employed by Bob Allies and Di Haigh in their 2014 edited book, The Fabric of Place, published by Artifice Books on Architecture, reflecting on the theories, methods and manifestations of Allies and Morrison's work in placemaking.

rigour and diversity activity across the scales of the fabrication, spatial and contextual order to deliver delightful, diverse surfaces.

The designer-specifier must explore and develop the description of material in the manner suggested in Pallasmaa's reflection offered in interview, "Details ultimately articulate and define the idea. A sense of tactile intimacy is important for me, and I attempt to detail my buildings and objects so that they are inviting in a tactile sense." [xxv] Furthermore, as was stated in the discussion of description, Pallasmaa suggests the same intimacy and endeavour may apply to writing and this is a notion which may be placed at the core of this papers argument for description as a *heuristic* design tool. When Pallasmaa speaks of "unexpectedness and non-linearity"[xxvi] in his writing, and the idea that this "could bring somewhat surprising views into focus"[xxvii] the intention to employ writing as a design tool is declared. Valuable terms of intimacy and authorship are afforded to the designer, the maker (if indeed, the designer does not become the maker), and the material, in the specific combination of free and regulated workmanship.

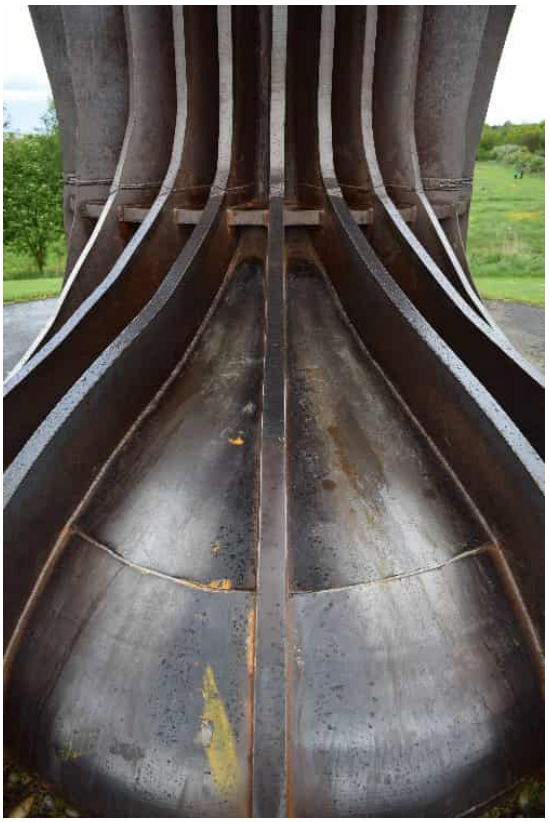

Figure 4, *The Angel of the North,* Antony Gormley, (1997-1998), Cor-ten weathering steel fabrication, Gateshead, UK

Descriptive specification negotiates freedom and regulatory control of the surface; the designer-specifier situates authorial intent in the conditions of realisation, and enables design to occur in the medium. Architectural surfaces are the outcome of free workmanship operating in the intervals of certainty. Furthermore, and of a more propositional status is the argument I am developing herein that descriptive specification raises the authorial stakehold of the fabricator, and embraces the opportunity for diversified surfaces and textures

benefitting from scrutiny in the conditions of realisation. In this regard we see the acceptance of risk as facilitating the maker's authorship and contingent free work, or as Pye suggests "The workmanship of risk can be applied to two quite different purposes, one preparatory, the other productive."[xxviii] Descriptive Specification allows, and invites Pye's "incidents of form and departures from regularity" [xxix] in the pursuit of surface diversity; diversity as smoothness, nuance, wear, scratches, and incidents of form, as the desired product of the workmanship of risk, and as an enhancement to the form, composition and regulation of certainty, and prescription.[xxx]

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IMPROVEMENTS IN UNDERSTANDING MATERIALS APPLICATIONS IN ARCHITECTURE

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Abstract

Resulting from the much-diversified gated communities and the subsequent gap between many professional disciplines, it is difficult to unite materials science with architecture. The last decade however shows much research initiatives that are carried out in the field of materials science to cover this gap. The actual research tends to endeavour an extension of the physics system that has been used as a model for materials science very long, and partly replace it by various cognitions and methodologies applied in psychology or in neurology.

The goal of this enterprise is twofold: - improve the understanding of experiencing applied materials perceived in buildings, and – provide a new set of terms for defining emotional and feeling-based affectivity for architecturally applied materials.

This article shows some proceedings of this quite new research line, and also delivers some examples, see figure 1. It may give knowledge and insight into the potential of interdisciplinary rapprochements ongoing now for the benefit of understanding the experiencing of architecture and of design.

Keywords: - Materials Science, - Materials perception, - Virtual Properties, - Consciousness, – Architecture and Design.

1 Introduction: on behalf of the material

In an article entitled "On Seeing Stuff: The Perception of Materials by Humans and Machines", the author recognizes that we usually tend to see 'things' rather than 'stuff'. *"It is 'things' which dominate 'stuff' even though the increased appreciation in e.g. advertisements on new shampoos that modify optical or mechanical properties of hair, or on coatings for timber parts that aim to nee no maintenance for over 10 years*." [1] If we peruse scientific literature on perception, a great deal of our attention is paid on recognizing objects and very little on recognizing materials; why should that be? The mentioned article analyses firstly the abilities which signify us as human beings. Nonetheless our mental focus we seem to have a good potential for recognizing materials as we don't keep to the outlines but are ready to grasp the core of things.

Moreover, the article indicates the needed software capacity for material identification ability. It does so by relating amounts of bites invested for representing independent acting clothing and haircuts of figures in animated cartoon movies to the haircuts and clothing which are dependent acting. Figures that are aimed to be as realist as possible, require haircuts and clothes represented in recognizable ways, so a simulation is then necessary of own weights and resistances to wind speeds. Computing capacity for independent figures is about 80 times the amount needed for non-dressed and hairless figures, hence a computer has to invest in it ca. 98,5% of its calculation force. Projecting this outcome to our own brain when it is perceiving a 'thing' seems we are concerned with natural laziness as we don't use or allow ourselves to use the full mental force capacity to invest. Is it caused by the natural laziness for mental work that we resist to invest capacity, or is it because we love to speak of things as a whole? And how do we feel when one of our key capacities is more explored? Maybe our culture is preprocessing us in looking for formal capacity. The actual gaining of materials interest does not undermine our linguistic orientations on 'things'. 'Great functionality' associates with wholeness and not with extraordinariness of components, so form is considered as a prime intelligence; for eventual understanding of materials applications in architecture we should comprehend why this intelligence representing is so dominant.

2 Experiencing materials by humans and machines

As each child discovers when it plays by experience applied materials in things, and hereby gradually learns to identify, so it learns to see materials in forms. [2] Adult human beings behold these habits, they explore the same tricks: - by identifying surface appearance, - by knocking on objects and listen, - by touching objects and smell, as in case of wool. (Wool has a look and feel, and when wet it has a certain smell.) We did collect in our lives certain methods based on sensing and on common sense. In contrast, robots have several routines with which they process multitudes of algorithms for using sensory equipment. Cars e.g. which drive in a self-reliant way will focus on using those sensors for formal identification of objects and speeds (by calculation), as for solving all complexities between systems, however they are *not* designed for materials identification. Let us suppose that a white box is being placed on a road, any self-driving car would monitor the shape and dimensions of it, but not its weight and stability (stiffness), so if the box were steel made overriding it would be harmful, but if the box were made of paper and polystyrene overriding it would be allowed. The assessment is taken arbitrary as the sensory system cannot decide this. When we project the cartoons cost investigation into this, the car computer capacity needed to identify materials in systems realistically were far, if not exponential exceeding those costs today (…. if it were possible at all).

This actual projection may enlighten our effort when we pursue to 'see materials' in an architectural setting, not just by surfaces. An increased understanding of it is our aim since we always choose how to represent materials in architecture. Mostly we aim a so called ´positivist view´ by defining "stuff" for the combined aesthetical - technical properties, but this viewpoint must be omitted if perception of materialization is also represented. Since applied material has a *meaning* plus a *working*, the not representing of it, positivism, is indeed abstracting architecture (… as we will see in pages to come). When we are conscious of architectural material as much as of form, the dominant positioning of whole things in relation to the humility of material 'reality' is equaled by the 'lived' existence´. The appreciation of architecture should then primarily be studied analogous to `consciousness`, an intricate field of knowledge in neurology and philosophy. Respectable authors like Antonio Damasio, Oliver Sacks, Gerald Edelman and Daniel Dennett hand over here their witnesses or sophistication.

3 Consciousness and historic materiality in architecture

Although we have a tremendous capacity for materials and details, we aim for wholeness. In his last book "*The River of Consciousness*" the late neurologist Oliver Sacks writes: "*We do not seem to have a mechanism in our brain responsible for the truth, or at least the credibility of our memories*. (.), *and what we regard as true depends just as much on our imagination as on our senses*. *There is no way to transfer or record events in the world directly into our brains; they are stored in an extremely subjective way that is different for each individual and interpreted or relived in different ways with each memory*. *Our only truth is the narrative truth* (...)." [3]

The citation depicts a vulnerable part of our consciousness, a fallible memory capacity, and mentions it as a method of conquering by telling stories to ourselves: narratives, a cultural feature that may overcome fallibility. The idea of the mind in neurology is that it is partly a hard-wired nerve system for coping with stereotypic environments, and partly it is adorned with plasticity mostly being capable for adapting or adjusting to unforeseen trends. The plasticity part, i.e. the cortex or evolved human brain, is the mere product of cultural selection and evolution, and has fallibility in contrast to the hard-wired nerve systems. Cortex-based minds deal with cultural replications or with 'memes', and are questioning how to select them, so how to think on them and imagine them. This refers to wholeness, hence is fallibility an issue; can we trust narratives or are we inclined to disbelieve them?

From the numerous authors which have added to consciousness theory materialist and philosopher Daniel Dennett is a focus point. In his book "*Consciousness Explained*" Dennett sets up a theory of consciousness on making judgements on basis of simultaneity and sequence of elements in personal experiences. Dennett writes: "*… at some point or points in our brain the corner must be turned from the actual timing of representations to the representation of timing, and wherever and whenever these discriminations are made, thereafter the temporal properties of the representations embodying those judgements are not constitutive of their content. The objective simultaneities and sequences of events spread across the broad field of the cortex are of no functional relevance unless they can also be accurately detected by a mechanism in the brain*." He adds: "*What matters is not the temporal properties of the representings, but the temporal properties represented, something determined by how they are taken by subsequent processes in the brain*." [4] Hence an introspective inner world 'glues' in consciousness onto the outer world representations, in order to become a whole. The brain or mind (: Dennett's materialism lets him ignore a difference between these), acts as consciousness machine and does not mediate between two realities, but is just one. Experienced reality is so being processed by representings that are mixed up with memory so that the brain achieves consciousness parallel to the memory function. This key insight dismisses the idea of a Cartesian theatre. Due to the fact that material is covered mostly in sub-consciousness by the presence of emotions, it means that perceiving of materials in form is essentially equal as mental mechanism to the perceiving of form without material identification, but probably in a slower pace. However, a perceiving of form is now being a standard, hence the brain activity is acting faster.

The fast brain allows and gives opportunity to the positivist thinking mode which rejects subjectivity. Also, it rules the meanings-narrative of modernity: 'that a building installed with latest technologies partakes intelligence in architecture, so also of actual times.' [5] Designer narratives will give room to a technology invention that is ideology-driven, but in the introspective world nothing is being 'glued' for reality; the subjectivity of the spectator is not esteemed and the applied material is treated as subordinate to formal aspects. In modern design the status quo of materials application has been reviewed and changed from the status quo that Vitruvius did formulate to the dynamic values that swept away the societal rules, and which transitions have been subjected into literature e.g. in the

novel "*The Man without Qualities*". [6] Key-figure Ulrich in this novel takes himself as someone who has sensed his old sense of reality has been dissipating, and who became a "*possibility man living in a finer sensory-logic, a web of imagination, dreams and conjunctions*". A possibility man is defined as somebody with an ability "*to think of anything that could be just as well next to that which immediately presents itself as reality*."

4 Consciousness and the psychology of building materials

The Vitruvian static meaning of materials was ontologically satisfying and in general anti-intentional as it was applied as a societal rule. [7] Its reach was very large until ca. 1860 AD when Europe dynamic values were introduced due to the introductions of steel and reinforced concrete in load bearing applications. While materialization changes due to industrialization processes, caused by multiple scientific experiments and theories, new 'memes' activated. Dennett then adopts the theory of cultural memes and states the raison d'être of what is called the cultural selection mind which is opposed to the natural selection mind, to control our well-being in case of a chaotic future and to stimulate quick adaption and learning processes under complex conditions. He writes: *"The important point here is that there is no* necessary *connection between a meme's replicative power or its "fitness" from* its *point of view, and its contribution to* our *fitness (by whatever standard we judge that). The situation is not totally desperate. While some memes definitely manipulate us into collaborating on their replication* in spite of *our judging them useless or ugly or even dangerous to our health and welfare, many – most, if we are lucky – of the memes that replicate themselves do so not just* with *our blessings, but* because *of our esteem for them.* [4]

Memes derived out of the concept of steel or concrete applications could be modelled into novel spaces, novel forms and art's plasticity. Dynamic arguments enhanced the production of those memes, and these new utility materials have become prolific. Utility material has become accepted by arguments of a representation of progress, but such ideals were unfeasible to Vitruvian minds. One could now see how the materialization issue would dominate the criticism of the time, e.g. in the public debate on the Eiffel tower. Modern society however was of help here by validating the methods for achieving comfort by engineering, stating that *experiments are prior to observations*. This emulated the existence or progressiveness for the materialization dimension in architecture as it simultaneously degraded the static status to classic domains and allow novel materials to dominate.

The new mental meanings of materials diverge from the classic adagios based on the idea of esteem. This 'hidden aspect' is historically overlooked often as it questions also emotional reasons on why we feel comforted by certain buildings more than by others. Recent have psychology teams initiated the research on perception of building materials, aiming to find why people do appreciate these or not. The research on sensing warmth e.g. started in ca. 2005 and it ignores performance - and political dimensions fully. [8,9]

5 Consciousness and architecture

Antonio Damasio writes in "The Feeling of What Happens" on being in the spotlight once a theatre show starts. "*It is an affecting moment for the public as well for the artist, in which imagination plays an important role because imagination is beyond functionality constraints and can add to feelings of self-identity.*" [10] Here imagination is used as a metaphor for self-awareness, however Damasio writes also on how we use the brain and on how it lets us know in consciousness. Emotion is much evolved in sub-consciousness but it can be transferred one enhanced, to awareness." *It is clear that intense emotions result in bad decisions and that no consciousness is real without emotions´*.

