ART AND ARCHITECTURE:
THEORY, PRACTICE AND EXPERIENCE

Editor

Assoc. Prof. Dr. H. Hale Kozlu

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PREFACE

Art and architecture research fields, which stand out with their direct and indirect connections with each other, provide important advantages in the creation of multi-dimensional and interdisciplinary studies. With this study, it is aimed to bring together theoretical researches and practices that are examined under the title of art and architecture and associated with architectural sciences.

In this context, this book is fictionalized as a selection representing four different themes. For these themes, "*Urban Design/ Landscape Design*", "*Architecture and Technology", "Construction Techniques and Building Materials" and "Architectural Conservation"* have been identified.

I would like to thank the authors who have contributed to the work formed by the scope of these themes with their valuable work, the valuable referees who have spent time along with their busy academic work and the staff of the Livre de Lyon publishing house and Assist. Prof. Dr. Mehmet Fatih Sansar for their support in the preparation and publication phases.

Assoc. Prof. Dr. H. Hale Kozlu

Editor

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CHAPTER I

THE EFFECT OF CLOSURE RATE ON USER PREFERENCES IN ROAD ROUTE SELECTIONS

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1. Introduction

Cities, which are indispensable living spaces of today, consist of many components. Urban components integrate with the combination of basic spaces, sub-spaces and spaces and form the main character of the city (Shirvani, 1985). Ways are very important networks in urban systematics for the integration of parts and the construction of the relationship between these parts (Hiller, 2002). The existence of roads allows both the sub-components to combine to form the whole and the creation of new spaces and components within the city. Because the road system is both a link and a component for the city.

Roads are one of the most effective landscape elements that reflect the character of the city and define the city (Bekar, Pulatkan, & Güneroğlu, 2017). Users directly or indirectly use the road system and circulation network to make definitions not only on a small scale but on a large scale (Kürkçüoğlu & Ocakçı, 2015). Because users need roads to reach the components that make up the city, to use these components and to continue their daily lives. The roads in which the urban character is heavily visualized serve to meet the sociological, physiological and economic needs of the urban user. (Brambilla & Longo, 1977; Shirvani, 1985).

At the beginning of the most important steps taken to create the concept of space and to make design decisions in landscape planning and design studies carried out at large and small scales, the location of the road and circulation network is the leading one. Because the road system that reflects the character of the design and creates a link between the spaces; forms the backbone of the design. This allows the user to define the beginning, continuity and end between design, space and experience. In short, roads represent the first impression of the city image (Lynch, 2010). Road decisions that meet the needs of the city user according to the ecological requirements of the city and by reflecting the urban identity are defined as healthy, balanced, holistic and sustainable. Buddha supports the image of the city in a positive way (Bekar & Gülpınar Sekban, 2018).

The determination and characterization of road routes, which are very important for the city, are controlled by many variables. These variables need to be considered both individually and holistically. Characterizing road routes and considering only circulation as transportation from one place to another is one of the most important mistakes made in planning and design. The characterization of roads is shaped by user preferences, ecological requirements and environmental conditions (Rapoport, 1991). It is expected that the road landscape will adapt to the city and the ecosystem features of the city. Plant elements come to the fore in the characterization of road routes. The combination of plant compositions and road components is very important in determining the landscape character.

Many features are considered together in the integration of plant elements with roads. These features can be grouped under three main headings as safety, aesthetic appearance and comfort. Safety is one of the most important factors in defining road landscapes. The work done is not to endanger both vehicle and pedestrian safety. It is the most important criterion that the view is not blocked and that the city user feels safe. In addition, the existence of aesthetic concerns is kept in the foreground in road planting works as in every design. Aesthetic appearance is an important criterion for the user to use that road and to choose the road route. It makes a great contribution to the city experience and indirectly to the image of the city. So much so that today, in countries such as Japan and France, there are road plants that are associated with the image of the city and come to the mind of the user first. The comfort provided by road planting in the city has become even more

important with climate change today. So much so that the roads have begun to be seen and defined as the veins of resistance and adaptation for the city. Because roads are the components that surround the city as a whole and define it down to its finest point (Bekar, Gülpınar Sekban, & Acar, 2018). By combining these components with the green element, adaptation studies for adaptation to climate change are carried out. In particular, the concept of urban trees has been associated with road trees in cities. With the presence of alle trees defining the roads, it is aimed to reduce the effect of the heat island formed in the city. When the corridors formed by the roads are associated with environmental factors, urban cooling studies are carried out with the help of wind and plant tissue. The most important factors in these studies are the crown and canopy value of the plants.

Trees cool the environment by interacting with solar radiation. Tree leaves can absorb up to 80% of the incoming visible radiation during photosynthesis, and about 10% of the visible radiation is reflected back to the atmosphere by the leaves. This allows the areas covered by the crowns of the trees to be cooler than the outer environment. Thus, trees cool their environment. This degree of cooling is directly proportional to the degree of closure of the tree. However, in some times and uses, this sense of closure is not welcomed by the urban user. The occlusion rate, condition, location can be defined by the user as unsafe, unusable and uncomfortable.

In this study, the choice of road routes and visual preferences of the city user according to the road typologies (pedestrian, vehicle and promenade) and closure rates were examined. The aim of the study is to determine how the occlusion rate affects user preferences according to road types. For this, studies were carried out on various road characters in Karadeniz Technical University Kanuni Campus.

2. Material and Method

This study was carried out on the Karadeniz Technical University Kanuni Campus campus in Trabzon (Figure 1). The reason for choosing the study area is that it consists of road networks that will allow a wide range of main, secondary and promenade roads that make up Kanuni Campus to be evaluated as a whole. However, the campus serves a diverse user base. This will allow the user preferences to be determined accurately.

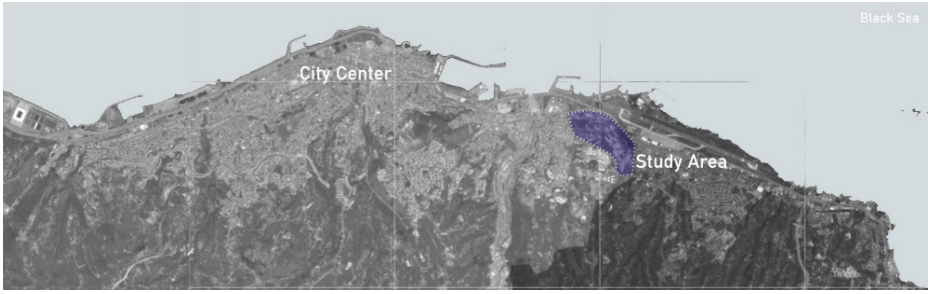

Figure 1. The location of the study area in the province

Many methods were used in the study within the scope of the aim (Figure 2). In order to determine the routes according to the road typologies (pedestrian, vehicle and promenade), pedestrian counting was made first. Two days of the week were selected for the pedestrian count. In the selection of days, weekdays and weekends were distinguished. In the pedestrian count, Wednesday was selected on weekdays and Sunday on weekends. Pedestrian counts were made at the same time intervals on both days. Counting hours were determined as 9.00 in the morning, 12.00 in the afternoon and 6.00 in the evening, and counts were made in 5-minute periods. By converting the censuses into density maps using the GIS program, dense, medium and less heavily used roads were determined according to road typologies. After determining the density of user preferences, photographs were taken according to three different road typologies in the first three regions where the density occurred (Figure 3).

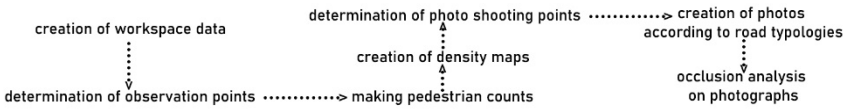

Figure 2. Flow chart of the study

Then, 388 people were surveyed. The main purpose of the survey is to question the road preferences of the users through visuals. The main factor here is that users want to reach from one place to another in the easiest and fastest way, which is one of the biggest factors when choosing road routes. The photographs used in the questionnaires and in which the questioning was made were taken in the same systematic and at the same time.

Figure 3. Images of different road typologies taken from the study area

A 165 cm tripod was used for photography. The photos were taken with a wide angle. In order to determine the occlusion rates of the roads, the photographs with the same dimensions were divided into 1395 squares. Then, entropy study was done on these photos. The sections expressing the squares are represented by three expressions as closed, open and semi-closed/semi-open. Accordingly, usage preferences were associated with the closure rate.

3. Results

3.1. Pedestrian Density Detections

The busiest day in the pedestrian count was determined on Wednesday during the week. As a result of the pedestrian counts made on Wednesday, a total of 1947 users were counted. The busiest hour is determined as 12:00. A total of 982 people were counted in a counting time of 5 minutes at 12.00. In the census made on Sunday at the weekend, it was determined that the busiest hour was 6:00 pm (Figure 4).

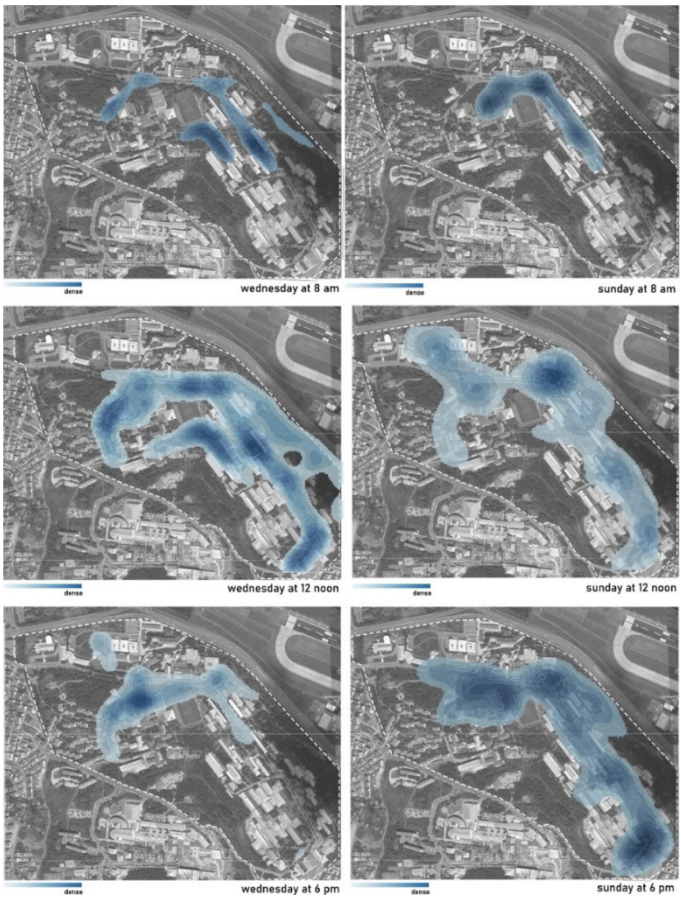

Figure 4. Density maps by pedestrian counts

3.2. Preparation of Visual Products According to Road Typologies

Within the scope of density maps, the three busiest road routes were determined according to road typologies (Figure 5). Within the scope of this

evaluation, three intense areas were determined for three different typologies and a total of 9 visual products were created (Figure 6).