Transferring this to architecture the prime spotlight moment occurs at the moment that we see the building and feel emotions coming present in our consciousness some instant later. Proceeding now in not exactly knowing how the replication process of memes in architecture supposes to be slowing down by emotional roles, we estimate it may happen once the full array of visible materialization and form starts up to speak with the opening up of an outside consciousness. This is how the focusing on attention spans (: heightening or longing) takes place, and so can a change in self-awareness possibly create affection caused by a materialization that takes care of the mental relaxation of the stimuli that storm the brain, enforced by the design. As modern design is an expression of intentions that we issue, the problem herein is the credibility of manipulated emotions. To a same extend as most of us love to live on an island, it confines our attention and hence intensifies our focus to reality; obstinacy of materials is working for intensifying the brain by focusing (and work), not letting attention slip. Materialization can be a quite effective means to internally (in the brain) create a slackening of reality. It is also clear that what originated Greek-Roman architecture, was the arranging of taboos or sacrificial applications that elements were treated as independently, so autonomous. [11] It renders a free imagination and free will and adds to self-identity as to memory and materials perception. In modern architecture positivist attributes are blocking affection so that a spectator can almost not resist the will of the designer instead of questioning the design with his own will. Ontologically he will resist to do this; his complaisance is in fact a kind of protest to this loosing of interest in architecture.

6 New Materials Science

We will take notice of the philosophy of 'New Materialism' by Manuel Delanda. Philosophical Materials Science is itself a new virtuality. In his essay "Emergence, Causality and Realism", DeLanda defines the potentials of materials by traceable capacities, tendencies and by mathematical modeling based on singularities. [12] Like the materialistic philosophical vision of Dennett that aims to clarify the mind by working of the brain only, ignoring the mind, DeLanda has adopted a realist vision on material by which he puts off positivism and acquires realism as prime working force. Defining the materials potentials is aimed by the virtual property assessment. Virtual properties are real, however are not actual. In this the meaning of potentials can be extended to sub-consciousness. A result is that virtual properties can speak of the power of 'esteem'.

According to this, working happens due to materials microstructural meanings. Components that carry loads, insulate, be fire resistant, or in brief: perform, act not to the potentials. Blocks that have a mass (: density) *which they do not perform*, are being *characteristic* to a building. Or steel that, although it is heavy and energetic, *has a touch of lightness that is not utilized,* has also a character if well expressed. Both can have esteem through their unutilized structural potentials, and hence due to the microstructure. The further a materials appearance can be associated with its microstructure, and a nonutilized microstructural property is guaranteed, the brain is increasingly notified and might at a certain point get consciousness through the form vs. the material. In experience architecture can relate to a theater spot light, so to a way of consciousness in an external form.

The dimension of 'obstinacy' can be elaborated more.

A high internal bonding energy of atoms or molecules is of prime importance for gaining esteem; the higher the bonding energy and the stiffer the material, the higher the heightened emotion. (This is why plastics, due to their low bonding energy, in general do not behave architecturally.) Workability is another prime aspect, necessary to inhibit the obedience of the material. (Because of its low workability, steel has difficulty of expression.) Thirdly is the differentiating of materials texture in space

necessary to the applied material, as it extends our feeling of esteem to material. (This is why concrete has a hard, emotionless architectural presence, nonetheless the high bonding energy and workability.)

Concluding we have made a substantiated speculation on how the mind works in relation to the topic of architectural materialization. We decided that consciousness as an analogy to this problem might clarify aspects of it, such as intelligence of material and 'meaning' and 'working'. The obstinacy of material that becomes activated not as a utility but as a non-utility may signify character and also a higher degree of self-identity, helping with assessing independence from form or formal intentions.

A freedom of personal imagination is hence the result, integrating esteem and rendering 'wholeness' from the analysis done.

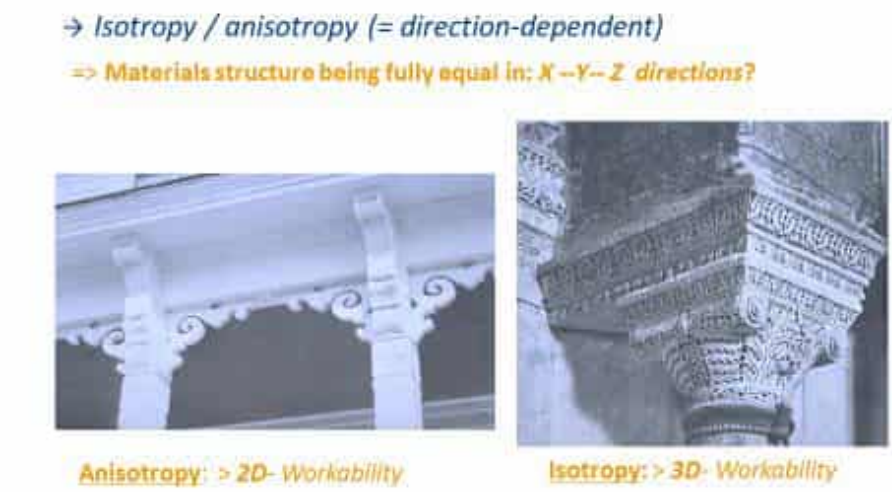

Figure: Decorated capitals (both instances) clarify the microstructure of the material and enhance the virtual property of esteem. It opens up the affection for these architectures, however the picture at right is stronger than the left picture due to the higher E-modulus and refined workability of stone over wood.

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CONSIDERATIONS FOR IN-SITU APPLICATION OF SUSTAINABLE RESTORATIVE MATERIALS IN THE PASARGADAE WORLD HERITAGE SITE

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Abstract

In this study, considerations for design, characterization, and in-situ application of sustainable materials for restorative use in the Pasargadae world heritage site are discussed. The study as a preparatory stage of an eminent restoration project deals with several preliminary requisites leading to mortar design for in-situ application. In this research, one of the most important considered requisites is compatibility. This property does not exclude any of its physical, chemical, mechanical, or aesthetical manifestations. Reversibility, where is practicable, is another essential property expected from such a restoration material to be taken in account. Moreover, sustainability of the conservation project is highly dependent on the environmental considerations in the design of the restorative materials. Economic considerations will also play a critical role in the frame of conservation plan as their enhancement can broaden the domain of conservation potentials. The designated waste-based strategy in design of restorative materials and their response to certain requisites of the conservation plan are discussed. Furthermore, the particular considerations for restorations in Pasargadae incorporated some exclusive strategies as a restorative tailored design task.

Keywords

Restorative material; compatibility; sustainability; reversibility; cultural heritage.

1 Introduction

Pasargadae world heritage site is located in the heart of Fars province of Iran and its unique stone architecture gets back to 559–530 BC [1]. The construction system in the Pasargadae – like the Persepolis- had been stone architecture without application of joint mortars. However, during the time with stone degradations, the stone joint gaps need to be filled with proper, compatible, and sustainable repointing material to decrease the weathering penetration effects in the depth of historic materials. The new restorative materials and their similarity with traditional mortars should be always evaluated, as this similarity is considered to be significant for the soundness of the compatibility requirement [2]. One of the most reliable materials as designated restorative grout has been always lime. The historical importance of lime as a basic material in constructions since ancient times has been frequently claimed [3,4]. On the other hand the incompatibility of some newer materials such as ordinary Portland cement (OPC) binders for restoration of historical masonry is now proven [5-9]. These, have rendered lime-based materials conventional and usually reliable restorative material [10]. However, lime mortars due to their high porous structure, slow setting and hardening through slow carbonation, and not high internal cohesion have been often mixed with various additives to enhance and meliorate such properties [11]. In many cases of historic mortars fatty acids in the form fatty organics have been used as additives inside the mortars to contain the moisture problem as fountainhead of many degradation problems for mortars [8] and inclusion of different types of oils in lime mortars in recent researches have almost always manifested progressive hydrophobic enhancements [12-13]. Manufacturing of mortars with waste-based additives can bring superior sustainability to the systems as a consequence of cutback of dependency on natural recourses [13,14]. This environmental advantage can enhance the index of the restorative material in the frame of conservation plan in order to facilitate and broaden the domain of restorative potentials. Broadening the potential domain of conservation is demanding, especially in the cases of developing countries with numerous tangible cultural heritage in need of conservation.

This study deals with the preliminary stage of tailored design of restorative mortars for pointing application in the Pasargadae world heritage site. A list of perquisites and considerations for material design in this particular site-application is listed. Compatibility considerations are discussed in categories of technical, conceptual (philological), and aesthetical. The considerations were directed at providing discernment into the contribution of the waste additives to enhancement of restorative mortars in a tailored design.

Figure 1. A view of the Pasargadae world heritage site

2 Main considerations

In the recent decades, many elements of the historic built environment are dealing with various types of decays and damages; hence exploring their conservation and preservation by compatible materials is demanding [15]. For a successful restorative intervention, compatibility of the designated materials for repair with the historic substrate masonry is a demanding prerequisite. Furthermore, sustainability and being economically friendly are other important issues for considerations [16]. However, the discussed low affinity of OPC mortars/binders and modern polymer-based materials with historical substrates and energy consumptions and emissions regarding OPC manufacturing are intensive due to the significant heat required for their production. Production of only one ton of OPC requires about 5 million kilojoules of energy, equivalent to almost 180 kilograms of coal, and emits nearly a ton of carbon dioxide [17]. The most destructive environmental problem regarding these materials is related to their contribution in increment of the mean air temperature [18], which is emanating from CO_2 formation in the atmosphere.

Apart from all the environment mentioned issues, in order to respect the essence of the original masonries, application of historic mixes as restorative grouts, renders, or mortars is highly recommended as both historic solutions and modern research discuss their high potentials of compatibility in restoration [19]. However, some traditional/ historical materialistic solutions are not significantly eco-friendly products, basically due to their production process or their compounds [20]. Hence, introduction of more environmentally friendly restorative materials is necessary especially due to recent acceleration in global warming.

Although the performance of many modern historic mortars is acceptably high, their expenses are quite high and their each single additive targets a certain property enhancement. Therefore these additives are usually combined in utilization and increase the workload and consequently the final price**.** The economic considerations play an important role in the conservation plans. Introduction of economically friendly materials spread the possibilities to treat historic built environment as best practice within the conservation plan and maintenance routines. Development of the sustainable and low cost repair mortars for rehabilitation of built environment is the concern of many scholars in fields of civil, materials, and cultural heritage.

In the historic site of Pasargadae there are various types of damages and deteriorations in need of repair with sustainable material. There are many gaps in need of pointing with restorative and compatible grouts (Figure 2). Such grouts/mortars rather than compatibility are recommended to have high indexes of performance, availability, durability and sustainability.

Figure 2. Example of degraded masonries in need of pointing with compatible mortars (Pasargadae, Iran)

Repointing was historically a common restorative practice, when new gaps were forming due to material degradations or when the external part of the mortar joints was periodically renewed. However, in the Pasargadae, pointing mortar does not have historical evidence as the construction system was not based on wet assemblies (without mortar joints). This new need is due to stone degradations over the years and the risk of weathering penetrations that can highly accelerate deteriorations. Despite the apparent easiness of repointing, the new materials used for these applications should be carefully designated, as their compatibility with the existing historic masonry is demanding to prevent negative consequences on the original materials. For example, the application of too stiff and compact cement-based mortars frequently ends to material detachment (significantly when sulphates release in the masonry after rising damp), or might end to corrosion and powdering of the surrounding masonries [21]. Hence, it is usually recommended that restorative materials manifest high similarities to the existing historic ones, in terms of microstructure and physical properties, mechanical properties and thermal properties. Even if it is usually suggested that restorative mortars be designed by incorporating simulations of the historic ones, still using traditional raw technologies does not guarantee the compatibility of restorative interventions, therefore the necessity of investigating new but historic-based restoration materials comes out.

Starting from the short discussion above, this paper discusses the considerations for new historic waste-based mortars that were formulated and manufactured for restorative applications in the Pasargadae. The microstructural and physical properties of these materials are under determination, in order to assess their compatibility with existing old/ historical masonries. Particularly, proper properties such as pore size distribution, water absorption and water vapour permeability, are significant to guarantee that exchanges of liquid water and water vapour can take place between the historic materials and the ambient. After application of the restorative grouts and mortars, if such exchanges were reduced, degradation has high potentials to take place.

2.1 Pointing the joints as the prior application

The stone-based construction of the Pasargadae was based of three categories of limestone classified according to their essence and colours (white, dark-gray, and green-gray). The two formers have a compact microstructure and the latter with higher porosity, respectively [22]. The stones demonstrate diverse macroscopic features, such as textures and decay patterns. A recent study on these stones manifests the main reasons of decay in the two latter categories as dissolution of calcite crystals and the lumping of clay minerals. However, in the case of the former category, the main decay factor was introduced as dissolution induced by microorganism activity [22]. The construction system of stone architecture in the Pasargadae –as well as Persepolis – had been dry without mortar joints as the stones were placing beside each other flawlessly. The mentioned before, degradations have ended to formation of gaps between the placed stones that potentially accelerate the materials deterioration through weathering penetrations. Hence, they should be pointed with compatible re-pointing mortars.

2.2 Compatibility

2.2.1 Technical compatibility

Lime based mortars were selected to prepare the test samples. The physical, chemical, and mechanical compatibility of lime mortars for restoration of historical masonries has been confirmed by various researches, due to their high permeability and not very high stiffness [10]. According to the newest version of standard of building lime [23] EN 459-1, the mortars used for this consideration are classified as air lime mortars with or without sesame oils as additives. This decision is made due to the climatic status of the Pasargadae with low relative humidity. In this condition the formerly applied hydraulic, formulated, and natural hydraulic limes have been unsuccessful as for their hardening and setting they need humidity for their pozzolanic actions.

Lime mortars historically have been mixed with various fatty organics to enhance their hydric properties. A recent study demonstrated that unsaturation extent of these organic additives can be a key factor in microstructural alterations and hydrophobicity of the final material [24]. In this research, sesame oil, as a common product in Iran with two different unsaturation levels in used as an organic additive to enhance hydrophobicity of the restorative mortars.

2.2.2 Conceptual compatibility

One of the main principles of the historic Persian architecture have been always dependency on the materials from the surroundings of the site. For instance, stone construction of Pasargadae and Persepolis had been dependent on the mines of their actual province. This principle apart from bringing conceptual compatibility imports environmental and economic values to the final product. Hence, the mix designs were decided to be dependent on the site potentials, including stone powders and sand.