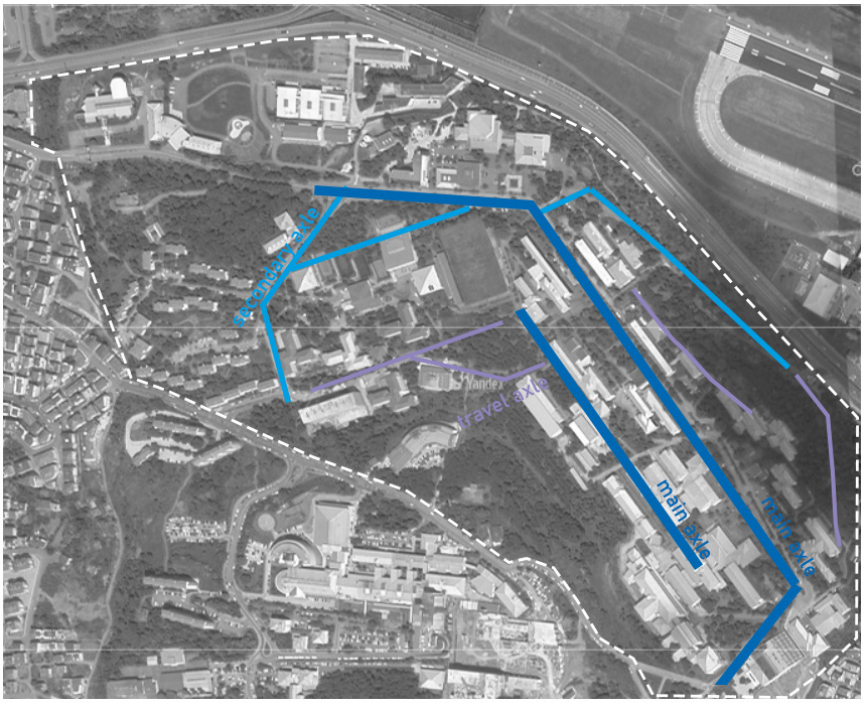

Figure 5. The routes of the three road typologies determined within the scope of the study

3.3. Evaluation of Participants' Visual Preferences

A total of 388 people participated in the survey study. The survey was conducted face to face with the user. The majority of the participants are women (63%). When we look at the age range of the participants, it was determined that 301 participants were between the ages of 18-25 and all of these participants were students. These findings reflect the main user base of the campus. First of all, depending on the road typologies, the participants were asked "Which road would you like to walk on?" question was posed. In the "main axle" typology, the preference of the photograph, which is defined as "intense use", is 45%. While the percentage of preference for the photo defined as "moderate use" is 17%, "low-intensity use" is 38%. The preference of the photograph, which is defined as "intense use" in the "Secondary axle" typology, is 11%. While the percentage of preference for the photo defined as "moderate use" is 35%, "low-intensity

use" is 54%. The preference of the photograph, which is defined as "intense use" in the "Travel axle" typology, is 26%. The preference percentage of the photo defined as "moderate use" is 25%, while "low-intensity use" is 49%. Finally, the users were asked "Which way do you prefer to use among 9 photos?" question has been asked. 57% of the users, constituting the vast majority, preferred the photo in the "secondary axle" low-intensity use category.

Figure 6. Photographs reflecting the road typologies used in the survey study

3.4. The Relationship Between the Opacity Degrees of the Photographs and User Preferences

When the degree of closure of the photographs in which user preferences are questioned is examined, the photograph with the most closed percentage in the "main axle" typology is "moderate use" (Figure 7). When the relations with the preferences are examined, it is seen that the users have openness expectations

from the main axle. In this category, survey participants preferred road types with a higher percentage of clearance. On the contrary, in the "Secondary axle" typology, it has been noticed that roads with low opening rate and higher closure percentage are preferred. However, it has been observed that semi-openings are preferred in "travel axle". It is thought that the differences here, because of the closedness of the plants with coniferous texture, affect the user negatively. Because the majority of the plants that make up the enclosure in the "secondary axle" are provided from deciduous plants with broad leaves. This partially allows sunlight to enter the area. However, the canopy consisting of coniferous trees has a more uniform and darker color. This creates a feeling of insecurity in the user.

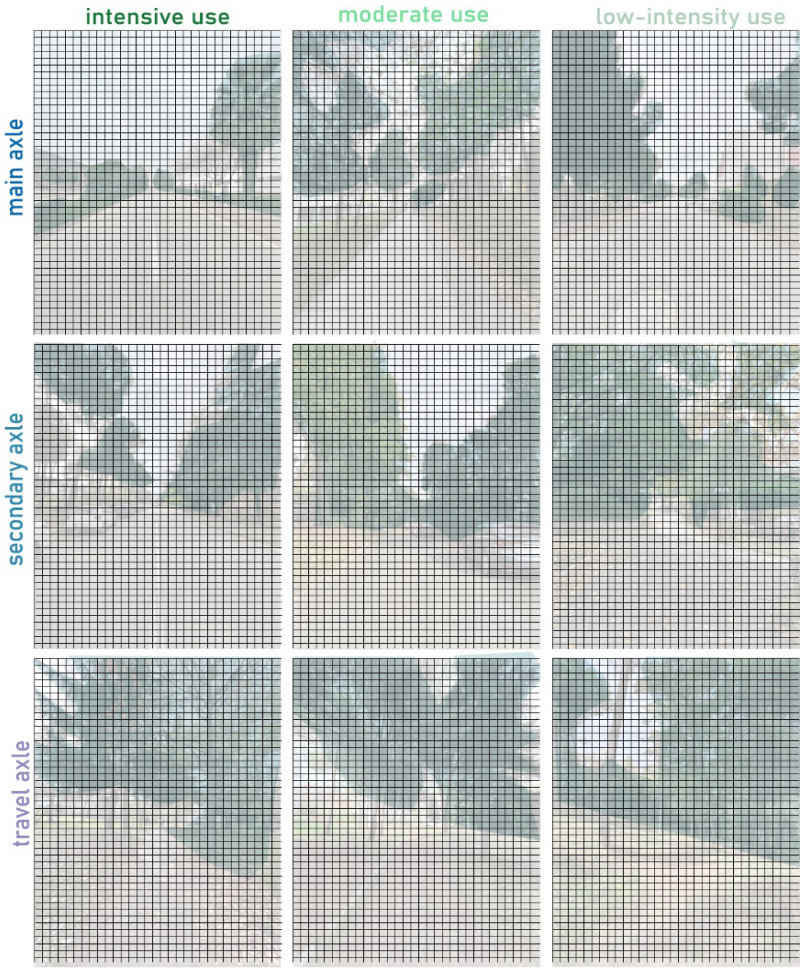

Figure 7. Coverage rates of visual products

4. Conclusion and Recommendations

Many variables should be controlled in determining road routes and contributing positively to the image of the city. The first of these is to meet the needs of the users in the fastest and safest way. In addition to these variables, attention should be paid to planting the roads in order to define the roads as a place where the users feel safe. Plants provide important contributions to both ecological, functional and aesthetic values together with the road landscape. While planting, one of the most important issues to be considered, especially in road landscapes, is the cover rate created by the plants. Coverage rate is very important for road landscapes. Because when the closure rate is very low, these areas are not considered as spaces. However, when the occlusion rate is high, insecurities arise in the road landscape. Landscapes may occur where users can feel uneasy. In order to prevent these, seasonal changes should be taken into account by keeping the closure rate within certain percentages. This is possible with the controlled use of closures caused by coniferous trees. The use of mixed planting techniques in road landscapes and increasing the rate of cover with deciduous plants are suggested by this study.

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CHAPTER II

SPATIAL EFFECT OF RIVERS ON URBAN MORPHOLOGY: THE CASE OF AMASYA

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1. Introduction

Physical changes in cities are unavoidable as their conditions evolve due to the simultaneous and permanent formations over time. Cities are subject to the passage of time through the formal changes made to spaces, reflecting the characteristics of the time in which they exist through their spatial lines. Understanding a city's current structure provides more precise and regulated growth and change for the subsequent developments. Cities are compound, and there are several morphological approaches to define and comprehend them (Kropf, 2009). The study of the creation of human settlements and the processes that lead to their production and alteration is known as urban morphology (Kropf, Karl,2017). Urban morphologists perceive abstract patterns and features of cities intuitively. *Urban morphology* is defined as the study of urban tissue to determine the environmental level generally associated with urban planning (Kropf, 2014). Urban morphologists define and classify different types of buildings, streets, and neighborhoods to develop theories that may guide architectural and urban design techniques (Moudon, 1997). Through an awareness of the patterns and processes contained in urbanization, this approach challenges the popular notion

of unplanned settings as chaotic or just about organic. Complexity science has offered further insights into how urban structures evolve in prevalent ways from the uncoordinated action of various individuals (Moudon, 1997). The urban system has physical separation between communities caused by natural obstacles, including canals, rivers, and green belts (Alsavada, 2021).

Urban morphology plays a crucial role as being more than a physical structure. The basis for both spatial analysis and social interaction is provided by morphological analyses. This study emphasizes the importance of urban morphologies as more than just a physical structure by focusing on rivers that play a very significant role in the morphology of the city.

As one of the essential topographic variables, rivers have played an important role in city creation, construction, and morphology. The coastal use of rivers, one of the natural components that make up the identity and morphology of cities, changes over time due to various circumstances. The study aims to investigate the effect of rivers on urban structures and their morphology. Amasya, a river city, has been selected as a case study to examine its history, morphology, urban settlement, cultural characteristics, and ethnic identity widely. The methods used for this research are based on qualitative research methods and are a descriptive study. The research is based on an inductive logical framework that employs specific premises and observations to draw broader generalizations. Qualitative data analysis was employed as a data analysis technique to present the research's conclusions. The city's data has been collected with observations and analyses of archives. In this analysis, the city development's expansion during the period of the city's history has been demonstrated. Then, the study focuses on the spatial relationship between Amasya and Yeşilırmak river, its coastal settlement, and the Yeşilırmak River's effect on the development of the urban texture. It further focuses on the building stock of the Hatuniye neighborhood, which is a riverside settlement. While doing this, the vernacular housing typology in terms of form-space-function has been investigated through elevations, sections, and plans. Moreover, in the framework of the study, different riverside settlements in different cities were comparatively examined in order to reveal the correlation between rivers and urban pattern and common characteristics of these cities.

2. Rivers in the Urban Form and Its Spatial Impacts

Water is a unique resource for all living beings on our planet. We can observe that almost all of them, from the first great civilizations of humanity to the most advanced settlements, have a close connection with the "coasts"

(Keleş, 1997). The dominance of the coastal concept in cities and settlements with natural water resources cannot be underestimated. Coasts and coastal areas have been the starting point of civilizations in all periods and have acquired social importance regarding settlement and use purposes (Canik, 2013). In the history of urbanization, the riverbanks were one of the essential factors for site selection (Şimşek, 2014). Rivers have played a crucial role in the development of civilizations as an essential component of urban geographical contexts that influence and confine the morphology of urban structures (Silva et al., 2006). The reciprocal relationship between city and coast creates a morphology in which a dialog has been created in terms of encouraging a holistic approach.

Rivers have an influence on urban patterns which differ from cities without rivers.

Many variables influence the nature of settlement in riverbank cities. These include water flow patterns, productivity of riparian fields, ease of defense, and beliefs (Kostof, 1992). The river's function in everyday living activities affects the distance, direction of communities, and house typology. The planning of river bank settlements should balance development demands, river ecosystem conservation, and people's socioeconomic well-being. The equilibrium would result in favorable reciprocal effects between humans and river ecosystems (Groffman et al., 2003). Erkök (2002) categorizes riverfront towns into four groups. Accordingly, riverside settlements in cities are grouped as equal use on both sides, one-sided use, one-sided weighted use, and islets on the river. (Figure 1)

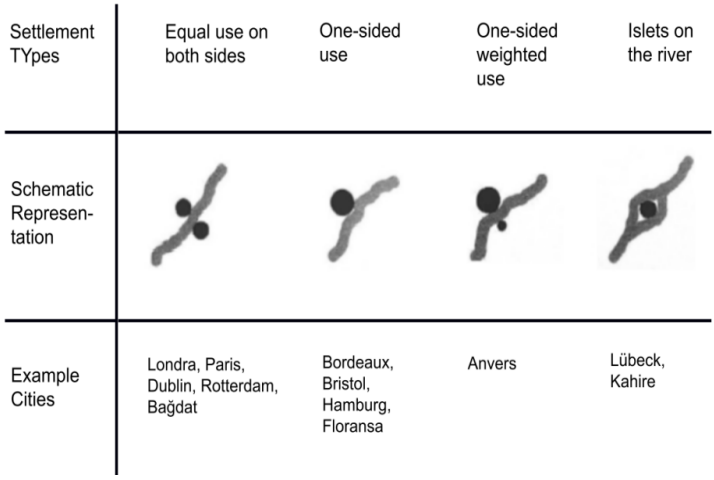

Figure 1. Settlement types of river coastal cities (adjusted from Erkök (2002)).

3. Case Study: Amasya

As an ancient settlement center, Amasya has a rich texture that reflects the historical eras it has experienced. Amasya is located in the Central Black Sea Region, between Kırklar Mountain to the north and Sakarat Mountain to the south, in a deep valley opened by the Yeşilırmak River (Iris River). The province of Amasya is located in the interior of the central Black Sea region. It is surrounded by Tokat in the east, Tokat and Yozgat in the south, Çorum in the west, and Samsun in the north. The area of the province is 5,701 km^2 (URL-1). Amasya is a multi-layered historical city that proves to be a remarkable settlement where contemporary urban conservation measures are evaluated and attempted to be implemented to ensure cultural continuity and transfer urban identity into the future. Due to its location at the confluence of the main branches of the Yesilırmak River and the mountains, Amasya has a very rough surface. Yeşilırmak is the most crucial water source in the province.

3.1. Historical development of Amasya: urban settlements in different periods

In the framework of the study, urban settlements in different periods were comparatively examined to investigate the change in the integration of the Merkez district of Amasya with the coast. The first settlement in Amasya, which developed from a type of settlement known as the "Castle City" and is known as the "Open City," was located in the northern part of the Yeşilırmak River. The main settlement and development of the city took place on the right bank of the river, i.e., in the section with less slope to the south (Karaer, 2007). The settlement at Amasya was built on both the north and south sides of the Yeşilırmak River, and several bridges connected the two sides of the river.

3.1.1. Amasya in The Roman Period

During the Roman Empire, Amasya maintained its wealth and importance but remained within the boundaries of the former city due to the circumstances of life and the physical conditions of the century (Kuban, 1995). The city is thought to have remained within the boundaries of the ancient settlement with slight adjustments, and içeri şehir and the neighborhood in the southern

section of the river were again the primary settlement areas (Kuzucular, 1994). (Figure 2)

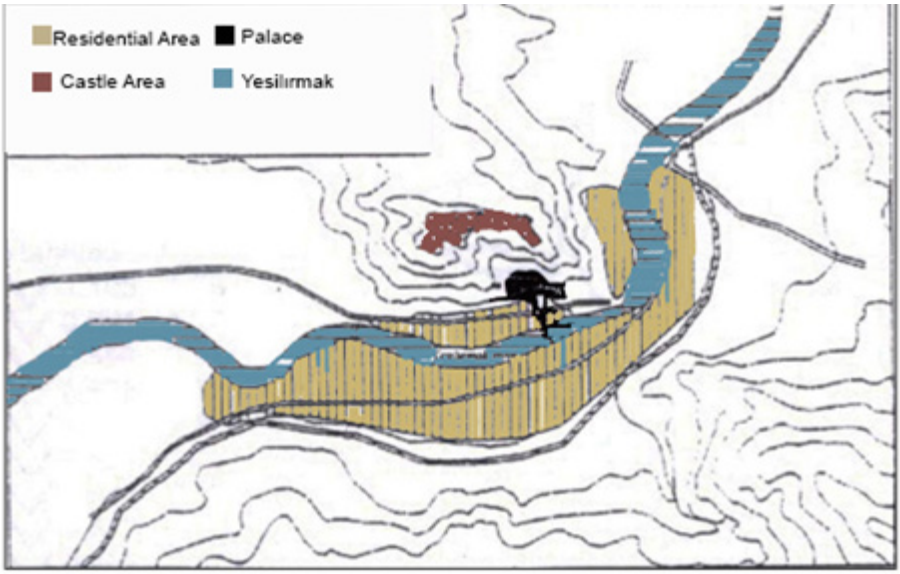

Figure 2. Amasya settlement in the Roman period (adjusted from(Kuzucular, 1994)).

3.1.2. Amasya In The Selcuks Period

During Selcuk's period, it continued its development towards the northwestern end. The gaps between the neighborhoods south of the river began to close due to the formation of new settlements. It has been determined that the number of mosques and masjids on the southern coast of Yeşilırmak increased during the Selcuks period, and accordingly, the number of neighborhoods increased (Yinanç, 1940).In addition, the presence of green areas on the riverbank is intensively observed. Amasya remained within the boundaries of the ancient settlements between the Seljuk-Ottoman period, and there was only a concentration in the urban texture. (Figure 3)

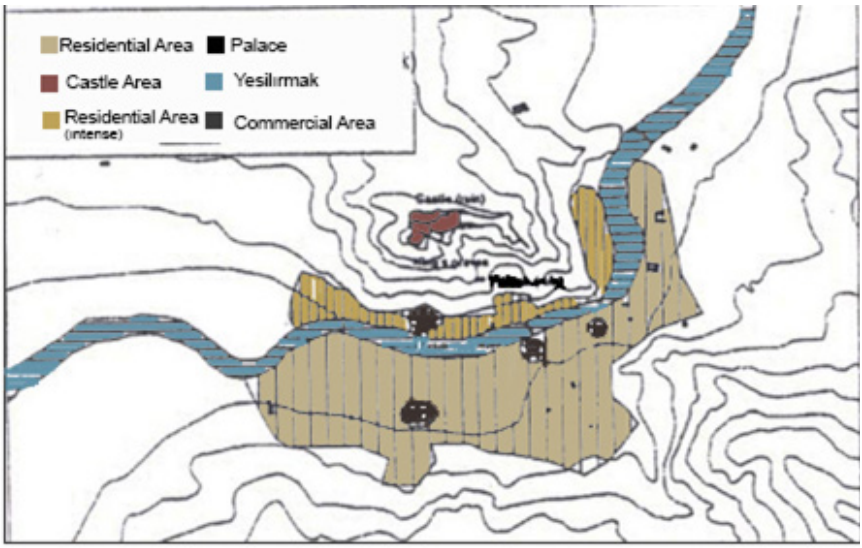

Figure 3. Amasya settlement in Selcuk's period (adjusted from(Kuzucular, 1994)).

3.1.3. Amasya In The Ottoman Period and Beyond

The Ottoman period is the most glorious period for the city. Amasya's hosting of Ottoman princes aided the city's growth in many ways, including physical and cultural development. The pashas of that time, commissioned by the Ottomans in Amasya, erected magnificent and huge monuments in their honor all over the city(Seçkin,2005). (Figure 4)

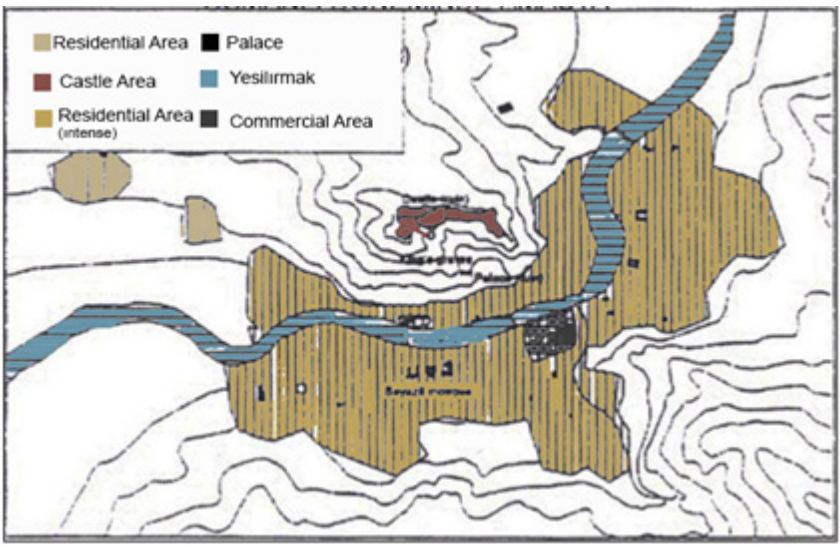

Figure 4. Amasya settlement in the Ottoman period (adjusted from(Kuzucular, 1994)).