2.2.3 Aesthetical compatibility

In the considerations for tailored-design of restorative mortars for repointing aesthetical compatibility plays a key role. The term "aesthetical compatibility" here deals with appearance of these new mortars/grouts that firstly is similar to many historic mortars. Secondly, it deals with their color adjustability. As 75 w.t.% of these mortars are included by the inert, the non-reactive part plays the main role in the adjustability of the colors of these materials. As displayed in Table 1 the inert is composed by three different stone powders and one type of normalized sand from the close by river. These stone powders with different colors (white, dark-gray, and green-gray) were opted for with adjustable percentage to perform as natural-physical pigments that can set the desired color for various platforms to achieve the appropriate aesthetic compatibility.

Table 1: Designated materials to form the inert

Material	**Colour**	**w.t. %**
White stone powder	White	18.75
Dark stone powder	Black	37.5
Sandstone	Beige	25
Normalized sand	Beige	18.75

2.3 Durability

The durability of the mortars were placed under evaluation under two different conditions: 1) curing at lab temperature, 2) curing in the environment before the in-situ application. The latter one was carried out due to the complexity and numerous parameters of natural curing at ambient that affect the curing process of mortars. The mortars cured in both conditions will be characterized in terms of microstructural, physical, and mechanical properties to facilitate the perquisites preparation for in-situ application through they comparison.

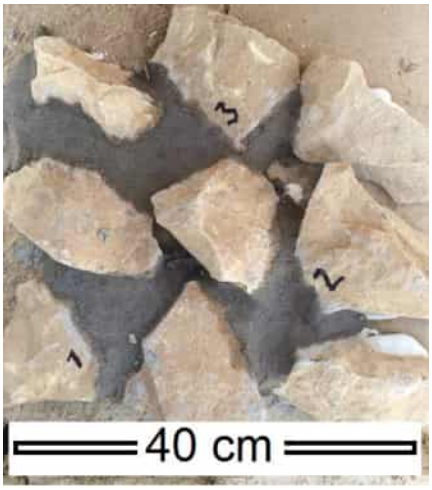

Figure 3. Curing of the mortars in natural condition and simulations

3 Conclusion

The considerations for tailored-design of restorative mortars in the Pasargadae world heritage deal with environmental, economic, compatibility, and technical issues. The waste-based policies are undertaken to cutback the dependency on natural resources. This apart from sustainability achievements, through economic advantages spreads the possibilities to treat historic built environment as best practice within the conservation plan and maintenance routines. Air-lime mortars were designated to make benefit of the low relative humidity of the environment for carbonation procedure and sesame oil was opted as additive to enhance hydrophobicity of the materials. Different percentages of various types/colors of the local stone powders where used as natural pigments to form the complex inert with aesthetic adjustability. The durability of the mortars/grouts were planned to be assessed in parallel conditions of laboratory and natural environment, as the latter one deals with more climatic parameters and leads to a more realistic tailored-design, respectively.

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FIRE SAFETY AND HERITAGE PROTECTION – ALWAYS ANTAGONISTS?

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Abstract

Again and again there are fire alarms in historical structures, most recently in the protected historical concert hall in Vienna/Austria. Fortunately, due to an effective fire safety concept, nobody was injured and there were no heavy damages at the historic building.

Fire protection contributes in an essential way to the prevention of personal injury, property loss and environmental damage. In particular, regarding historical buildings or monuments, fire safety concepts can be seen as heritage protection. In Germany, the legal and technical requirements concerning the guarantee of sufficient fire safety have significantly changed over the last centuries. This permanent optimization of fire safety requirements has led to a continuous decreasing of death by fire and a low level of fire caused damages in Germany related to other western industrial nations [1].

But, often comprehensive fire protection requirements collide with interests of heritage protection. Fire safety authorities, owners and authorities for the protection of historic buildings and monuments have to balance their interests to affect the existing structure not more than necessary in order to preserve them for posterity. Especially historical structures, monuments or culturally relevant buildings like museums, operas and concert halls need an individualized fire safety concept which respects their special tasks and their value for society.

The paper analyzes various concepts of fire safety in historical structures and discusses advantages of active and preventive fire protection. Furthermore, it discusses current German legal and technical fire protection regulations for historical buildings. The authors will present examples where fire safety and protection of historical structures work together in an ideal way to save lives as well as prevent the destruction of historical buildings or monuments and their interior. Fire safety and historic structure protection do not have to be antagonists. On the contrary, they should collaborate in the interest of the important cultural heritage.

Keywords

Fire safety, heritage protection, historical buildings, individualized concepts.

1 Introduction

Each year hundreds of people die because of fire, smoke, heat and fire gas. Furthermore, fire causes huge direct and indirect fire damages with enormous cost, e.g. in Germany approximately 0.2% of the gross domestic product, which means around 2.5 to 3 billion Euro per year [1]. That is why importance of preventive fire protection increases year by year which can be identified by growing sales of preventive fire protection products [2]. Apart from the dangers to life, limb and property, fire represents one of the most important risks in building heritage, because of a particular combination between various risk factors [3].

Building heritage are buildings and structures whose conservation and use are of public interest [4]. A worldwide statistic of the United Nations Educational, Scientific and Cultural Organization (UNESCO) shows that 47% of the protected historic structures are located in Europe and North America [5] and around 78% of the listed UNESCO-heritage are buildings [6].

Mostly, building heritage and other protected historic structures will be adapted and reused to keep them operational, to show its beauty and to preserve them and its interior for posterity. The difficulty is to link the conservation of these architectural spaces to an adequate response to needs of people who use the spaces itself, in terms of functional requirements. This becomes really relevant and critical while ensuring safety in building heritage and protecting it from natural disasters (fires, earthquakes, floods, hurricanes, storms, and so on) [3].

2 German Fire Safety Requirements for Historic Structures

Normally, fire protection regulations in Germany are made for new constructed buildings. But, in building heritage generally valid regulations for fire protection cannot be applied. Nevertheless, there are some basic principles of fire safety also building heritage must comply with [7].

For existing structures local building authorities only can enforce the establishment of a modern fire protection if there will be a real danger for life or health of human or animals, for example if there are no escape and/or rescue routes. But, if a monuments' owner intends to start construction works in an historical structure or wants to change its usage, normally he or she must act in compliance with the current fire safety regulations. That would mean, that the fire safety concept of the existing structure must be adjusted to the current legal situation if reasonable.

Regarding fire safety requirements a distinction has to be made between preventive fire protection and defensive fire protection [8]. This paper focuses on preventive fire protection which includes structural, technological and organizational fire protection.

2.1 Legal Requirements

The German heritage protection law requires the owner of monuments to care for the protected building, to maintain and to protect it from damages [4], such as fire. Fire protection requirements for Germany can be found in the local building regulations of the German Federal States and in nationwide applicable technical standards. Structures in Germany are to

design, to construct, to maintain and to alter in a way that the incipient fire as well as spread of fire and smoke will be prevented. Furthermore, in case of fire, the rescue of humans and animals as well as an effective fire-fighting must be possible (e.g. Section 14 Saxon Building Regulations 2017 [9]). Although these rules primarily are applicable to new constructions they also contain schemes to deal with the specialties of existing structures.

Often, in Germany, protected buildings are so called 'special structures', on the one hand because of their dimensions and on the other hand because of their usage. For these special structures (e.g. structures higher than 30 meters or which are used by many peoples such as theatres, hotels, churches or opera houses) specific regulations exist. Thus, there can be tighter fire safety requirements or even reduced fire safety requirements, dependent on type and usage of the building. The responsible building authority controls the compliance with the local building requirements.

Nevertheless, in historic buildings there is no need to meet every single current fire safety requirement. Only the fire protection objective must be reached [10]. The building authority has the right to decide about the extent of fire safety measurements as well as the reduction of legal and technical requirements for fire safety (Section 3 (3) and 67 of Saxon Building Regulations 2017 [9]). Often, individual fire safety concepts are the solution for meeting fire protection standards in historic buildings.

2.2 Technical Codes

In Germany, fire safety in structures mainly has to be realized by structural means in compliance with regulations, guidelines, recommendations and technical codes. Usability of building materials and construction methods normally is proofed by meeting national technical regulations. Most of the construction methods for preventive fire protection (such as reinforced concrete, steel, masonry) are regulated in nationwide applicable technical standards such as Eurocodes or German DIN Codes (e.g. DIN 4102 [11], DIN EN 13501 [12] or Eurocode 2 [13]). Fire protection codes applicable to new constructions also can be used for existing structures. Dependent on the dimensions of the historical buildings there are requirements regarding building elements, building materials and construction methods such as fire resistance of building elements and flammability of building materials. Additionally, there are regulations regarding the structure's division in fire compartments.

In Germany, requirements for fire resistance of construction products and building elements depend from their function in the structure. These requirements must be met in structural design of buildings. As higher and more complicated the structure as higher the demands on the building elements used. In addition to the mentioned regulations the flammability of the building materials must be considered.

Fire resistance of building elements defines the duration while the building element keeps its functionality when exposed to fire. That means at least to guaranty load bearing function and/or to prevent fire spread (flame, hot gases, excessive heat) beyond designated areas (separating function). Dependent on the building elements' function in the structure, local building regulations and respective national technical standards contain different requirements regarding their fire resistance and the flammability of the building materials they consist of.

For classification of construction products and building elements regarding their fire resistance the reaction-to-fire performance of the element must be verified according to DIN EN 13501 [12], DIN EN 1363 [14] or DIN 4102 [11]. Fire resistance classification according to DIN EN 13501 contains letters, which mark the respective performance criteria, and the information of the minimum duration of fire resistance in minutes (e.g. REI 90).

The responsible building authority controls the compliance with the respective building requirements. Deviations from the technical requirements are allowed if standards will be met in an equivalent manner with a deviating technical solution (Section 3 (3) of Saxon Building Regulations 2017 [9]). Within a fire safety concept the equivalence of the planning with the code requirements must be proofed.

3 Fire Safety versus Heritage Protection

3.1 Importance of Heritage Protection in Germany

In Germany, heritage protection enjoys a status of high importance. Around 79% of German people believe protection of historic structures is important [15]. Therefore, in the year 2017 Germany invested more than 138 million Euro in the support of heritage protection [16]. Germany ensures and encourages the protection of monuments by legal requirements, approval procedures, funding and taxes.

Because of the federal system of Germany in each of its federal states exists an own heritage protection law (such as in the Federal State of Saxony the Saxon Heritage Protection Act – *Sächsisches Denkmalschutzgesetz* [4]) where, among others, a definition of protectable heritage, requirements for the treatment of monuments as well as the tasks and competences of the state heritage protection authorities can be found. In other legislation such as the federal state constitutions a particular status of heritage protection is acknowledged.

Beside the state also private organizations or persons are active in monument protection such as the German Foundation for Monument Protection (*Deutsche Stiftung Denkmalschutz*) or heritage protection volunteers.

3.2 Balance between Fire Safety and Heritage Protection

Fire safety in historic buildings and monuments in practice often is an ambivalent issue. Because of building heritage protection reasons not all of the necessary fire protection measures are acceptable. But, often the structural status, existing preconditions as well as the desired usage of building heritage require special preventive fire protection measures.

That's why, individualized fire safety concepts are needed. Due to heritage protection interests, existing structures should not be more affected than necessary by fire protection requirements. For building heritage, the state authority for the protection of historic buildings and monuments must decide in cooperation with the responsible state building authority about the extent of preservation of historical structures and a potentially resulting reduction of fire safety requirements. Generally, it is allowed to plan and build in deviation from technical code requirements if standards will be met in an equivalent manner with a different technical solution (Section 3 (3) of Saxon Building Regulations 2017 [9]). The equivalence of the planning with code requirements must ideally proofed within a fire safety concept. If the

planning engineer is able to proof the equivalence of the deviating technical solution, the fire safety authority has to accept the deviating system.

It is important to know that refurbishment and modernization of historic buildings not always contribute to their preservation. The resulting construction works can lead to outbreak and spread of fire. For example by installation of modern technical building systems, walls and ceilings will be opened which supports fire and smoke spread. Furthermore, a new building structure (e.g. by smaller units and conversion of attics) may affect and hamper the first and second escape route [7]. That's why it is important to raise the construction workers', planners' and monument users' awareness of the specialties of historic structures. Unfortunately, in civil and structural engineering as well as architectural education at universities, the topic of fire safety combined with heritage protection plays only a minor role.

3.3 Special Structures (Theatres, Opera Houses, Churches, Monuments etc.)

Most of the German federal states' heritage protection acts require that monuments should be open for public in a reasonable limit. In order to show the cultural value of building heritage, these historical structures often are visited by many people or are used for cultural or religious events such as concerts, wedding ceremonies, worships or even as residential buildings. This often results in an intensive usage which can additionally increase the risks of fire. That's why sophisticated fire safety systems which also respect and integrate existing (historical) fire protection measures as well as the historical appearance are highly important.

3.4 Risks of Automatic Sprinkler Systems

Automatic sprinkler systems, as one of the most used fire protection methods, not only can fight the fire but also have the danger to water parts of the building which are not involved in the fire [7]. Thus, the water may destroy the interior of building heritage which often is historical as well. That happened in October 2017 in a German theatre, where two automatic sprinklers accidently caused damages of around four million Euro while in 30 seconds 16000 liters of water rushed down to the stage. Spotlights, audio and video systems, musical instruments, stage floor and understage systems were destroyed. Nearly four month the main stage could not be used [17]. This example is not an isolated case. Since 2017 damages caused by automatic sprinkler systems have been increased significantly [17].

3.5 Examples of Individualized Fire Safety Solutions

As discussed before, automatic sprinkler systems not always are the best solutions to prevent and fight a fire, especially in historical buildings with culture historic important interior or water sensible content such as theatres, libraries or archives. Thus, as an alternative to automatic sprinkler systems linear infrared fire detectors, fire alarms systems and smoke detectors could be used. Furthermore, a sufficient number of fire extinguishers always should be available in historical buildings.

Water mist systems may replace the traditional sprinkler systems in water sensible building heritage. Thus, in the historical palace theatre Celle/Germany from the 17th century, a water mist systems was installed which uses a pressure of 200 bar [17]. Also, in other historical

buildings such as the 'Schlaue Haus' from the 16th century in Oldenburg/Germany, where the development of an fire safety concept because of the historic building structure is challenging, an fire control system including a water mist system prevents fire and smoke spread. In case of fire, nozzles at the ceilings spray high pressure water mist which supports additionally the exhaust smoke gas by a vertical air flow [18].

Furthermore, smoke extraction systems can be included in historical windows as done in the staircases of the castle 'Wartburg' in Thuringia/Germany. It is much better to open the historic windows in the case of fire to enable the necessary smoke extraction than to be forced to break it [7]. In this way it is possible to preserve the old colored windows and to affect the existing structure only in a minor extent.

Active fire prevention systems, which reduce the oxygen percentage in the air by controlled supply of nitrogen are a solution for areas which are not often frequented by people such as archives or places where historic instruments, costumes, stage decorations or literature are stored. The risks of an open fire will be strongly reduced and the areas will stay accessible and usable [19]. Using these kinds of active fire prevention systems protects valuable documents or interior from smoke and extinguishing agents. A further advantage of the reduced oxygen percentage in the room air is the slowdown of documents' paper aging [18].

4 Individualized Fire Safety Concepts for Historic Buildings

Before fire protection modification of building heritage a fire safety analysis has to be made. In historical buildings often outbreak of a fire emergence will be caused by dilapidated technical installations, open fire or acts of arson [7]. The spread of fire will be supported by former time's construction methods (such as close distance of buildings and ceiling openings) and the frequent use of easily flammable construction materials, e.g. timber or straw. This is aggravated by the fact that in historical structures normally automatic systems for early recognition of fire as well as escape and rescue routes do not exist.

Due to the age and specialties of historic buildings, e.g. regarding construction system and building materials, requirements and fire protection systems developed for new constructed buildings only can be used with respect to the specialties of the existing structure. Nevertheless, some basic principles of fire safety also in building heritage must be obeyed.

An integrated fire safety concept must include coordinated structural, technological and organizational as well as defensive fire safety measures to meet the specified protection objectives. Aim of such an integrated fire safety concept is to proof fire safety for one special building. It must balance the need for the safety of the user, damage prevention interests and heritage protection requirements. For reaching this goal, state fire safety authorities, state heritage protection authorities and owners should cooperate solution-oriented and respectfully.

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DESIGNING "WORKFORCE" HOUSING AFFORDABILITY

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Abstract

Housing, affordable and proximate to places of employment, is crucial to sustaining California's economic competitiveness. This is particularly so in highly impacted metropolitan California communities. Incentives to construct new, affordable units throughout the state are scarce, but some financing is available from the California Tax-Credit Allocation Committee (TCAC). Their limited funds largely support construction of housing for households with extremely low (<30%) and very low (30-50%) area median income (AMI). Housing projects for households with low (51%-80%) and moderate-income (81%-120% AMI) are typically not competitive for TCAC funds. Median income in California ranges widely as does the housing type desired by the workforce. Types include: dormitory style farmworker housing in the Central Valley; service worker housing in recreational areas; rental units for service delivery workers on the central coast; and, entry-level multifamily rental housing for highly educated IT workers in Silicon Valley. The housing occupied by these families is largely produced by the private sector and has been labelled in the literature (and variously defined) as "workforce" housing as no shared definition state wide or national currently exists.

The urgency to seek housing solutions for low and moderate-income households in California through private sector initiatives is recognized widely and reflected in data on housing prices. For example the Center for Housing Policy's first quarter report for 2017 lists 13 California metros in the 15 highest metro median home prices in the US. The top nine California metros outrank Honolulu Hawaii (10th) and Seattle Washington (15th).

This paper presents findings from research (supported by a grant from the California Department of Housing and Community Development) on innovative ways in which housing for low and moderate-income families was designed through public/private partnerships. This work has informed the 2015-2025 State-wide Housing Plan. Based on lessons from successful and innovative housing projects for working families in California it recommends policy and practice to enhance the creation of innovative design, regulation and financing of housing for low and moderate-income households "workforce" housing.

Keywords: "workforce" housing, design, plan, finance, innovate

1 Introduction

Affordable housing that is proximate to places of employment is crucial to sustaining California's economic competitiveness. A significant barrier to this is particularly so in highly impacted metropolitan California communities, located in high amenity regions such as coastal and scenic recreation areas, is borne out by the high median price of housing in these areas.[i] Here the demand for housing is met at the higher end by conventional market driven residential development. But this market rate housing is out of reach for and renders "housing burdened" a significant number of working but low and moderate-income families. And these low and moderate-income families are increasingly displaced from, or voluntarily leave, amenity-rich high cost coastal areas for less expensive housing markets in the region. They have thus inherited or taken on long commutes to and from job centers and the related impacts of these commutes on families and on their local communities.

In the San Francisco Bay Area Silicon Valley's the growth of the high technology industry and its impact on regional housing markets has been widely noted including in the popular media.[ii] And on going academic researchers have examined the resulting gentrification and potential for displacement on the health and economic wellbeing of communities.[iii] The urgent need to seek housing solutions for low and moderate-income households in California, loosely referred to as "workforce"[iv] households, through private sector initiatives is reflected in data on housing prices.[v] A study[vi] supported by four key state agencies analyzed the cost of building multifamily housing in California listed as its first conclusion (pg. 5) that:

> "Local factors have an impact on costs. Specifically, projects with more community opposition, significant changes imposed by local design- review requirements, or that received funding from a redevelopment agency cost more, adding 5 percent, 7 percent, and 7 percent, respectively, to the cost per unit, on average."

Thus local regulations and the increase in cost of building when state or federal subsidy is involved are pinpointed as major constraints. The findings, that housing is quintessentially defined and enabled by local realities, is further explored in a study by Dandekar (Dandekar 2015).[vii] It reveals that private sector and non-profit developers in collaboration with city and county planning departments have constructed, without deep state or federal government subsidy, housing for low and moderate-income "workforce" families. The innovative examples identified are attributable to the tenacity of many individuals - developers, city and county planners, construction managers, architects, urbanists, real estate agents, executives of non-profit organizations and housing trust funds and their commitment to seeing these buildings to completion and occupancy. They provided the detailed information of on-the-ground realities that only those who are directly engaged with construction know intimately. Their insights offer valuable lessons to planners and developers seeking to expand the units of housing for low and moderate-income families in a climate where only scant federal and state support for such production is available.

2 Research Method

This goal of this study, supported by a grant from the Division of Housing, Policy Development, California Department of Housing and Community Development (CDHCD). was not only to identify exemplary projects but also distil from them the "take away" characteristics that made for success and thus help others to replicate such efforts in other communities and contexts.

The experience of some eighty-two experts, many of them planners at the city and county levels and developers was tapped. They responded to an on-line survey developed by the research team.[viii] Their answers helped define the context of housing in various regions of California. *Some 90% of respondents identified a high or moderate need for housing for the low and moderate- income group.*

*The s*urvey responses helped identify potential case studies that had promise of meeting the stipulated criteria –housing for low and moderate income families constructed without benefit of state or local subsidy.[ix] Twenty-three planning and architecture students in a Housing and Planning class taught by Professor Dandekar also identified suitable cases and developed preliminary descriptions. Eight of these were selected as case studies in the final report. A matrix of 38 successful projects located throughout California were selected, and winnowed down to 10 projects that scored highest for innovations along the following parameters:

Design

The design categories examined included smaller by design, manufactured homes, modules or components, flexible design, and, adaptive reuse. The design analysis also included examining projects for design strategies such as mixed use, small lot, multifamily and higher density.

Regulation

The regulatory categories examined included relaxation of parking requirements, density and height increases, setbacks and plot size reduction as well as streamlining approvals and deferring fees.

Finance

Financial strategies considered include innovative ownership, tenancy and rental arrangements such as shared ownership/occupancy in co-ops/co-housing, house-sharing, ancillary dwellings and live-work arrangements.

The 38 selected projects were analyzed for their innovations in design, regulation and finance in a matrix format.

Fig 1 *Location of 38 Innovative Projects, largely located in high amenity areas of California*

3 Findings

The successful housing is recent, built in the last decade, and primarily located in regions of California where housing and land prices have escalated, employment has increased, and the demand for housing is extremely high. These successful projects offer an alternative approach, predicated upon the convergence of entrepreneurial design, responsive government and shifting housing preference. They vary greatly, responding to local needs in high cost areas, to fill the affordability gap between subsidized and market rate housing.

The study report features ten cases that underscore the localized, context-grounded nature of housing design choices low and moderate-income households are making to obtain housing close to work that is not a burden on household budgets. The developments track trends in housing preference more recently attributed to young professionals - an acceptance of smaller housing, closer to amenities, with a reduced dependency on the automobile. The trade-offs in housing consumption that these preferences represent, and the ways in which some entrepreneurial developers and local governments are responding, provides useful lessons. These lessons are not a blueprint for project-specific replication, but identify opportunities for housing households not typically served by public investment yet priced out of the competitive high amenity housing markets in California. Featured case studies showcase rental and ownership projects located near work and public transit, student housing near educational facilities, and shared open space residential development within walking distance of jobs, recreation, shopping and services. They highlight key planning and development strategies:

Key Attributes of Identified Projects

- Changes in land use regulations that enable increased density, lot coverage, and smaller units.
- Flexible space configuration to respond to changing market demand and client preferences.
- Pragmatic attention to detail, aesthetically designed for environmental sustainability and long-term functionality.
- Cross subsidy from units sold at market rate.

Areas of Innovation in 10 Selected Projects

1. Small by Design (90%)

Smaller size units reduce the cost of entry to housing. These units have been accepted and are selling in the market which supports the building professions' sense that in high land value contexts smaller, denser, minimalist housing, shared amenities and open space with neighbors, is gaining acceptance. Young urban professionals are the demographic that is most receptive to these units.

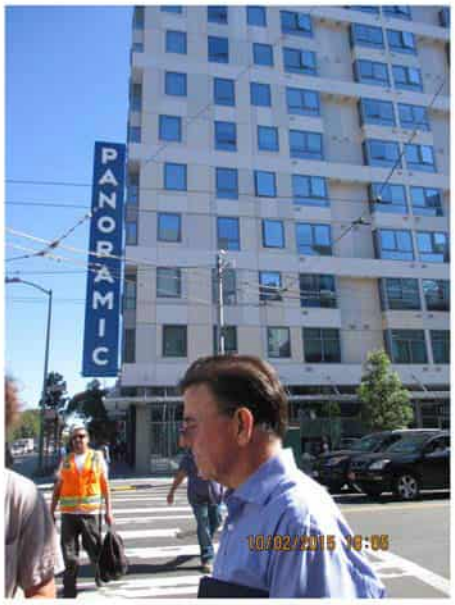


Figure 2 *Micro Units in Downtown San Francisco developed by Patrick Kennedy (in foreground).*

2. Flexibility in Unit Design and Mix (70%)

Projects feature unit designs that can be easily be modified by connecting adjacent units, dividing rooms to yield more bedrooms, deploying rooms and spaces so that they can be converted for multi purpose uses (bed room, study, office space, storage or workshop), or put to a different use (nursery, guest room, accessory dwelling unit). This flexibility promises to provide a hedge against obsolescence.

Figure 3 *An Accessary Dwelling Unit (ADU) in Santa Cruz from prototype design commissioned by the city.*

3. Green by Design (80%)

Projects designed to exceed California (CalGreen) building standards and/or adopt adaptive reuse strategies yield energy and cost savings that might allow units to retain greater affordability into the future. Repurposed units also restrain costs when the project is reconfigured on a smaller-by-design and/or mixed-use footprint.

4. Parking Reduction or Elimination (80%)

Projects strategically located near sites of employment, education, recreation, and services encourage residents to use alternative modes of travel including bikes, electric scooters, and public transport. Low or no parking requirements are extremely important in the success of almost all the featured projects.

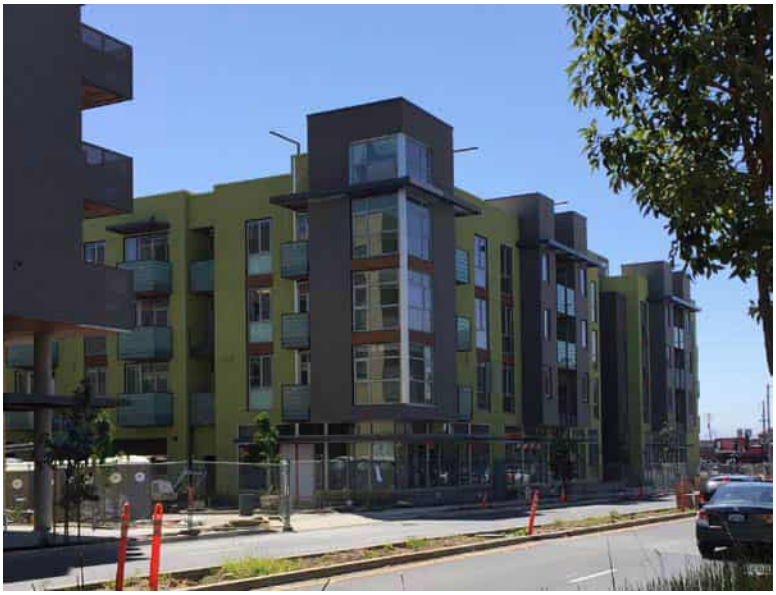


Figure 4 *Parc on Powell in Emeryville 36 units (22% of total) below market rate with parking, density, height and setback variances and city ownership of parking structure.*

5. Density Bonus (90%), Height Increases (80%), Setbacks Concessions (90%)

All projects have benefitted from one or more regulatory concessions on the maximum allowable built up area, setback requirements, density bonuses, and, allowable height. These have at times enabled a doubling or more of the total square footage built.

6. Cross Subsidy from Units Sold at Market Rate (70%)

Profits from sale of units at market rate, as well as from commercial and retail/service space sold or leased at market rate have cross-subsidized the price of units for low and moderate-income households. In one case, direct transfer of in lieu fees captured from a commercial development to land held in trust for affordable housing provided interim financing for predevelopment costs, allowing a public non-profit developer to obtain a conventional loan to construct shared-equity town homes for local workers

Figure 5 *Moylan Terrace, San Luis Obispo 29 units (36% of total) for very low to moderate-income families juxtaposed seamlessly with market rate.*

4 Summary

This study navigated local planning, design and building channels in order to gain access to how creatively bundled incentives can work to create "workforce" housing. Each successful effort analysed local risk, market, interest, and collaboration to formulate an investment strategy that has worked for specific sites under circumstances particular to local conditions and prevailing construction costs - land, labor, materials and finance.

The ideas and innovations represented in these projects are not radical or particularly new, but they were creatively assembled, implemented and timed well. In most cases, reduced parking requirements, zoning and building codes that supported smaller building footprint and design, set back reductions, height increases and density bonuses, allowed for more units to be constructed on expensive land so as to restrain cost per unit and provide a cross subsidy for affordable units.

The manner in which the partners resolved the inevitable tensions that arise amidst planning and design, regulatory oversight, evolving and proprietary investment, escalating housing prices and broader market fluctuations sets these projects apart. The variety of ways in which experts, in their separate fields, teamed up to identify barriers and created strategies to navigate the local planning process, governmental regulation and economic uncertainty is worth recognition. Their efforts have made it possible to offer market-rate affordable housing options to middle income workers who are ineligible for government subsidies but unable to afford conventional housing in high cost areas. These examples offer some good news in a bleak landscape of housing inaccessibility for low and moderate-income families. They should encourage local governments and housing developers to find their own winning strategies to build housing that meets the needs of these "workforce" households in Californians.