By signing the Amasya Circular at the beginning of the National war, Amasya regained its place among the Turkish cities. The first development plan of Amasya was drawn up in 1945, 22 years after the Republic's establishment, at the end of World War II. (Yetman,1981). In 1966, the second development plan of Amasya was completed. At that time, the physical structure of Amasya was deteriorating due to immigration and squatting (Tekeli,1982). Another development that the city experienced after 1965 was rapid densification. The green areas at the western and eastern ends of the city were lost as they were concreted over (Kuzucular, 1994). After 1970, as a result of the conservation measures initiated, attempts were made to create urban open spaces such as squares that would bring society together. Under the influence of the changing conditions in Amasya, the desire to create new urban open spaces emerged. The most striking arrangement that can serve as an example of these developments is the Yalıboyu Promenade area, which was realized on the south side of Yeşilırmak, where the Yalıboyu houses and the rich historical heritage behind them are located.

3.2. Amasya and Yeşilırmak River: Coastal settlement pattern and Social Aspects

The city of Amasya has the characteristics of a river city established in a narrow valley opened by Yeşilırmak, surrounded by steep and high cliffs on both sides. The Yeşilırmak is one of the most important rivers in Turkey, flowing into the Black Sea. It rises at Kosedağı (2812 m) in the northeast of Sivas. Its length is 519 km, and the total precipitation area is 36,000 km2(URL-2). The river flows westward, crosses a narrow strait after Turhal, and reaches Amasya.

Amasya and its riverside have served different uses for centuries. Yeşilırmak River has been used as a water source by the Anatolian people from the past to the present. Today, it maintains its value due to the fertile lands it provides at the points it passes through, and it is also used as the country's energy source. Every shade of green is represented by the river, which displays the most exquisite natural beauty produced by water, the source of all life for humanity. Yeşilırmak River has arable lands at every point of its crossing points and has also created magnificent areas for social activities.

The river determines the city's settlement. The river, which flows deep below the walking route, creates a visual connection with people. On the south bank of the river, in contrast to the conventional housing development on the north bank, there are multi-story apartments and commercial buildings, which

are often built nearby. The approach boundary was set to a certain distance from the river bank in constructing these buildings. A pedestrian walkway and vehicle road were built along the riverbank to separate the water from the new settlements.

3.3. Housing Typology in Hatuniye District

Hatuniye district is a vital example to examine the riverbank building stock. Hatuniye is a neighborhood of the central province of Amasya. It is a neighborhood north of the Yeşilrmak River, located on the riverbank. This neighborhood has traditional Amasya houses on the north side of the river (Figure 5).

Figure 5. Hatuniye neighborhood plan. (Blue legend:Historical Building, Orange legend: traditional housing (Ateş et. al (2019))

These houses date back to the 19th century and have been registered and placed under protection. These houses, reflecting the Ottoman architectural style, are located on the north bank of the river, directly on the river, and in the side streets parallel to the river. The houses adjacent to the riverbed, called Yalıboyu houses, are arranged to be adjacent to the river and overhang the river. These houses limit the use of the riverbank in one direction by their arrangement (Figure 6).

Figure 6. Yalıboyu houses (URL-3)

The ancient Yalıboyu houses, essential elements of the Yeşilırmak coastal fabric, are situated on the river's northern bank, allowing them to cantilever over the river. In Amasya, the Yalıboyu promenade on the south of the river has been established as a pedestrian area, overlooking the Yalıboyu houses, the King's Rock Tombs, and the Harşena Castle to the north. The doors of the houses or courtyards open to narrow and long streets parallel to the Yeşilırmak. The streets that run parallel to the river have a common exterior. The streets open to small squares at the ends of the bridges over the river. Yalıboyu houses usually have courtyards and gardens. In single-section houses, one enters the courtyard first from the street and then enters the house from the courtyard. In addition to the single-section houses, there are two-section houses consisting of a harem and a selamlik. In the two-section house type, the courtyard stays in the middle and helps the house to have a closed appearance (Doğanbaş, 1996). Although most residences have two stories above the basement, applications with one story above the basement are also common. Some Yalıboyu houses are elevated above the ground. While basements in residential buildings are used for storage and wood sheds, they serve as service rooms in commercial buildings. The floor plans on the top floor or upper floors, where living continues, have features of the traditional Turkish house. Sofas and rooms determine the floor plan type (Figure 7). In Yalıboyu, there are houses with and without sofas, as well as apartments with an indoor sofa, an outdoor sofa, a corner sofa and a center sofa (Güzelci, 2012) (Figure 8).

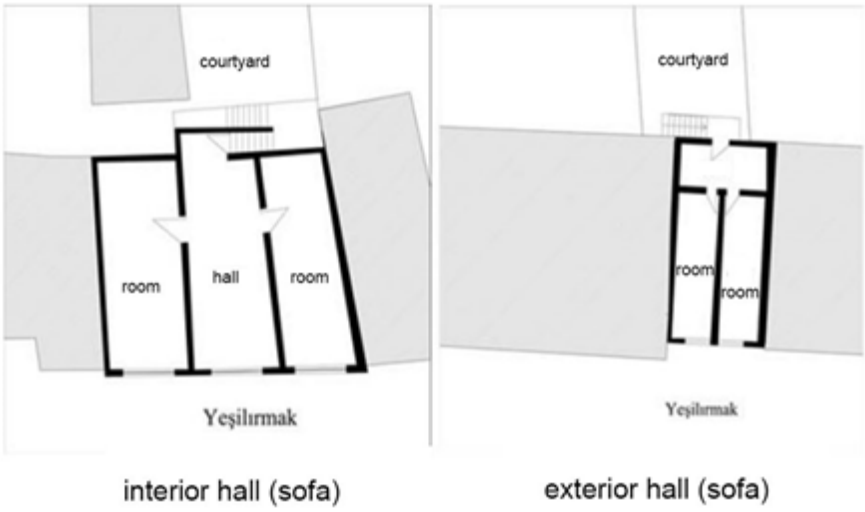

Figure 7. Yalıboyu houses plan types (adjusted from (Güzelci, 2012))

Figure 8. Yalıboyu houses plan types (adjusted from (Güzelci, 2012))

The upper floors of Yalıboyu houses are generally built with projection. Projections often extend toward the street and the view. On the facades of the houses, there are projections of various shapes. These are inner exiting, single side exiting, double side exiting, corner exiting, full floor exiting, square exiting, and oriel (Güzelci, 2012). While there are few windows on the first floors of Yalıboyu houses, there are more windows on the upper floors, which open to the outside through the projections, than on the lower floors.

3.4. A comparative Investigation of River Cities with Amasya

The intent is to conduct a comparative analysis of different riverside settlements in various cities in terms of similar prominent leading structures for morphology and urban pattern. The Arno river, which was chosen from Italy and Yeşilırmak, are compared to each other in the colloquial language with their similarities in river city relation.

3.4.1 Musi River

The Musi River is a river in Indonesia on the island of Sumatra. It originates in the Barisan Mountains northeast of Bengkulu, flows in an east-northeast direction, and empties into the Bangka Strait. It has many tributaries, and 90 km from its mouth is Palembang City. The river flows roughly southwest to northeast

from the Barisan Mountain range at Kepahiang in Benatkulu, which forms the backbone of Sumatra, into the Bangka Strait, which forms an extension of the South China Sea. It is approximately 750 kilometers long(URL-4).

In the Musi zones, there were variances in settlement morphology, which can be seen in the breadth of the buffer area, orientation, and building type. People's dependence on the functions of the river is the key element that shapes settlement morphology. The houses were constructed along the riverside, facing the river. Each riverside house has two elevations: one facing the river and the other facing the road. Settlements are erected closer to the river's shore as they go closer to the downstream zone. The river served as a transportation route between villages and as a means of disseminating architecture. The housing structures of villages along the river were altered and transformed. The significant expansion of the native architecture of the highland building along the Musi River merged with Malay architecture (Oktarini, 2019). The river provides pure water, lush land, a fishing area, and a transit route. In South Sumatra, Palembang Port is situated on the bank of the Musi River, which flows from the western mountain region through the center plain terrain to the east coast. This port is critical to the economic activity of the region. Musi River is a link from Kertapati to the downstream districts for the transportation of coal that was formerly provided by a train network (Hardian, 2011).

3.4.2. Arno River

The Arno is a river in Tuscany, Italy. The river, which rises on Mount Falterona (1654 meters), leaves the Alps, flows through Florence, Empoli, and Pisa, and finally flows into the Tyrrhenian Sea. With a length of 241 kilometers, it is the longest river in the region(URL-5). The river drains into the Tyrrhenian Sea after passing through towns such as Florence, Empoli, and Pisa. Despite its large catchment area, the Arno is categorized as a torrential river due to its physical structure and importance for agriculture and industry (Nuti, 2018). Several flood events have occurred in the river's catchment region over the ages, affecting not only the manner of life of the locals but also the river's morphology. Apart from the challenges associated with floods, the Arno has always played a significant historical role. Many villages and cities have benefited from its waters from ancient times, as well as Florence. Until the introduction of the railroad in the nineteenth century, the Arno served as the primary commercial and product delivery

route (Nuti, 2018). The river, together with the riverside areas, contribute to the landscape and tourism interest of the area. This historical region is home to a unique fusion of Roman, Medieval, and High Italian Renaissance architectural styles. Pento Vecchio is located on the Arno River in Florence. Pento Vecchio has maintained its distinction with the stores on it, unlike ordinary bridges. The bridge appears unique and touristy since these stores are arranged in a line like galleries. The Arno, the lifeblood of Florence, divides the city in two and offers spectacular views with its magnificent old bridges.

4. Results and Discussion

This study is also interested in comparing the presence and absence of rivers in different cities and the effects of rivers on the morphology of areas on different riverbanks. In the study framework, different riverside settlements in different cities were comparatively examined. The rivers analyzed in this study have physical characteristics of different lengths, but as a common point, we see that all three are the longest rivers in their region. Another common point for these rivers, located in three different cities, is that they pass through many different cities and form a connection between them. Yeşilırmak passes through the provincial borders of Sivas, Tokat, Amasya, and Samsun, Arno river passes through Florence, Empoli, and Pisa. Musi likewise connects the four South Sumatran ethnic groups' settlements. Examining the interaction between rivers and cities results in the following conclusions: The Yeşilırmak River has considerably influenced settlement, building stock, agricultural, and socio-cultural activities for many years. The Anatolian people have traditionally used the Yeşilırmak River as a water source. Today, it retains its significance due to the fertile lands it provides at the points it passes through and is also used as the country's energy source. However, the most striking feature of the river in today's Amasya is its social impact on the city. The Yeşilırmak river bank is a popular destination since it serves as the city's movement axis. It is regarded as a vital focal point for social activities. The Musi river had a significant impact on early populations, including changes in culture, civilization, and religious systems. These impacts can be observed in the development of settlements, houses and other structures, as well as in creativity and handicrafts. The remarkable feature of the Musi river between the other two rivers is that it accommodates

economic activities with its port. Large ships can navigate the river all the way to Palembang, which is home to essential port facilities for economic activities. Arno was one of the critical components in the first settlement site in the area with the development of the Roman town, which served as the starting point ok tor history of Florence. It greatly impacted the city's growth and was essential to the urban landscape. Today, the river and its banks continue to serve as the Florence metropolitan area's structural element and multipurpose infrastructure. A comparison of the architectural styles along these rivers reveals that they represent various architectural styles as a result of differences due to the differentiation of elements such as in geography, culture, and social life. The houses built on the historical city walls on the edge of Yeşilırmak reflect all the features of the traditional Ottoman house. On the other hand, the housing structures of villages along the river represent Malay architecture.The region where the Arno river is located is home to a unique fusion of Roman, Medieval, and High Italian Renaissance architectural styles. As a difference Arno River has the Pento Vecchio bridge, which stands out with its touristic feature.The findings reveal that the physical characteristics of the river influence the settlement morphology. The common result of all three examples is that people's dependence on the functions of the river is the key element in shaping the morphology of settlements. The planning of river bank settlements balance with development demands, river ecosystem conservation, and people's socioeconomic well-being. As cities, technology, and industry develop, the patterns of urbanization also changes. Accordingly, the city's relationship with the river is evolving as well.