Notes

[i] See "Driving Home Economic Recovery: how Workforce Housing Boosts Jobs and Revenues in Marine" http://nonprofithousing.org/wpcontent/uploads/DrivingHomeEconomicRecovery.pdf accessed 10.12.14. See also Marin Community Foundation, www.marincf.org "Building Livable Communities Enhancing Economic Competitiveness in Los Angeles" L. A. Business Council, http://labcinstitute.org/files/LABC_MHTJ_Report_2012_only_final_r-1.pdf accessed 10.12.14

[ii] See Kloc, Joe, "Tech Boom Forces a Ruthless Gentrification in San Francisco" Newsweek, April 15, 2014
http://www.newsweek.com/2014/04/25/tech-boom-forces-ruthless-gentrification-san-francisco- 248135.html
See also Chokshi, Sonal, Mapping Silicon Valley's Gentrification Problem Through Corporate Shuttle Routes, Wired: September 2013.
http://www.wired.com/2013/09/mapping-silicon-valleys-corporate-shuttle-problem/

[iii] Chapple, Karen, Mapping Susceptibility to Gentrification: The Early Warning Toolkit, August 2009.
http://communityinnovation.berkeley.edu/reports/Gentrification---Report.pdf

[iv] The term "workforce" housing has been ill defined and used to denote various income levels and family types throughout California. For this study the term "workforce" was not used, lacking as it does a

specific definition. However, families in low and moderate income categories are generally families where one or more of the household has work. The term is used here in this somewhat imprecise fashion.

[v] For example the Center for Housing Policy's first quarter report for 2014 lists 13 California metros in the 15 highest metro median home prices in the US. The top four California metros (San Francisco, San Jose, Santa Anna and Santa Cruz) outrank Hawaii and New York.

[vi] Affordable Housing Cost Study: Analysis of the Factors that Influence the Cost of Building Multi-Family Affordable Housing in California, October 2014.
http://www.hcd.ca.gov/housing-policy development/docs/finalaffordablehousingcoststudyreport-with- coverv2.pdf

[vii] Dandekar, *Designing Affordability: Innovative Strategies for Meeting the Affordability Gap Between Low Income Subsidy and the Market in High Cost Areas* Project Report for the California Department of Housing and Community Development, Dec. 2015.

[viii] The survey consisted of 15 questions aimed at identifying: Perception of need for low and moderate income housing; and, location of housing projects that demonstrated innovations in design, regulatory practices, and/or, finance.

A total of 82 responses were received between mid March 2015 to end of June 2015 from individuals who were employed in the following sectors: 71% Public; 14% Private; and 15% Non Profits.

Need: Question 7 of the survey asked if there was a need for housing affordable to low and moderate-income households in their region and to estimate the level of need. 52 respondents answered as follows: 65% High; 25% Moderate; 6% Low; 4% None. Significantly some 90% of respondents identified a high or moderate need for housing for this income group.

CLASSIFICATION OF RESIDENTIAL BUILDINGS IN BOSNIA AND HERZEGOVINA IN RELATION TO THEIR ENERGY PERFORMANCE:

FOCUS ON THE **SINGLE FAMILY HOUSES** BUILT FROM **1981 TO 1991**.

Mladen BURAZOR, Erdin SALIHOVIC, Nermina ZAGORA,
Faculty of Architecture, University of Sarajevo,
Patriotske lige 30, 71000 Sarajevo, Bosnia and Herzegovina,

0/RESEARCH METHODOLOGY SCHEME

01 ANALYSIS LITERATURE REVIEW

EU PROJECT/IWU DARMSTADT " TABULA" METHODOLOGY LITERATURE REVIEW:
- STATISTIC AGENCIES
- FACULTY OF ARCHITECTURE UNIVERSITY OF SARAJEVO
- FACULTY OF ARICHITECTURE AND CIVIL ENGINEERING UNIVERSITY OF BANJA LUKA

NORMS AND REGULATIONS
- AUSTRO-HUNGARIAN EMPIRE (1878 - 1914)
- KINGDOM OF YUGOSLAVIA (1919 - 1941)
- YUGOSLAVIA (1945 - 1991)
- EN STANDARDS
- BAS STANDARDS

02 DEFINITION OF CRITERIA FOR THE CLASSIFICATION OF RESIDENTIAL BUILDINGS OF BOSNIA AND HERZEGOVINA

- ARCHITECTURAL AND URBAN PARAMETERS
- CONSTRUCTION PERIODS

OUTCOMES
- PRELIMINARY BUILDING TYPOLOGY MATRIX
- QUESTIONNAIRES AND STATISTICAL PREPARATION

03 STATISTICAL SURVEY: REGISTRY OF EXISTING RESIDENTIAL BUILDINGS

SAMPLE AND MAP PLANNING FOR THE SURVEY
- QUESTIONNAIRE 'A': 13 044 BUILDINGS
- QUESTIONNAIRE 'B': 3 261 BUILDINGS

STATISTICAL ANALYSIS DATA WEIGHTING

CLUSTER ANALYSIS AND THE SELECTION OF TYPICAL BUILDINGS

MATRIX OF THE RESIDENTIAL BUILDINGS OF BOSNIA AND HERZEGOVINA

04 TECHNICAL RECORDING OF TYPICAL BUILDINGS

ARCHITECTURAL PROJECT DOCUMENTATION DEVLOPMENT

THERMOGRAPHIC RECORDING OF TYPICAL BUILDINGS

05 CALCULATION OF ENERGY PERFORMANCE OF THE TYPICAL BUILDINGS

ENERGY STATUSA QUO CALCULATION

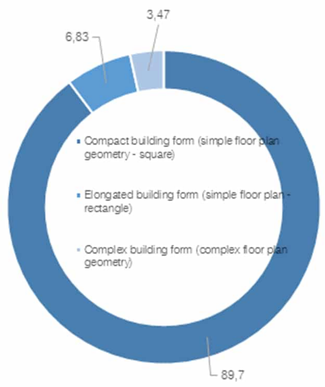
EE IMPROVEMENT MEASURES
- SCENARIO 1
- SCENARIO 2

06 RESEARCH RESULTS PUBLICATION

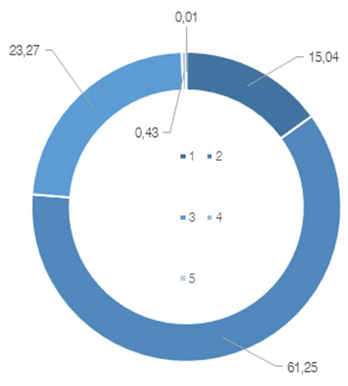
TYPOLOGY OF RESIDENTIAL BUILDINGS IN BOSNIA AND HERZEGOVINA

1/TYPICAL ARCHITECTURAL FEATURES

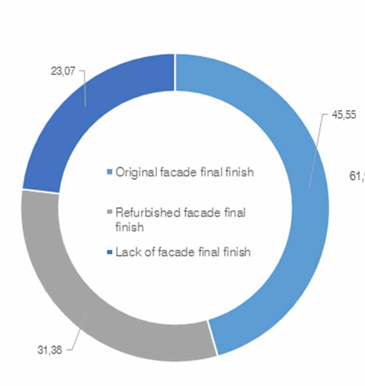
FLOOR PLAN SHAPE



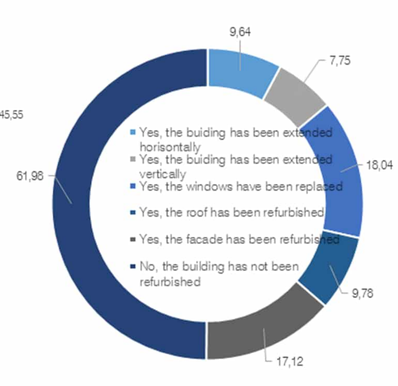
NUMBER OF FLOORS



FACADE CONDITION

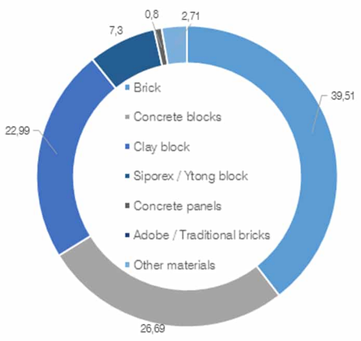


THE LEVEL OF REFURBISHMENT

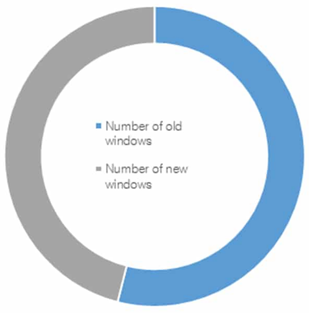


2/ARCHITECTURAL ENVELOPE

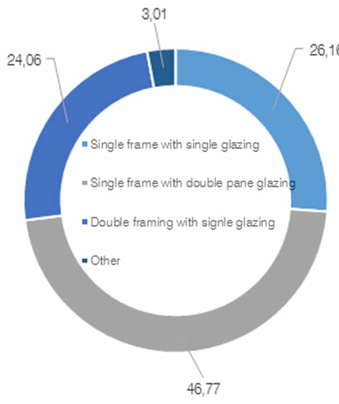
EXTERIOR WALLS MATERIAL



OLD VERSUS NEW WINDOWS



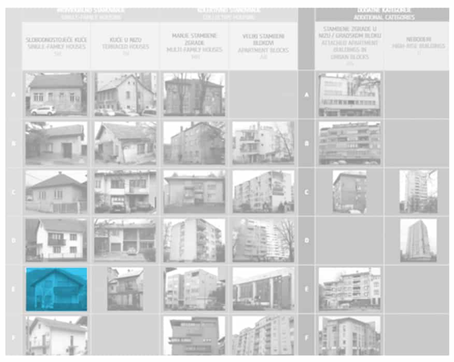
PREVAILING TYPE OF WINDOWS



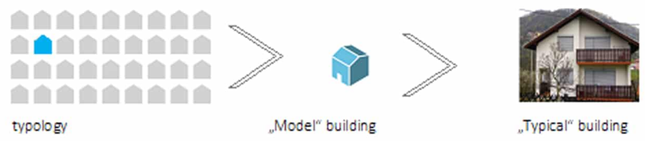
This study has stemmed from the registry of data on the residential stock of Bosnia and Herzegovina, collected from 2014 to 2016 in the course of the research project entitled "**Typology of residential buildings in Bosnia and Herzegovina**", which included a statistical survey of 13 044 existing buildings. The applied research methodology originates from the European research project TABULA, a unique typological model of classification of residential buildings according to their construction period and typical architectural properties.

The estimated number of buildings in the category in focus - the **single family houses from 1981-1991** - accounts for 236 075; comprising of 306 898 dwelling units and covering 38 282 654 square meters of gross building floor area in Bosnia and Herzegovina. All buildings from the specified category share several common properties in terms of their architectural form and volume: each building from the indicated category comprises of maximum three floors and maximum three dwelling units; in terms of its urban disposition and form, it is a freestanding building dating from the period from 1981 to 1991.

3/SELECTION OF THE **TYPICAL BUILDING**



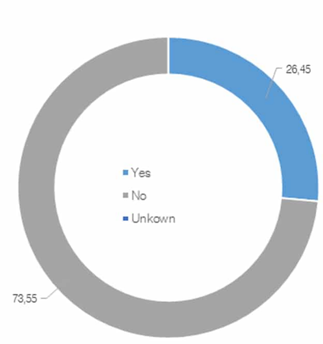
Outlining the principles of classification of building typologies and the development of the database enabled the extraction of the **typological features** of the buildings, their architectural envelope and heating systems. The succeeding objective was to search for an existing building within the entire database, which would reflect the shared properties for each category, and hence may be proclaimed as the **"representative" or the "typical" building.**



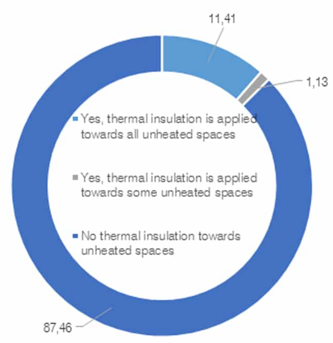
4/CHARACTERISTICS OF THE ARCHITECTURAL ENVELOPE

In response to the research and calculation outcomes, two scenarios of the **measures of EE improvement** were simulated at the level of the architectural envelope and heating systems. (1) The measures of improvement of the architectural envelope (walls, slabs, floors, roofs) consisted of the application of the thermal insulation layer towards the non-heated spaces with predefined width and heat transfer coefficients (e.g. for the external walls, basic improvement scenario consisted of application of 10 cm of thermal insulation of $\lambda = 0{,}041$ W/mK; the advanced improvement scenario 20 cm of thermal insulation of $\lambda = 0{,}041$ W/mK).

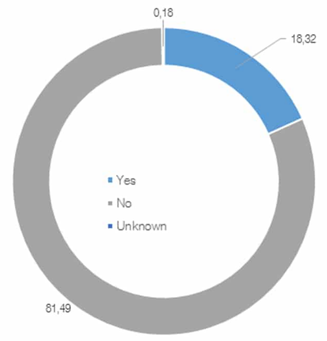
PREVAILING TYPE OF WINDOWS



THERMAL INSULATION TOWARDS THE NON HEATED SPACES

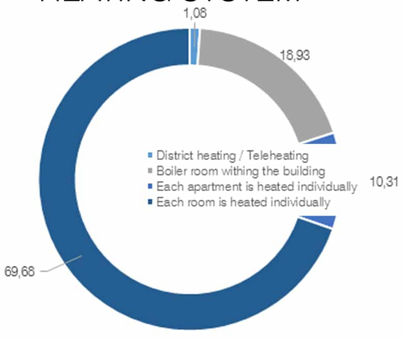


THERMAL INSULATION OF EXTERIOR WALLS

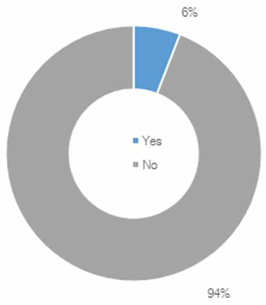


5/HEATING SYSTEM

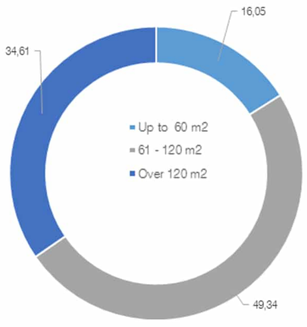
THE YPE OF THE HEATING SYSTEM



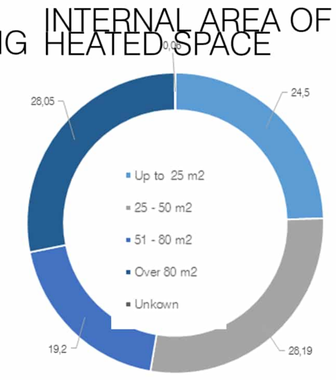
HEATING SYSTEM REFURBISHMENT IN THE LAST 5 YEARS



GROSS INTERNAL AREA OF THE BULDING

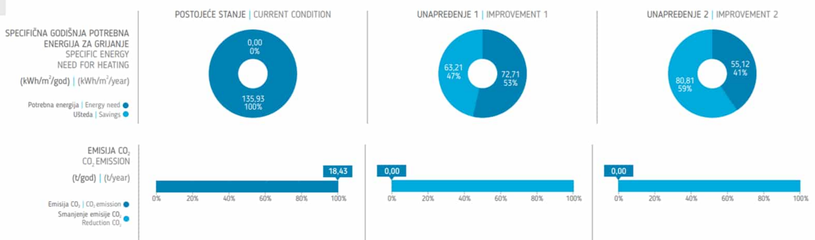


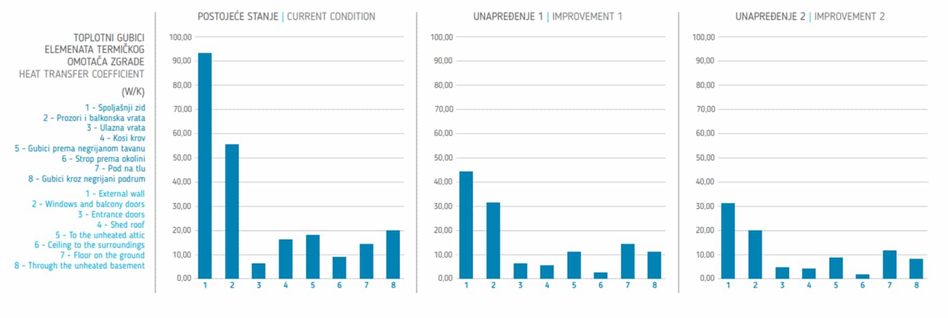
INTERNAL AREA OF HEATED SPACE



THE YPE OF THE HEATING SYSTEM

6/ EFFECTS OF THE MEASURES OF IMPROVEMENT

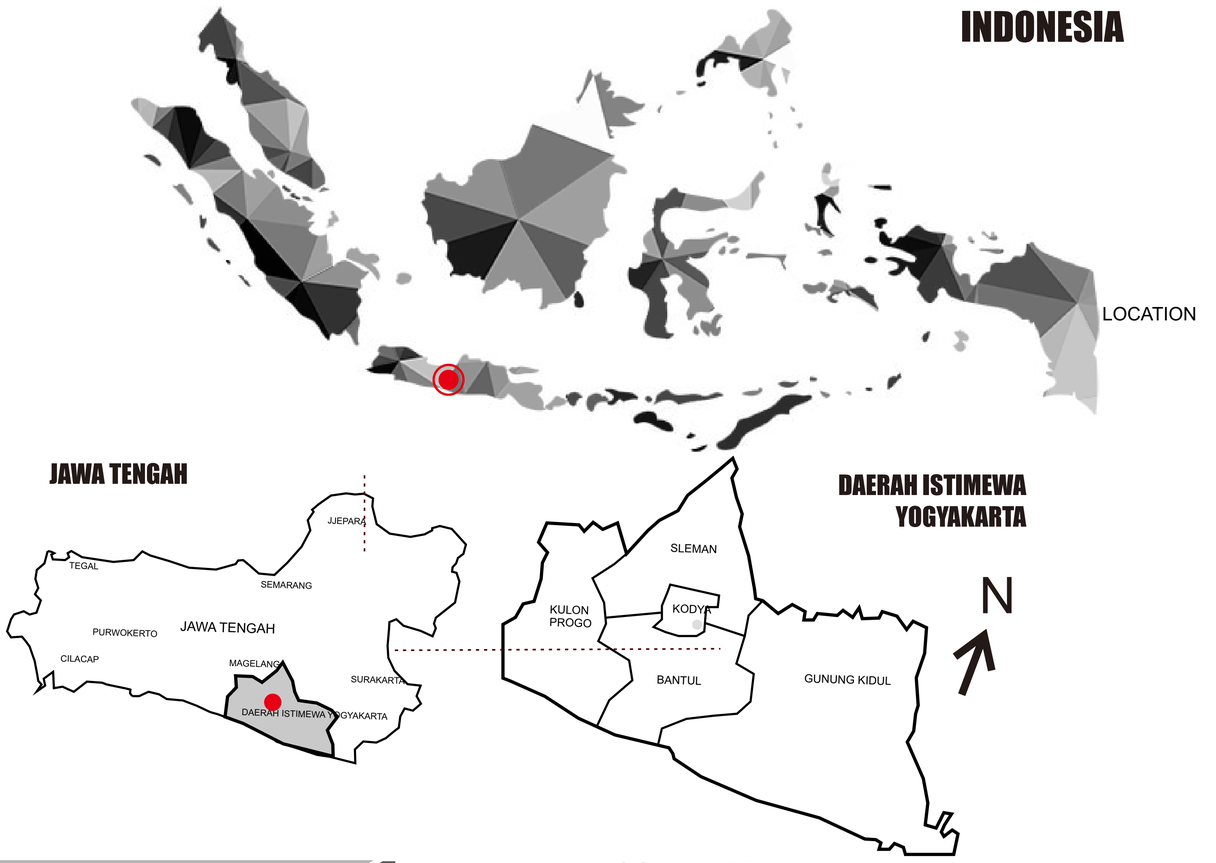




TYPOLOGY OF RESIDENTIAL BUILDINGS IN BOSNIA AND HERZEGOVINA

CIPTA RASA-KARSA

FOR THE FUTURE DEVELOPMENT OF A HUMANISTIC AND PROFITABLE YOGYAKARTA CITY



ABSTRACT

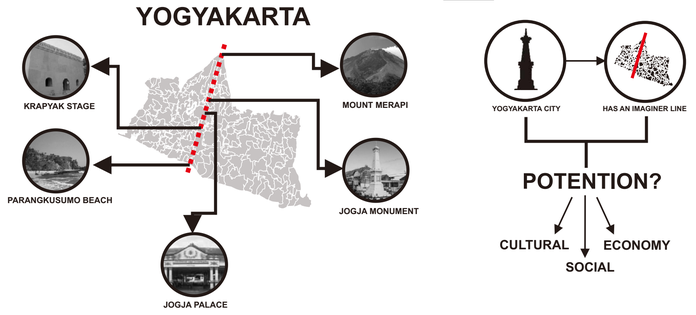
Yogyakarta is the official city born on 7 October 1756, Yogyakarta is a beautiful city that embraces the philosophy of development "**hamemayu hayuning bawana**" or can be interpreted to heed something that has been beautiful, many factors that affect Yogyakarta as a beautiful city, Merapi Mount as a span in the north, South Coast in the south, and the Kraton as its center made by Sultan Hamengku Buwono 1. Yogyakarta is also a city that is accompanied by local people and migrants. The Sultan is the one who controls everything, Sultan is the King and Father for the Yogyakarta citizens, Another beauty in the city of Yogyakarta, is Yogyakarta as a disaster-prone city. Yogyakarta earthquake on 27 May 2006 destroyed 1.2 million occupancy, the eruption of Mount Merapi killed 194 people, but is it a disaster or a blessing?

For Yogyakarta people who adhere to the life view of "**Cipta, Rasa, and Karsa**" (**Cipta** is the image that is in our minds, **Rasa** is personal emotion, **Karsa** is determination, intention is the power that moves Cipta and Rasa). Disaster is a social, cultural, and economic blessing from God, they take the wisdom of all that, the Sultan is the person who nurture us during the disaster in Yogyakarta, mutual cooperation, mutual tolerance, good life, and profitable to rebuild the city of Yogyakarta.

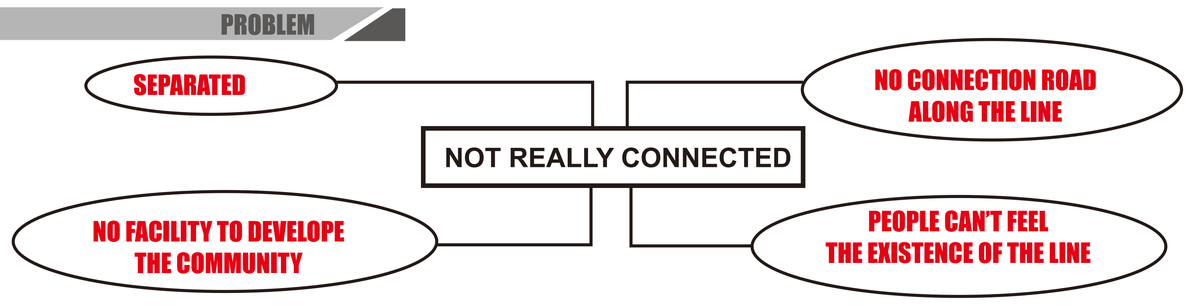
Humanity becomes the most attention, which makes Yogyakarta a peaceful city. "cipta, rasa, and karsa" is sometimes not owned by the newly arrived, because for the citizens of Yogyakarta, without the "cipta, rasa, karsa" humans will feel lonely, The solution I give is to create an open city in Yogyakarta, so that everyone can feel the benefits and blessings of Merapi and the South Coast, the warmth of the Kraton family and its descendants, and unite all aspects, to become a humanist and profitable city in the future.

ISSUE

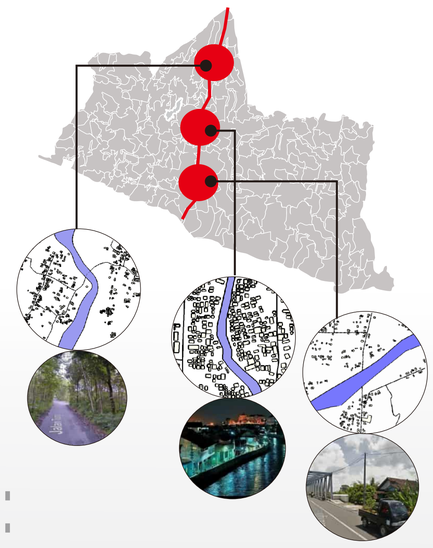
The people of Jogja know the imaginary straight line across Jogja, the imaginary line that connects the point between Merapi, Tugu and Keraton Yogyakarta. The people of Jogja considered the line to be quite historical and philosophical. Among its meanings is the symbolization of the relationship between the king and people and the harmonious and inline God, symbolized by the imaginary straight line. If this straight line meets then there is a meaning that is actually very connected, which originated from Merapi as a volcano, and ended in Parangkusumo as the sea. Water and Fire, a philosophical meaning that is not only an imaginary line, but also a symbol of the harmony of elements in nature, Water and Fire, Yin and Yang manifested in the local wisdom of Jogja people.
Therefore it can also be said of this uniqueness as another feature of Yogyakarta. Where ever when building the palace has paid attention to everything in detail. Kraton Jogja built with balance and harmony in it. The combination of fire and water as a symbol of good relationship between God with his creature and among human beings.



PROBLEM



FUNCTION



PERFORMING ART SPACE

Yogyakarta is a city known as a student city. However, in addition to being a student city, Yogyakarta is also known as a Cultural City which is a city with various cultures that are still strong and highly upheld by the people of Yogyakarta. Various traditional arts of Yogyakarta are still alive and preserved by Yogyakarta artists.

Not only in Yogyakarta, Yogyakarta's traditional art variety has been known and staged throughout Indonesia and even the world. Like the example of Wayang Kulit which has been popular also outside Indonesia. In addition, various dance arts have also been displayed several times in other countries such as Japan. So we also must be proud of the culture of Indonesia, especially Yogyakarta, which has been instrumental in the name of the nation.

ART PEDESTRIANS

Interesting sights often occur in pedestrian paths, where the boundaries of public space and private spaces melt away, or simply touch. Different experience gained if we are walking, not just as observes from inside the vehicle. Indeed, driving speed can be achieved, but with a walk of relaxation can be enjoyed. This pedestrian access but also as a place to showcase the work of art.

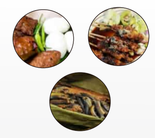
SPACE TO CREATE

SOUVENIR SPOT

Not only popular with typical rural tourism and also the charm of natural attractions of Mount Merapi wich is Kaliurang. Sleman in fact also store a myriad of culinary that is not less

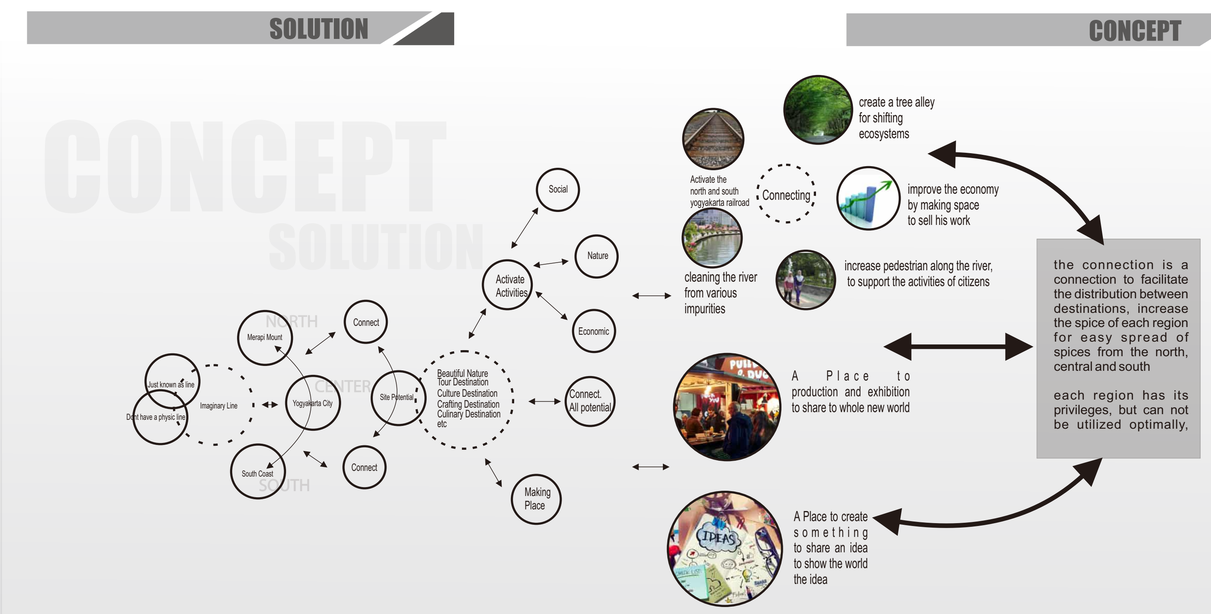
Culinary Spot is designed to provide a container for the typical of sleman culinary lovers to enjoy various types of culinary typical of sleman. as well as an e ort to introduce a typical culinary of sleman to the general public and to