From the comparative spatial analysis of these three cities with rivers, the similarities and differences in terms of physical, city-river interaction and architectural features. This comparison has been presented in Table 1.

Table 1. Comparatison of Yeşilırmak, Musi, and Arno River (by the authors)

	Yeşilırmak River	Musi River	Arno River
Physical Feature	Yeşilırmak, one of Turkey's largest rivers, has 519 kilometers length.	Musi River, the largest river in Sumatra is approximately 750 kilometers length.	Arno River is the region's longest river, measuring 241 kilometers in length.
Connection Points	Yeşilırmak passes through the provincial borders of Sivas, Tokat, Amasya and Samsun.	From a source in Bengkulu Province, the Musi River travels almost all the way across Southern Sumatra before coming to an estuary in Palembang, the region's capital.	The river flows into the Tyrrhenian Sea after passing through Florence, Empoli, and Pisa.
City-river interaction (Early times)	For many years, the Yeşilrmak River has been having a significant impact on the settlement, building stock, agricultural, and socio-cultural activities.	Early communities experienced many impacts from the Musi river, including changes in culture, civilization, and religious systems. These effects can be seen in the development of houses and other buildings, settlement, inventiveness, and arts and crafts.	With the construction of the Roman town, which served as the beginning point for the history of Florence, Arno was one of the major elements in the first settlement site in the region.It significantly influenced the city's development and became an important element of its urban environment.
City-river interaction (Today's)	Yeşilırmak river bank is a place that is used intensively as it creates the movement axis of the users in the city. It is seen as an important spotlight for the conduct of social activities. Today, it maintains its value due to the fertile lands it provides at the points it passes through, and is also used as the energy source of the country.	The river's settlement bank is no longer considered as a material aspect, but rather as the result of an interrelations with all the various civilizations surrounding it.	Today, the river and its banks continue to serve as the Florence metropolitan area's structural element and multipurpose infrastructure.
Architecture style	The houses built on the historical city walls on the edge of Yeşilırmak reflect all the features of the traditional Ottoman house. The houses adjacent to the riverbed, called Yalıboyu houses, are arranged in such a way that they are adjacent to the river and overhang the river.	The river served as a transportation route between villages and as a means of disseminating the architecture. The housing structures of villages along the river were altered and transformed.The significant expansion of the native architecture of the highland building along the Musi River merged with the Malay architecture.	This historical region is home to a unique fusion of Roman, Medieval, and High Italian Renaissance architectural styles.Pento Vecchio is located on the Arno River in Florence. Pento Vecchio has maintained its distinction with the stores on it, unlike ordinary bridges. The bridge appears unique and touristy since these stores are arranged in a line like galleries.

5. Conclusion

The motivation of the study is to investigate the effect of rivers on urban morphology. Rivers have played an essential role not only in the foundation of cities but also in the construction and morphology of cities, being among the most important topographical factors. The coastal use of rivers, one of the natural components that contribute to the identity and shape of cities, varies over time due to several factors. This study aimed to understand the spatial structure and character of the city of Amasya by examining the patterns of its components as well as ownership, control, and occupation. ok tor reason, this study investigates rivers' influence on Amasya's morphology and explores how a city's physical network interacts with a river flowing through it. Amasya is one of the cities that occupies a vital position in the history of Anatolia. Amasya, which was a strong military headquarters in the Roman and Byzantine periods, later became one of the political and cultural centers of the Turkish period. The results ok that the river's physical characteristics influence the settlement morphology and that the river has led to a linear city expansion. Thus, the Amasya Yeşilırmak River bank has developed following the changing needs of people from the past to the present depending on the social and cultural changes. It has acquired an urban space identity, which it uses for various recreational purposes.

The comparison made with other riverside cities reveal that all three examples ok that people's dependence on the functions of the river is the key element in shaping the morphology of settlements. Although the river has come to the fore with its features, such as being an important water source for cities and shaping the settlement since ancient times, today it is more expected to contribute to social life as cultural activities, touristic activities, gathering points, and festival areas.

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CHAPTER III

CONSTRUCTED WETLANDS: AN EXAMPLE OF SOUTH LOS ANGELES WETLANDS PARK

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1. Introduction

Climate refers to the average characteristics of the weather conditions observed over many years and their temporal distribution, and climate change refers to the statistically significant long-term changes in the average state of the climate (Türkeş, 2008). Climate change, which takes place in hundreds of years, depends on two natural formations. The first is changes in solar activity that change the amount of energy from the sun, and the second is large volcanic eruptions that increase the number of aerosols in the atmosphere. The rate of increase in global surface temperature observed in the last fifty years has increased considerably compared to the rate in any previous fifty-year period in the last 2000 years, revealing that human activities are the dominant cause of global climate change today (IPCC, 2021). The main reason why climate change is moving away from natural factors and becoming a human-influenced problem is the greenhouse gases and aerosols released from land cover change and fossil fuel use.

¾ of the earth is covered with water and 97% of this water body is salty and 3% is fresh water. Even if the rate of fresh water suitable for human use is

3%, only 1% of it is accessible because 2% is in the form of ice (Yeang, 2012). The amount of water in the world can neither increase nor decrease. When it is liquid on the earth, it evaporates and rises to the atmosphere, and condenses from the atmosphere and descends to the earth again in the form of precipitation. Some of the water that descends to the earth is absorbed by the soil and feeds the underground resources, and some of it passes to the surface flow and flows into streams, lakes, etc. mixes with the earth's waters. Water that is constant in quantity circulates regularly between surface and groundwater, oceans and atmosphere, and this is called the hydrological cycle (Bayramoğlu et. al., 2013). Despite having a limited resource of 1% to meet all needs, the fact that cities started to take place as a layer in the water cycle caused the natural water cycle to be damaged. The existence of water, which can ensure its continuity in its natural process, is at risk due to wrong practices in cities. The fact that underground water resources cannot be fed sufficiently due to impermeable surfaces and the spillage of surface flow waters directly into the surface waters by carrying pollutants with them reduces the quality of the water. On the other hand, one of the most important components of the hydrological cycle is the atmosphere, and changes in the atmosphere directly affect the hydrological processes of the basins such as precipitation, evaporation and flow (Karaman & Gökalp, 2010). Changes in precipitation regimes and land use as a result of changes in atmospheric structure due to climate change create temporal and regional differences in water resources by affecting the hydrological cycle. This can cause drought or flash floods (Yang et al., 2021).

The United Nations Population Fund reported that as of November 2022, the world's population reached 8 billion. Cities, which make up only 1% of the terrestrial surface area and host more than half of the world's population, are the areas where anthropogenic effects are most intense. While cities take place as an influential factor in climate change, they are the areas most affected by the consequences of climate change, such as the increase in temperatures, irregularity of precipitation regime, and rise in sea level. For this reason, making cities resistant to emerging threats is among the United Nations Sustainable Development Goals. In line with these purposes, it is aimed to take urgent action to make cities safe, durable and sustainable, and to combat climate change and its effects (Tuğaç, 2022). The decrease in water availability and quality due to anthropogenic factors in cities has made water an important element among sustainable development goals. For this reason, it has become a priority to produce solutions to ensure fair and equal distribution of water in cities, to protect water resources in good quality and to increase resilience against disasters.

Nature-based approaches that can be integrated into water management are being developed in order to protect and improve water quality in cities, to reuse wastewater as a resource, and to control the risks posed by runoff rainwater. Low-impact development techniques are part of green infrastructure systems, which are among the subtitles of nature-based approaches. The lack of correct infrastructure applications, especially in cities, causes a large concentration of rain water to pass into the surface flow. Rainwater passing into the surface stream changes the flow of streams, increasing flooding and reducing water quality by causing erosion to stream corridors. Low-impact development enables on-site management of rainwater by reducing the effects of runoff and polluted rainwater. There are five basic principles of low-impact development (Eşbah Tunçay, 2021). These;

- Protecting natural areas as much as possible
- Reducing the effects of construction on the water cycle as much as possible
- To shape the land taking into account the rate and duration of the water coming with the surface flow
- Integrating nature-based solutions that can absorb, collect, store and evaporate water into management applications
- To organize trainings to prevent pollution and to carry out appropriate maintenance.

Low-impact development techniques benefit the urban ecosystem by capturing carbon, improving urban air quality and creating microclimate and habitat for wildlife, while supporting the continuity of the natural water cycle. In addition to its benefits to the urban ecosystem, it helps to support social life and economic development.

2. Sustainable Urban Drainage Systems

Sustainable urban drainage systems are all approaches that aim to create biodiversity and aesthetic environment while controlling the amount and quality of water that passes into the surface flow in cities. Sustainable urban drainage systems aim to harvest rainwater to allow it to advance and slow down without creating erosion. Compared to traditional drainage techniques, sustainable drainage systems not only support the water cycle in nature, but also increase the economic value of these areas by creating aesthetic environments that will meet the recreational needs of the citizens (Eşbah Tunçay, 2021). While establishing sustainable drainage systems, special attention should be paid to the inclusion

of surface water in the design at an early stage, the use of surface water as a source, the evaluation of rainwater at its source, the management of water on the surface as much as possible, the creation of a drainage management system, the prevention of water pollution and the reduction of surface runoff (Eşbah Tunçay, 2022). Various sustainable drainage systems have been developed for harvesting rainwater, such as rain gardens, landscape channels, constructed wetlands, and green roofs (Türk et al., 2017; Seyhan & Bayramoğlu, 2021). Waste water generated as a result of domestic and industrial activities can be treated in constructed and conventional treatment systems. Conventional treatment technologies are systems with high operating costs and high energy consumption (Göçmez & Kayam, 2018). Constructed wetland systems, on the other hand, are more ecological systems with minimum energy and chemical use and low operating costs (Gökalp & Karaman, 2014).

2.1. Constructed Wetlands

In urban areas, the waters coming from the surface runoff contain suspended solids, heavy metals, hydrocarbons, etc. It causes water pollution by carrying substances to waterways (Sholz & Martin, 1998; Scholz, 2004). Constructed wetlands are one of the sustainable drainage systems that improve the quality, capture, settling and infiltration of precipitation waters that pass into the surface flow. Constructed wetlands, which are similar to permanent pond applications, create a habitat for flora and fauna because water fluctuations are not rapid (Levi, 2007). They can be used in conjunction with applications such as sediment weirs, small ponds. Constructed wetlands are more economical in rainwater treatment than traditional systems and are more energy efficient and sustainable systems (Kadlec et al., 2000; Scholz et al., 2005). Constructed wetlands are constructed in two ways: surface runoff and subsurface runoff. Runoff wetlands mimic natural environments more and are more suitable systems for wetland types because they create permanent stagnant water. In subsurface flowing wetlands, water passes horizontally or vertically through porous media such as sand or gravel, and there is usually no standing water (Scholz & Lee, 2005).

Selection of plant and soil material, hydrological conditions are important factors to create sustainable constructed wetlands. Macrophytes are a common design element in constructed wetlands. Wetland plants can remove pollutants from the water and provide a growth medium for microorganisms. Climatic conditions, wastewater characteristics to be treated and wastewater quality are the parameters to be considered in the selection of plant species. Soil materials

used in constructed wetlands affect water movement and plant growth. Used as substrate, these materials provide surface area for microorganisms to attach to plant biomass and create a filtering medium for pollutants. Particle sizes, pore spaces, permeability coefficient of the material used can change the purification performance. Water is very important in controlling the productivity of constructed wetlands. Depth of water, dominant plant type, temperature, transit time of water etc. factors can affect water efficiency (Gorgoglione & Torretta, 2018).

2.2. South Los Angeles Wetlands Park

Located between 54th and 55th Streets approximately 8 km south of downtown Los Angeles, the area was built in 1901 by the Los Angeles Railroad as a transportation facility for the maintenance and storage services of locomotives. In 1993, MTA combined this area with its own areas and used it as a vehicle maintenance and storage place. The area, which was used as a maintenance place for buses and non-profit vehicles in 1964, continued to be used as signage workshops, storage and stopping places after 1987. The area was started as a wetland park by PSOMAS in 2011 to meet the requirements of the Federal Clean Water Act and to provide a beneficial use to the community (Anonymous, 2016). The project aims to provide open green space, public use facilities, entertainment and education opportunities to the residents, as well as ensuring that the rainwater, which brings various pollutants, is treated and reaches the Los Angeles River.

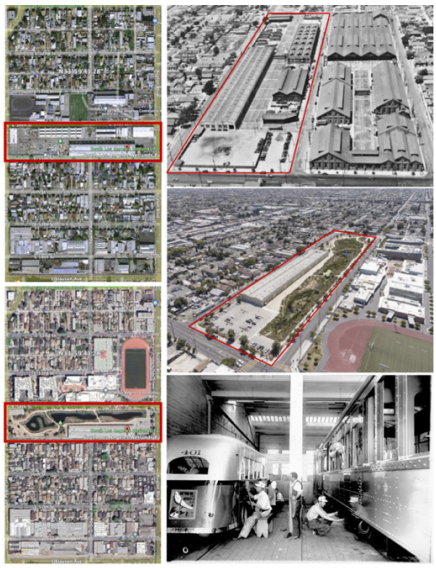

Figure 1. South Los Angeles Wetlands Park Location (URL1, 2022)

Within the project area of 9 acres, 4.5 acres of wetland to purify 56 m^3 of rain water, protection of approximately 82 m2 of historical structure, open parking area and parking lot have been proposed. The wetland in the park consists of three wetland cells consisting of open water, emergency marsh, riparian and highland habitats, a deep marsh system, energy distribution and forebay. The primary goal of the project is to purify rainwater. Rainwater from the rain channel on San Pedro Street is first taken to the pre-treatment system in the service area. Here, the oil, grease, garbage, residue etc. substances are separated. It is then pumped into the constructed wetland to remove additional contaminants from it. The pump system is automatic and there are two separate pump systems. The first is the low flow pump system for dry seasons, the second is the high flow pump system for storm and heavy rainy seasons. Wetlands consist of three main cells, and the cells are built with a slope through which water will flow from cell to cell. After the water sent to the cells from the pre-treatment system is purified by biological means, the rain channel on San Pedro Street is emptied back. Drinking water can be discharged to these areas in order to maintain the water volume in the cells during drought periods. In addition, the parking lot in the area is covered with a semi-permeable material and surrounded by a planted ditch. Excess rainwater from the parking lot is collected and diverted directly to the wetlands. The floor of the wetland cells is covered with an impermeable liner to prevent leaks and maintain water levels. Finally, the vegetation used was selected from local species (CDM, 2007). *Salix exigua, Schoenoplectus californicus, Cyperus eragrostis, Anemopsis californica, Rosa californica, Salvia spathacea, Baccharis salicifolia, Qercus agrifolia* are some of the plant species used (Shannon & Hood, 2016).

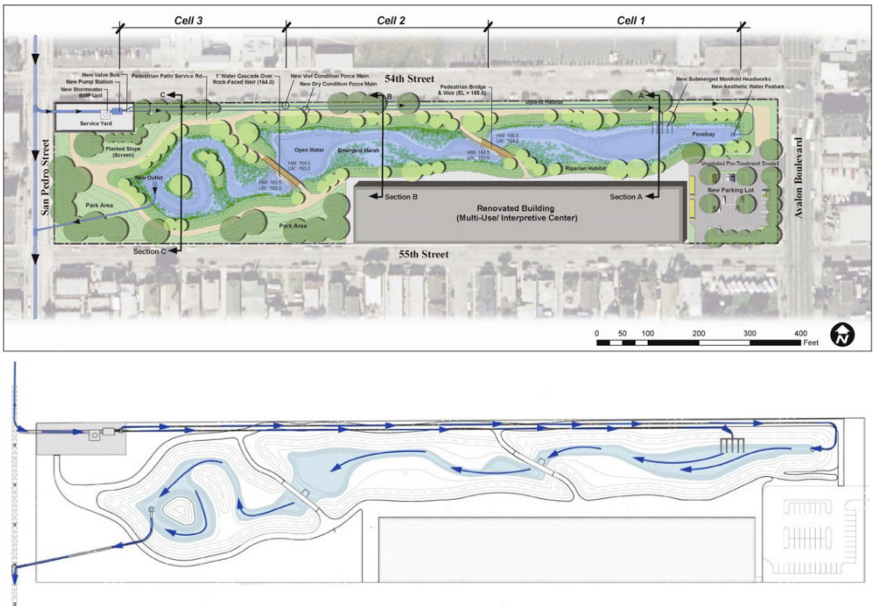

Figure 2. South Los Angeles Park Plan and Storm Water Management (CDM, 2007; Shannon & Hood, 2016)

The secondary objective of the project is to provide various public use facilities, education and entertainment opportunities to the public by creating an open green space in the densely populated area. Walking paths, rock garden and picnic area have been designed around the wetland area so that the residents of the region can walk, jog, observe the wetland habitat and wildlife. Walkways consist of durable surfaces that can support vehicles that have to enter for emergencies and maintenance. Two wooden bridges were built over the wetlands for monitoring and observation, and all roads and bridges in the area were designed in accordance with the disability law. Wetlands have the feature of creating natural life as well as reducing water pollution. The boards that will give information about the vegetation and the wildlife in the area serve the purpose of education by positioning them along the walking paths. Through these boards, visitors can learn about biological processes while learning about species native to California. Except for the 81,760 m^2 historical building located in the south of the project area, all buildings were demolished. This preserved building has been renovated to create a community facility, warehouse space, and transportation museum. 10,000 m^2 of the building is reserved for the learning center and multi-purpose community facility focused on wetland education. An area of 5,000 m^2 was used to store the park's maintenance, entertainment and educational materials. The

remaining 66,760 m^2 area is reserved for railway exhibits, transportation wagons and a museum that will represent the historical use and development of the area. For the operation of the park, it is planned to work 1 park director, 3 recreation assistants, 5 gardeners and caregivers, and 1 security guard (Anonymous, 2008).

Figure 3. Images from the Park (URL2, 2022; URL3, 2022; URL4, 2022; URL5, 2022; URL6, 2022; URL7, 2022)

The implementation process of the park consists of demolition, excavation and installation of auxiliary facility, construction of other project features and architectural coating stages. First of all, all the structures in the area were demolished except the protected building. Afterwards, rough leveling was carried out and excavation works were carried out for the wetland cells between 3.5-4.5 m and the site leveling was completed. Simultaneously with the site leveling, the pre-treatment system, pipelines, trench, etc. auxiliary facilities were established. After field leveling, the impermeable lining was placed on the site. Afterwards, the top soil layer was brought for the park area, walkways, bridges and parking lot were built, completed with irrigation system and planting. Finally, the interior and exterior of the historical building were renovated and brought into use.

Figure 4. Images from the Project Application

Shannon & Hood (2016) examined the landscape performance benefits of the project under environmental and social titles. The environmental benefits of the project include the improvement of 56 m^3 of rainwater per day. It was stated that 100% of oil and grease, 75% of bacteria, 96% of suspended solids, 41% of nitrate and 34% of phosphorus, which are pollutants in this rainwater, were removed. Thanks to the lighting system installed in the project area and working with solar energy, 66% of the energy use of the area is met. It is estimated that 1.82 tons of atmospheric carbon is sequestered from trees in the area. An 11% increase in parking space per capita is shown as social benefits.

3. Conclusion

Today, sudden precipitation regimes or extreme droughts appear as an effect of climate change. Although water is the most basic requirement of life, studies show that there will be a water crisis in the future. On the other hand, fresh water resources with limited access are under threat, especially as a result of wrong practices followed in cities. The water, which comes with rain water and is actually clean, cannot seep into the soil due to the excess of impermeable surfaces in the cities, and as a result, underground resources cannot be fed. In addition, rainwater that does not infiltrate into the soil passes to the surface flow, dragging various pollutants with it, or reaching the sewer and surface water, causing pollution. For this reason, it is necessary to implement sustainable systems against future water problems and to collect rain water from every possible surface and bring it into the water cycle in a clean way. Constructed wetlands are much more economical in terms of energy savings, construction speed, maintenance and operating costs compared to conventional systems for water purification. Since conventional water treatment plants consist of structural masses, they do not provide a pleasant appearance in terms of environmental aesthetics and emit bad odor. Constructed wetlands, on the other hand, purify water with biological processes, while creating a natural habitat and making a positive contribution to environmental aesthetics. In addition to these, since it can be used as a recreation area, it provides effective service in the social life of the city. It also helps alleviate pressures on the hydrological cycle, unlike conventional water treatment plants. The integrated green spaces within the landscape mosaic are fragmented by the urban texture. The deteriorated green space system causes problems such as the formation of heat island and the increase in emissions, especially in cities. Constructed wetlands, which provide the recovery of water coming from the surface flow, form a habitat for vegetation.