CULLINARY SPOT

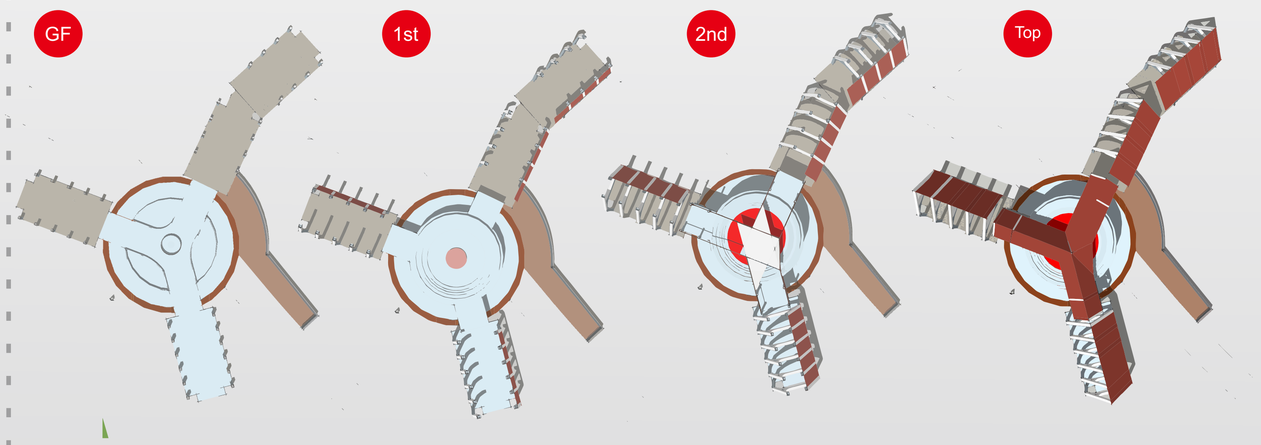


SOLUTION

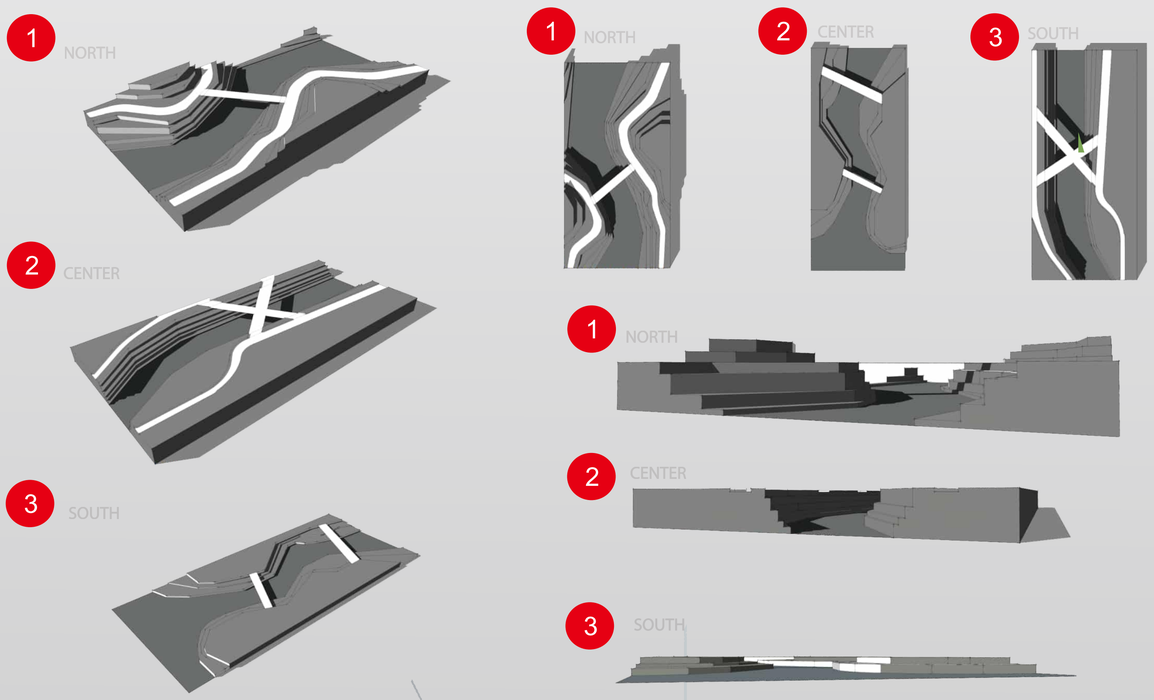
CONCEPT



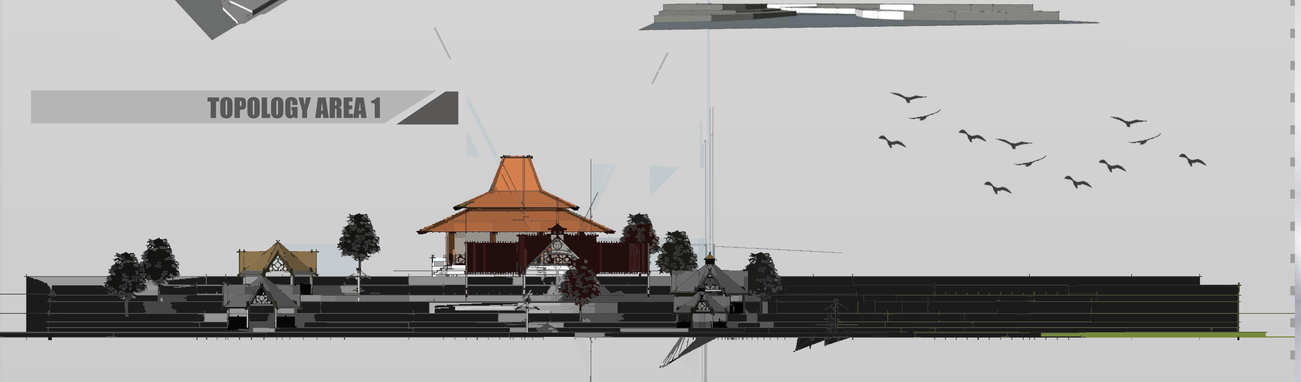
DESIGN



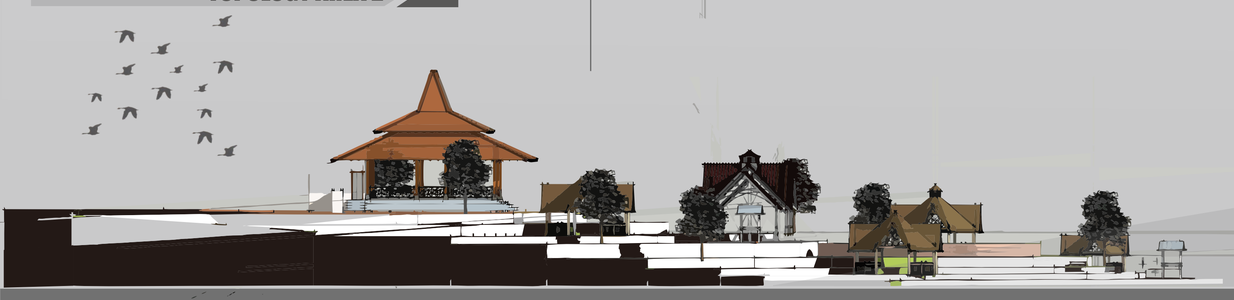
TOPOLOGY



TOPOLOGY AREA 1

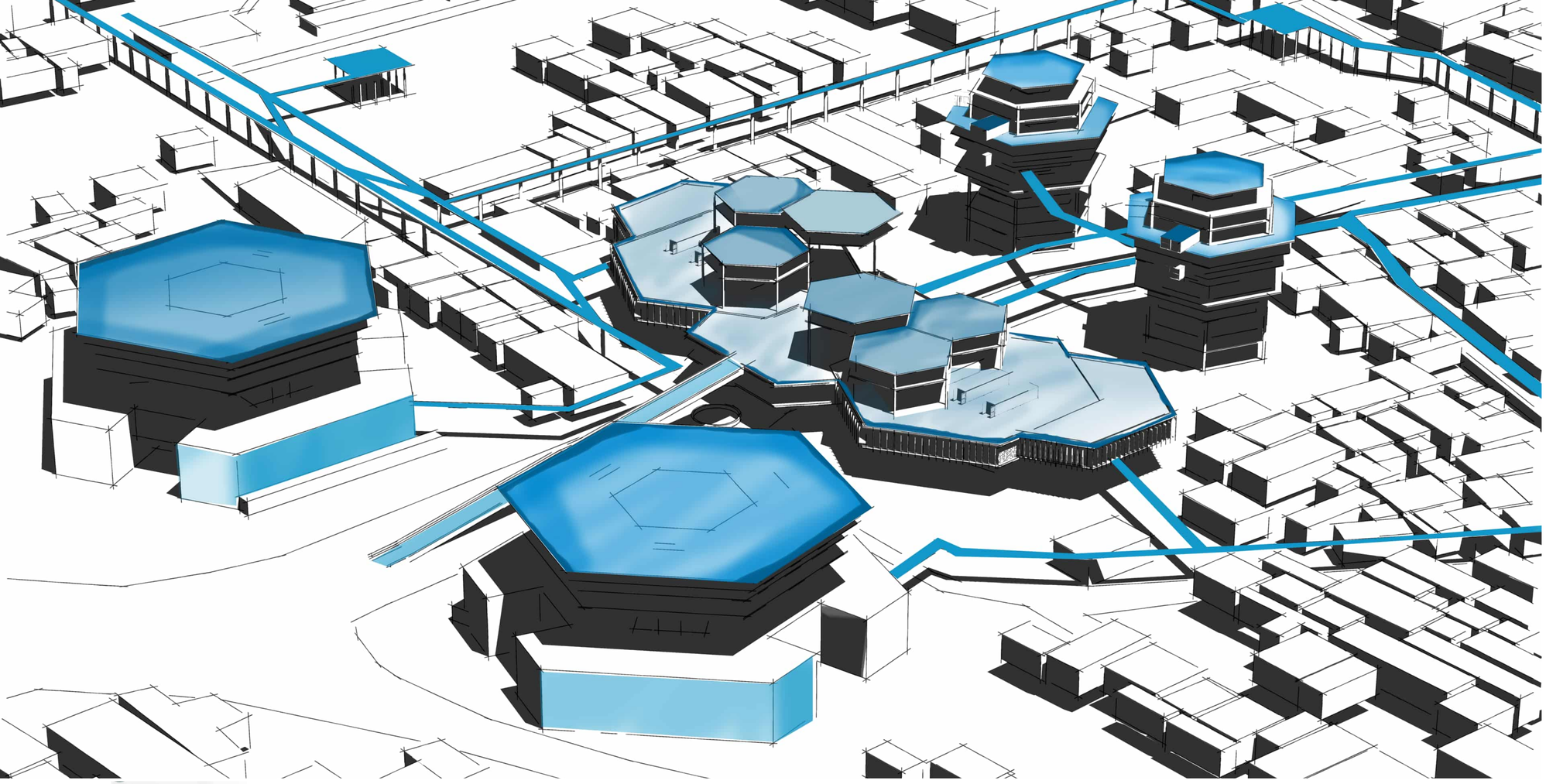


TOPOLOGY AREA 2



Ridho PAWENANG | Annisa Ramadhani PUTRI

S.ARCH - The 5th International Conference on Architecture & Built Environment + AWARDs
CONFERENCE S.ARCH ARCHITECTURE AWARD 2018 23-24 May VENICE, Italy



EXISTING

OPEN SOCIAL CITY IN URBAN UTOPIA

Making Inequality a Way to Become a Beauty

S.arch COMPETITION - **MOH. BINTANG LAZUARDI R**

Open Social City In Urban Utopia

Making Inequality a Way to Become a Beauty

Abstract

This writing aims to describe or present how the role of urban society to the social environment and its impact on the surrounding environment in this era. Urban Utopia is how society imagines or dreams about a society in which one is happy, has equal degrees, has the same ability and skill and physical equivalent that urban Urban Utopia will be a perfect social environment and will minimize a problem or gap that lies in a city or things that will be distorted in it and it is always applied in urban communities in various countries including Indonesia, especially in the province of Yogyakarta. **Open social city** will be another point of view that can be a new benchmark applied to urban utopia, so have the view that the perfection of the city does not mean equivalent in many ways but how to manage inequality is a thing that supports each other that makes the city perfect.

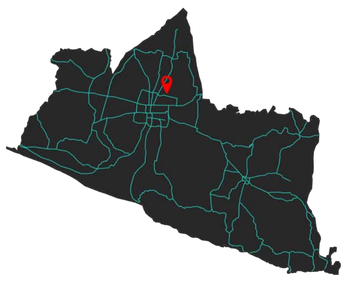
Open social city uses social analysis method, in its application this method is used to know and deepen social reality. The social character in Asia is one of Indonesia that is specified again in the province of Yogyakarta has a attitude of gathering or togetherness is high enough and the nature of empathy, sympathy and tolerance is strong enough with this method we can compared the people character in Asia and Europe to be a benchmark of what Urban Utopia is expected to be.

The conclusion of this open social city is a new perspective on how people will understand their social relations in urban areas rather than seeking equality in urban society but with inequality existing in the city into a strategy in solving urban problems and together and participating in resolving them, social analysis supports that attitude to understand people with one another, one group and the other and a broader relationship.

Keyword : Open Social, Open City, Analysis Social, Urban, Utopia.

Topic: T06 and Ecological and Social Aspects

LOCATION

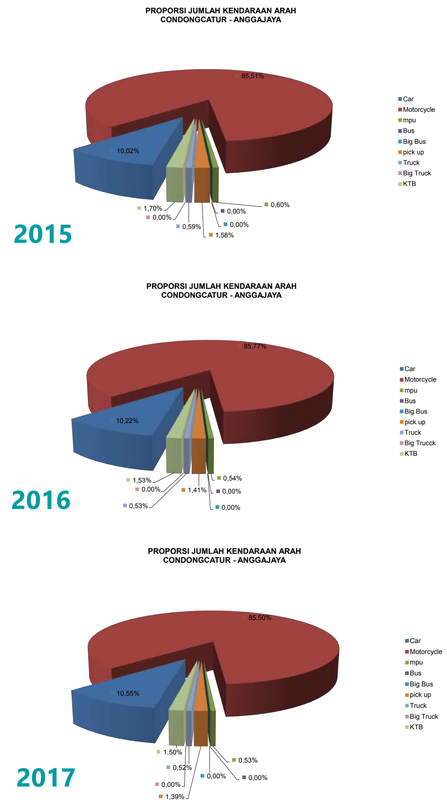


WHY CONDONGCATUR?