These areas, which are designed in urban areas, also serve as open green areas that will help ensure the continuity of the disintegrating green area system.

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CHAPTER IV

IMPACTS OF PARKS ON LAND SURFACE TEMPERATURE: THE CASE OF FETHİYE

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1. Introduction

Population rate and urbanization have been increasing rapidly in the last century throughout the world. This situation causes changes in land cover and land use (Lv and Zhou, 2011). This natural and human-induced change in land cover and land use causes a decrease in open green areas, global climate change, desertification and natural disasters (Mao et al., 2012). In order to determine these emerging problems, it is very important to determine the changes in the land cover and land use in a region over time and to make plans to reduce the land surface temperature of that region (Kaçmaz, 2021).

Land surface temperature; light energy from the sun is transformed into heat energy on earth and spread around. The materials used in urbanization and construction absorb the energy reaching the earth. Therefore, it causes an increase in the land surface temperature. Land surface temperature is an important factor that has an impact on various types of events on Earth. In this context, determining the land surface temperature regionally and developing regional planning proposals are also of great importance in terms of preventing global climate change (Akyürek, 2020). Data on land surface temperature is one of the components that will affect urban planning studies (Özkök et al., 2017). Land surface temperature data is a frequently preferred data type in vegetation change analysis, land use and land cover change analysis, global warming studies and meteorological studies (Zhang et al., 2006; Li et al., 2013; Ndossi

and Avdan, 2016; Yıldız et al., 2017; Akyürek, 2020). Within this scope this type of data could contribute to the production of effective strategies at all planning scales (Ibrahim et al., 2012; Özkök et al., 2017).

Developments in remote sensing and geographic information systems enable rapid evaluation of spatial and spectral data of different resolutions belonging to very large areas. Thus, by means of remote sensing and geographic information systems, temperature data of large areas can be visualized and a lot of thermal data can be obtained in a short time (Kuşcu Şimşek and Şengezer, 2012; Ardahanlıoğlu et al., 2020). With the development of satellite technologies and thermal images obtained from satellites, it is possible to monitor temporal surface temperature changes and compare land use and land cover changes with land surface temperature (Ding and Shi, 2013; Feng et al., 2014; Özkök et al., 2017). Landsat, The Moderate Resolution Imaging Spectroradiometer (MODIS), The Advanced Very High Resolution Radiometer (AVHRR) and SPOT sensors are frequently used for spatial determination of land surface temperature changes with remote sensing data (Ding and Shi, 2013; Nutini et al., 2013; Feng et al., 2014; Özkök et al., 2017).

In researches on land surface temperature, it has been determined that the land surface temperature value of urban areas is generally higher than rural areas. The main reason for this is the artificial materials used in urban areas (Stone and Norman, 2006; Pal and Ziaul, 2017; Kesgin Atak and Ersoy Tonyaloğlu, 2020). At the same time, it has been revealed in scientific studies that this situation negatively affects human health and bioclimatic comfort (Gasparrini and Armstrong, 2011; Savic et al., 2018; Karakuş and Selim, 2022).

Urban green areas have an important place in reducing the land surface temperature in cities. Scientific researches show that regions with dense vegetation are cooler than other regions (Pal and Ziaul, 2017; Xiao et al., 2018; Masoudi et al., 2019; Atwa et al., 2020; Kuşçu Şimşek et al., 2022). Vegetation in urban green areas absorbs the sun's rays and provides shade and evaporation. This situation reduces the negative effects of the land surface temperature in the vegetation area and contributes to the cooling of its environment (Cao et al., 2010; Yuan et al., 2017; Kesgin Atak and Ersoy Tonyaloğlu, 2020). However, the effect of green areas on reducing land surface temperature is not the same. The level of impact of green areas on reducing land surface temperature; It varies depending on the size of the green area, the type of plant, the number of

plants, the presence of water surface, the amount of impermeable surface and the shape of the green area (Chang and Li, 2014; Wang et al., 2018; Masoudi and Tan, 2019). At the same time, this effect of green areas on the land surface temperature varies depending on the structures around the green areas and the development of the urban (Pramanik and Punia, 2019; Mabon et al., 2019; Kuşçu Şimşek et al., 2022).

Parks in urban green areas are areas used by individuals living in the city for recreational activities (Lapa et al., 2012; Özer and Karakuş, 2012; Karakuş, 2016). Parks have many functions for the city and its inhabitants at the same time. One of these functions of parks is to reduce the land surface temperature by positively affecting the microclimate of the region, to reduce the urban heat island effect, and to be a carbon sink in the tackling against climate change (Yücel et al., 2009; Karakuş and Yücel, 2011). In this context, the aim of the research is to evaluate the effects of parks on the land surface temperature in the example of Fethiye city center.

2. Material and Method

2.1. Material

The city center of Fethiye district of Muğla province is determined as the research area (Fig. 1). Fethiye city is located in the southwest of Anatolia. Fethiye city is surrounded by Antalya province to the east and southeast, the Mediterranean to the south/southwest and west, Dalaman district to the northwest, Denizli and Burdur provinces to the north. Fethiye is a typical coastal city within the Mediterranean region of the line separating the Mediterranean region and the Aegean region (Özer et al., 2013; Ardahanlıoğlu Bozhüyük and Karakuş, 2016; Özer et al., 2016; Ardahanlıoğlu Bozhüyük et al., 2018; Çınar and Karakuş, 2021). The population of Fethiye district in 2021 is 170379 (TURKSTAT, 2022). Due to its geomorphological features, Fethiye city is settled on a plain surrounded by high mountains. Due to the scarcity of flat areas around the plain, urbanization has expanded towards the plains and slopes (Ardahanlıoğlu Bozhüyük et al., 2015).

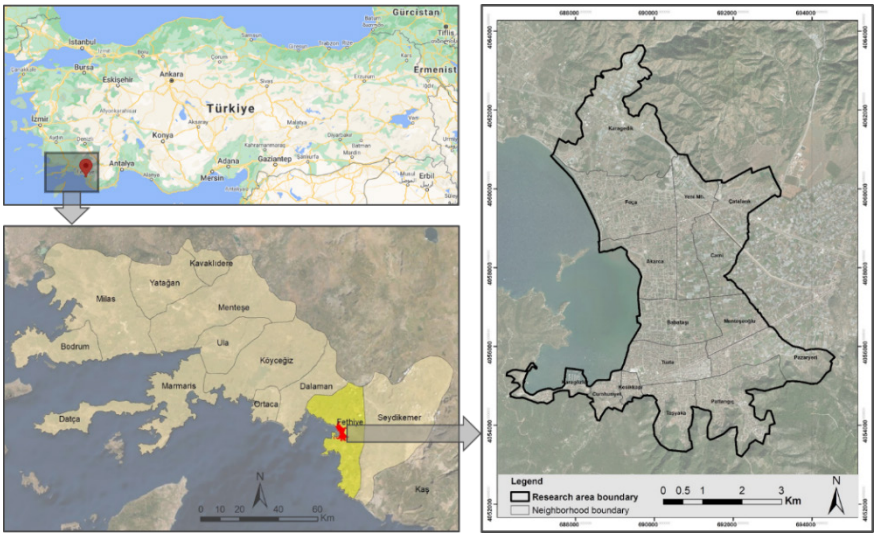

Figure 1: Research Area

In the previous researches about the region, it is determined that there are 15 urban neighborhoods in the Fethiye district (Karakuş et al., 2014; Selim et al., 2014; Çınar et al., 2015; Selim and Karakuş, 2016). In this context, 15 neighborhoods in Fethiye urban center is included in the research area. Landsat 8 satellite images covering the Fethiye city center and parks in 15 urban center neighborhoods constitute the study's main material. In addition, studies related to the research area and subject are other materials of the research.

In the previous researches about Fethiye urban center, the parks in the urban center were determined and the areas of the parks were given in square meters. These data were converted to decares and used in the research (Table 1).

Table 1: The Amount of Park Areas in The Neighborhoods in The Research Area

Neighborhood	Parks area (da)
Akarca	57.08
Babataşı	80.45
Cami	3.29
Cumhuriyet	48.69
Çatalarık	3.53
Foça	91.88
Karagedik	1.65
Karagözler	48.25
Kesikkapı	1.78
Menteşeoğlu	7.26
Patlangıç	123.57
Pazaryeri	13.91
Taşyaka	41.27
Tuzla	107.90
Yeni	18.00

Landsat 8 is the National Aeronautics and Space Administration (NASA)'s the eighth satellite in this series. Landsat satellite images provide important data for monitoring and evaluating human livelihoods such as food, water, and forests. The Landsat 8 satellite measures visible, near-infrared, short-wave infrared and thermal infrared (VNIR, NIR, and SWIR) information. Landsat 8 satellite, which takes images at different intervals, provides data with a resolution between 15 and 100 meters depending on the spectral range (USGS, 2022). In this research, Band 4, Band 5 and Band 10 of Landsat 8 dated 21.07.2021 were used to determine the land surface temperature (Table 2) (Figure 2).