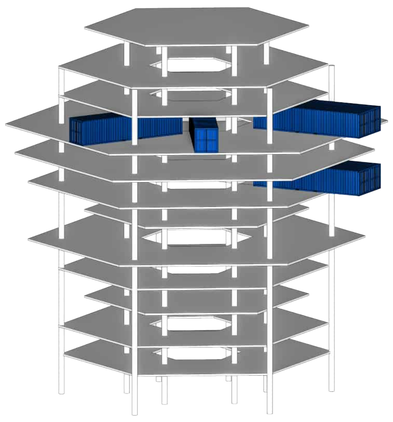
The development of the existing transportation and the increasing of economic level in Condongcatur village make the public lack of interest to use public transportation so Condongcatur Terminal as a place for transit looks quiet but public transportation which still many passengers that is at TransJogja Bus stop other than bus other such transportation yellow and angkot minibus seen only a handful of people who use it.

The potential that exists in the area around Terminal Condongcatur due to close to North Ringroad Road and Affandi Road makes many retail and street vendors are mostly located on the outskirts of Jalan Anggajaya I and from Anggajaya III Road which connects the road from Kaliurang Road to Jalan Anggajaya I also established many retail and street vendors, making the circulation on the roads become densely packed and parking lot less make the circulation more dense again.

The cause of circulation in the area of Jalan Anggajaya I and III is not only from existing merchants and retail but also from residential and boarding houses and there are schools located in the area. The narrow road width is also the cause of congestion in the area around the terminal and crossing from Jalan Anggajaya III to North Ringroad Road and towards Jalan Anggajaya II becomes one of the reasons for traffic jams as well.

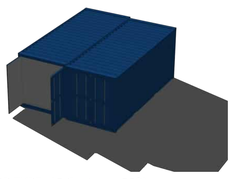


TYPOLOGI HOUSING

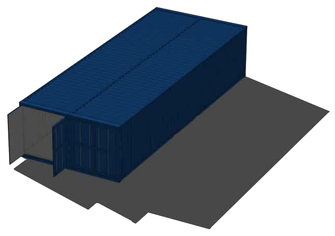


In the housing area, the design applied is a lowcost apartment, the material used with containers of 12 mx 2.5 mx 2.6 m (40ft) and 6 mx 2.5 mx 2.6 m (20ft) with Dry Cargo container type Container. This apartment is functioned for immigrants who from various wishes to have a place to live in the area Condongcatur. So that the empty land that is still productive can be utilized for green area.

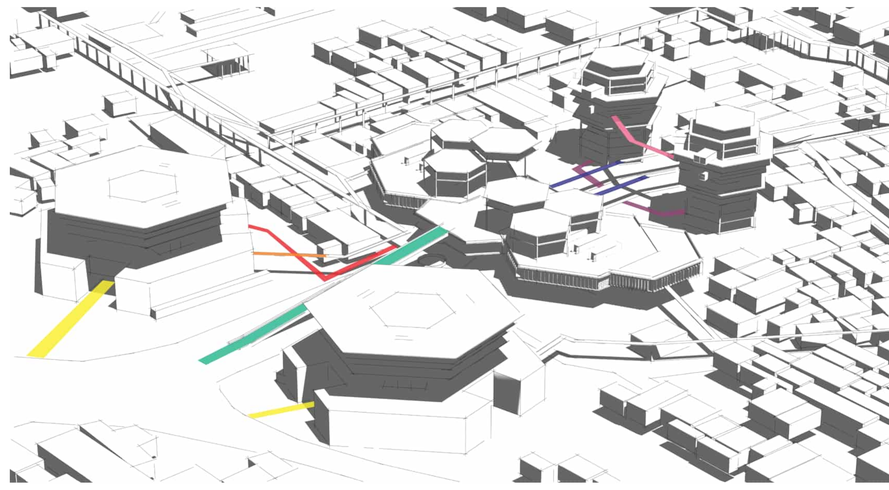
ROOM TYPE

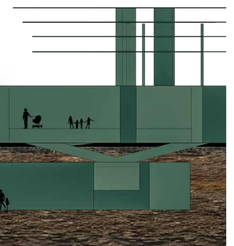


STANDARD TYPE : (2 Container 20ft)
FUNGTION : Dining Room, Bedroom.



EXCLUSIVE TYPE (2 Container 40ft)
FUNGTION : Dining room, Bedroom, Family room,





ENTRANCE BUS & ANGKUTAN UMUM KE TERMINAL

ENTRANCE MIXUSED BAGI PEJALAN KAKI

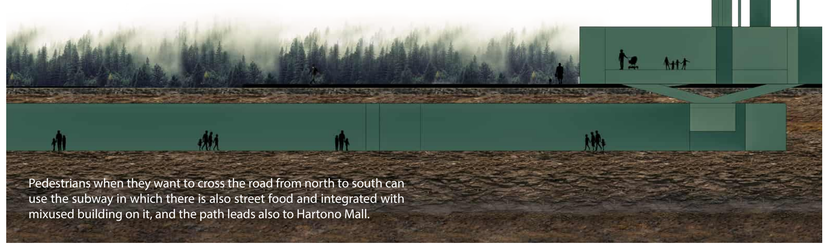
ENTRANCE MIXUSED DARI ARAH PARKIR

ENTRANCE MIXUSED DARI SKYWALK

ENTRANCE APARTEMEN

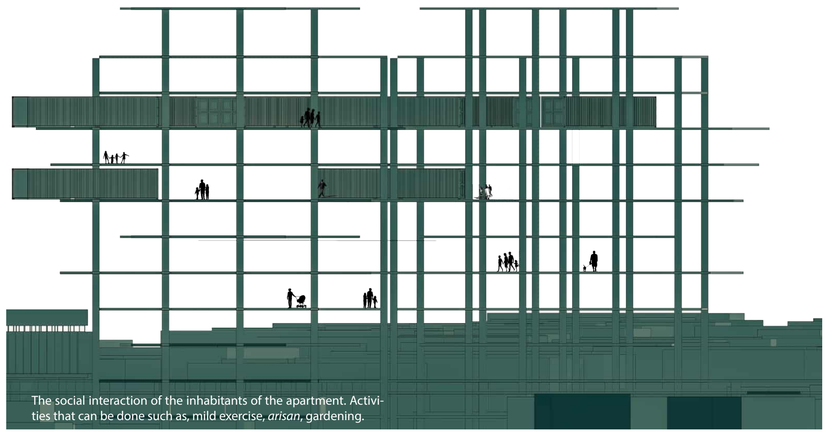
ENTRANCE TERMINAL DARI SKYWALK

JEMBATAN PENGHUBUNG APARTEMEN



Pedestrians when they want to cross the road from north to south can use the subway in which there is also street food and integrated with mixused building on it, and the path leads also to Hartono Mall.

SECTION OF VERTICAL HOUSING



The social interaction of the inhabitants of the apartment. Activities that can be done such as, mild exercise, *arisan*, gardening.

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MODELS OF PRACTICAL LEARNING IN ARCHITECTURAL ACADEMIC PROGRAM
CASE STUDY: FURNITURE PROTOTYPE DEVELOPMENT AND LIBRARY REFURBISHMENT

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The presented pieces of furniture were designed by the three generations of students of the Faculty of Architecture University of Sarajevo from 2013 to 2017, within the academic framework of the Interior Design course, have become a part of the project of refurbishment of the Faculty's library. Case studies displayed in this poster will focus on the continuity and interrelation of the design process and the prototype development, resulting from a series of collaborations between the academic and industrial sectors.

The aim is to demonstrate the applied teaching methodology and the pedagogic approach, which consisted of the following stages: (1) Design brief development in collaboration with the industrial sector; (2) Furniture factory visits and learning about the production capacities, materials and technological potentials and limits; (3) Design development – sketching, conceptual and preliminary design; (4) Selection of the best design projects; (5) Furniture prototypes development – active participation of the students in the technological process of production in the factory; (6) Exhibition of the final prototypes; (7) Incorporation of the student design/furniture prototypes in the project of redesign and refurbishment of the Faculty of Architecture library.

1/DESIGN BRIEF DEVELOPMENT

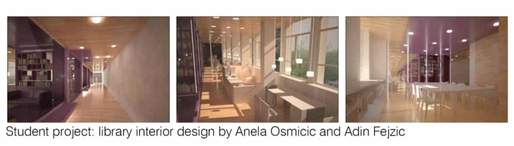
1

2/ FURNITURE FACTORY VISITS

2

3/ DESIGN DEVELOPMENT – SKETCHING,CONCEPTUAL AND PRELIMINARY DESIGN

3



Student project: library interior design by Anela Osmicic and Adin Fejzic

Furniture small scale models. Design by Asmir Voljevica.

Furniture small scale models. Design by Ermina Bajramovic and Irma Softic.

Furniture small scale models. Design by Srdjan Dautbegovic.

Furniture small scale models. Design by Emina Alic.

4/ SELECTION OF THE BEST DESIGN PROJECTS

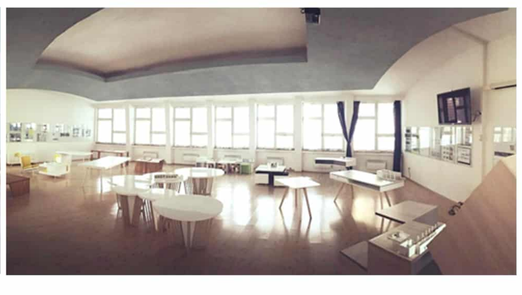
4

5/ FURNITURE PROTOTYPES DEVELOPMENT

5

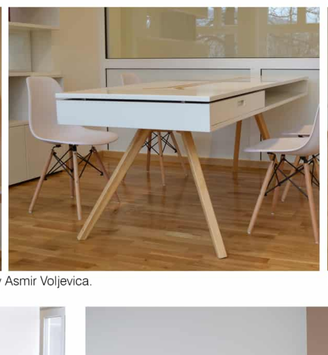
6/ EXHIBITION OF THE FINAL PROTOTYPES

6

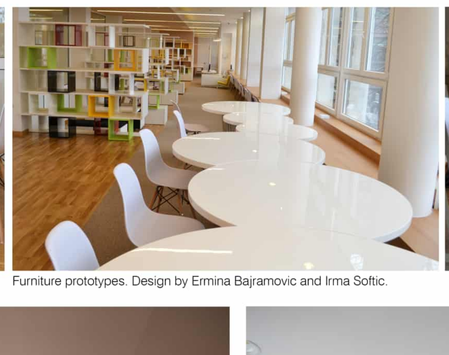


7/ REFURBISHMENT OF THE FACULTY OF ARCHITECTURE LIBRARY

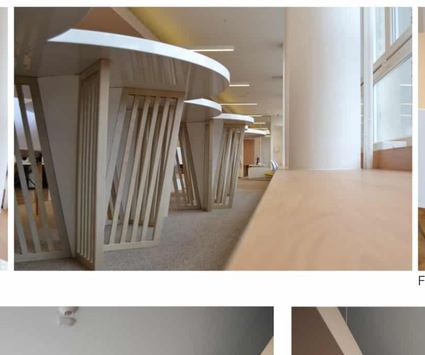
7



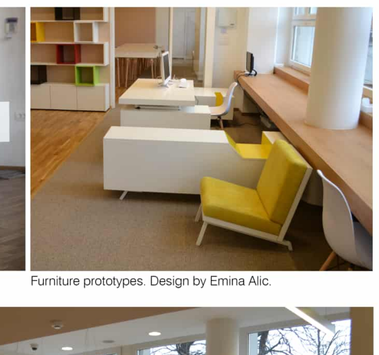
Furniture prototypes. Design by Asmir Voljevica.



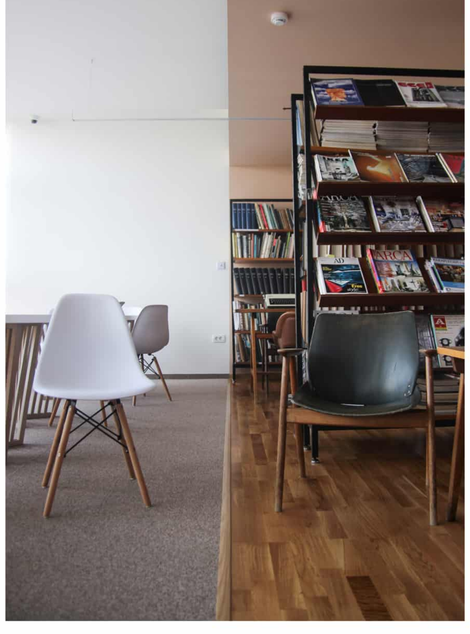
Furniture prototypes. Design by Ermina Bajramovic and Irma Softic.

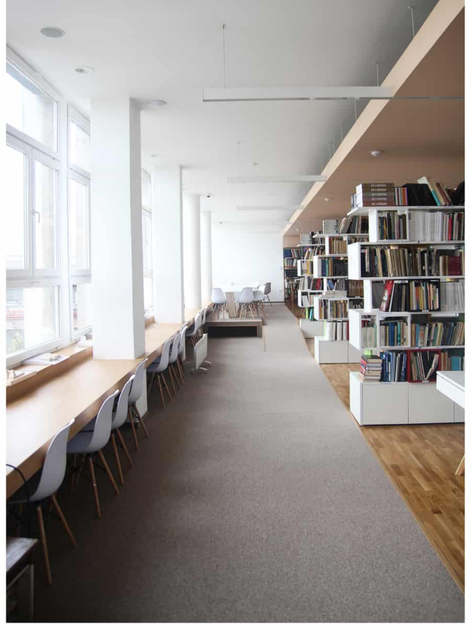


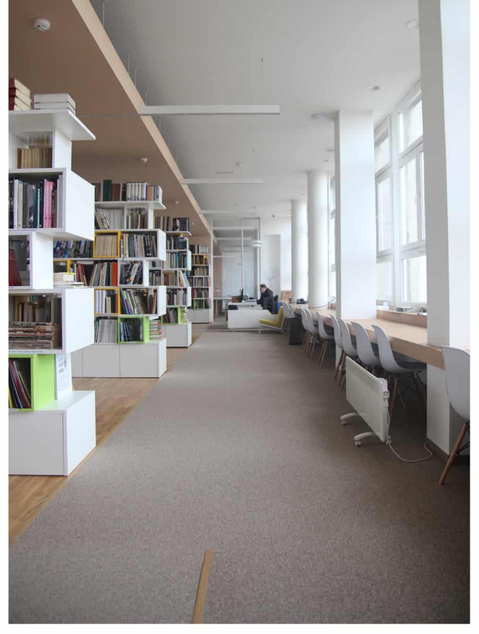
Furniture prototypes. Design by Srdjan Dautbegovic.



Furniture prototypes. Design by Emina Alic.







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