Table 2: Landsat 8 Spectral Bands Used in The Research (Çoşlu et al., 2021)

Spektral range	Wavelength	Resolution
Band 4 - Red	0.64 - 0.67µm	30 m
Band 5 - Near-Infrared	0.85 - 0.88 µm	30 m
Band 10 - TIRS 1	10.6 - 11.19 µm	100 m

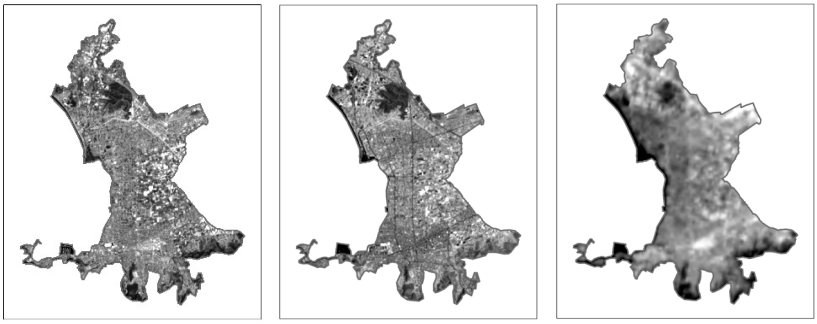

Figure 2: Landsat 8 Bands, Band 4 (a); Band 5 (b); Band 10 (c)

2.2. Method

The research was carried out in 5 stages. In the first stage of the research, the literature of Fethiye district and the research topic was searched and reviewed. In the second stage of the research, the satellite images and the physical maps of the region were obtained and the research area boundary was determined. In the third stage of the research, the satellite image was processed in order to calculate the analysis of Land Surface Temperature (LST) values of the research area. In this context; By using the thermal band (Band 10) of the Landsat 8 satellite image, the brightness values were converted into radiance (TOA spectral radiance) values (Milder, 2008). Then, radiance values were converted to Brightness Temperature values (USGS, 2022). In order to determine the vegetation, NDVI (Normalized different vegetation index) images were produced using Red (Band 4) and Near-Infrared (Band 5) bands. Then, the proportion of vegetation was calculated using NDVI and the emissivity was calculated using this ratio (Anandababu et al., 2018). In the fourth stage of the research, the Land Surface Temperature (LST) map of the research area was produced by using the brightness temperature and emissivity values (Artis and Carnahan, 1982). In the last stage of the research, the amount of park areas and the land surface temperature of the 15 neighborhoods in the research area were evaluated and interpreted together.

3. Results and Discussion

The land surface temperature map of the research area is obtained with the three bands of the Landsat 8 satellite dated 21.07.2021 used within the scope of

the research (Fig. 3). According to the land surface temperature map, the lowest temperature is 32.93°C, while the highest temperature is 46.03°C in the research area. According to the research findings, the average temperature value of the research area is 40.63°C.

In order to evaluate the land surface temperature according to the park area in the neighborhoods, firstly the parks were classified according to their size. As a result of the classification, the amount of the park area of 7 neighborhoods in the research area is below 25 da. In addition, the amount of the park area of 3 neighborhoods is between 25-50 da (Fig. 3).

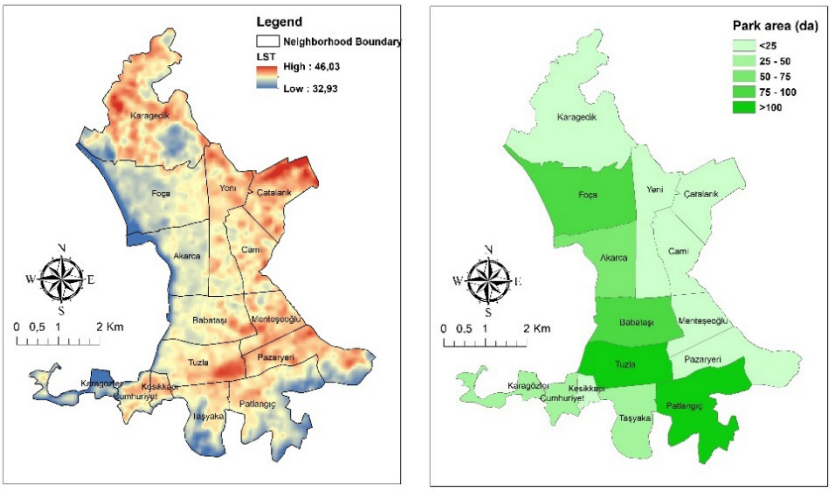

Figure 3. Land Surface Temperature (LST) and Park Area Maps of The Research Area.

In the research, the land surface temperatures of the neighborhoods within the research area are determined separately (Table 3). The obtained land surface temperature values are evaluated together with the park areas in the neighborhood (Fig. 4).

The neighborhood which has the highest park area with 123.57 da is Patlangıç neighborhood. The neighborhood with the lowest amount of park area is Karagedik with 1.65 da. In general, 7 out of 15 Neighborhoods in the research area have less than 25 da of park area (Table 3).

According to the results, the land surface temperature of the Çatalarık neighborhood is the lowest at 40.07°C and the highest at 45.41°C. It is the neighborhood with the highest average land surface temperature value (42.42°C) in the research area.

The land surface temperature of Karagözler neighborhood is the lowest at 32.93°C and the highest at 41.41°C. It is the neighborhood with the lowest average land surface temperature value (37.60°C) in the research area.

The neighborhood with the highest land surface temperature value is Karagedik with 46.03°C, while the neighborhood with the lowest land surface temperature value is Karagözler with 32.93°C in the research area (Table 3).

Table 3: Land Surface Temperature (LST) Values and Amount of Park Area of Neighborhoods in The Research Area

Neighborhood	LST (C°)			Parks area (da)
	Min	Max	Mean	
Akarca	33,51	41,40	39,35	57,08
Babataşı	34,50	43,60	40,61	80,45
Cami	39,55	43,78	41,12	3,29
Cumhuriyet	36,32	42,45	40,62	48,69
Çatalarık	40,07	45,41	42,42	3,53
Foça	33,38	42,21	39,54	91,88
Karagedik	36,04	46,03	41,04	1,65
Karagözler	32,93	41,41	37,60	48,25
Kesikkapı	38,16	42,63	41,24	1,78
Menteşeoğlu	39,01	43,88	41,56	7,26
Patlangıç	36,07	42,93	39,96	123,57
Pazaryeri	36,97	44,20	41,14	13,91
Taşyaka	36,16	43,05	39,90	41,27
Tuzla	36,04	44,42	41,31	107,90
Yeni	39,63	43,94	41,32	18,00

Increasing the vegetation cover is one of the simple and effective methods for reducing the land surface temperature and the negative effects of global climate change in urban settlements (Fortuniak, 2009; EPA, 2012). Researches on this subject show the effects of the presence of vegetation on the land surface temperature. In research conducted in Manchester, it was revealed that a 10% increase in the vegetation of the urban could reduce the temperature of the city by 4°C (Farina, 2012). In the research conducted by Şekertekin et al. (2015) in the city of Zonguldak, it was observed that the surface temperature of the lands with vegetation is approximately 5 ºC lower than the city center and open areas.

Generally, in the research as the amount of park areas increases, the land surface temperature decreases, and as the park areas in the neighborhood decrease, the land surface temperature increases (Fig. 4).

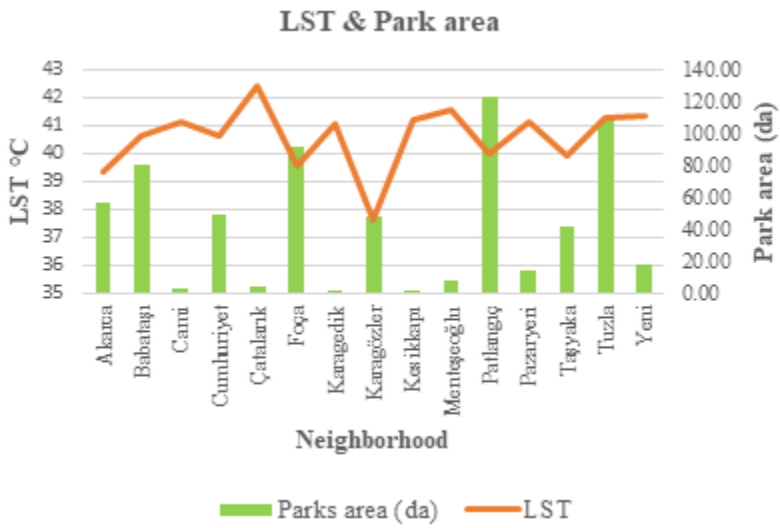

Figure 4: Relationship between LST and amount of park area at neighborhood scale

However, although the amount of park area in Babataşı, Patlangıç and Tuzla neighborhoods is higher than some neighborhoods, the land surface temperature of these neighborhoods is high. Patlangıç neighborhood has the most park area. Despite this, the land surface temperature of this neighborhood is higher than the neighborhoods with less park area. The residential and population density in Patlangin is higher than in other neighborhoods. For this reason, the high level of construction in the neighborhood causes the land surface temperature to increase. Babataşı and Tuzla neighborhoods have a high density of housing, just like the Patlangıç neighborhood. Therefore, although the amount of park area is high in these neighborhoods, the land surface temperature has a high value. The land surface temperature in the Karagedik neighborhood, which has the least park area, is close to the average land surface temperature of the urban. Although the amount of park area in the Karagedik neighborhood is low, both the low density of housing and the presence of green areas apart from the park are effective in the fact that the land surface temperature value of the neighborhood is not very high.

According to the research findings, it is seen that only the park area is not effective in reducing the land surface temperature. In the study conducted by Wardana (2015) for the city of Bandung (Indonesia), it is emphasized that the vegetation in green areas is important in reducing the land surface temperature. In particular, it has been determined that high-density vegetation is more effective in reducing the land surface temperature. In this context, high and dense vegetation areas should be created in the parks.

4. Conclusion

According to the results of the research, the highest land surface temperature in the research area with 46.03°C is observed in the bare soil and rocky area in the Karagedik neighborhood, while the lowest land surface temperature is observed in the Karagözler neighborhood with 32.93°C. The average land surface temperature of the research area is determined as 40.63 °C. According to the land surface temperature data obtained from the neighborhoods, the temperature difference between the lowest and the highest temperature is higher in the Karagedik neighborhood than in other neighborhoods. It has been determined that this difference is between the bare soil area and the water surface in the Karagedik neighborhood. In general, the land surface temperature increases as you move away from the sea and forest areas in the research area.

As a result, green buffer zones with dense vegetation should be planned within urban areas in order to reduce the negative effect of construction on land surface temperature while making land use plans. Agricultural and forest areas should be taken under protection, and construction should not be allowed in these areas. In this context, the integration of green infrastructure systems into the planning studies to be carried out in the urban and the planning of dense vegetation in the parks will reduce the land surface temperature in the urban areas.

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CHAPTER V

PREFERENCE IN URBAN GREEN AREAS - FEATURES AFFECTING THE PREFERENCE AND THE NATURALNESS VARIABLE

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1. Introduction

As a result of urbanization, the proportion of people living in urban areas is expected to rise to 70% by 2050. Density of urban areas; it causes traffic, pollution, noise, urban heat, poor housing conditions, stress and social isolation (UN, 2022). However, urban green spaces can play an important role in reducing the impact of all these problems; They can reduce heat-air pollution, absorb noise, store rainwater, help people relax and relieve stress. One of the most important effects of green spaces is the opportunities they offer for socialization (van den Berg et al., 2022). Because while socialization supports social cohesion by communicating between people, it also provides social inclusion by providing equal access to these areas for everyone (Alpak et al., 2018; Düzenli et al., 201a7; Özkan et al., 2017). Thus, urban green spaces connect people to a community, develop a sense of belonging and support social integrity by providing unity.

The inadequacy of urban green areas or their features that negatively affect user preference also negatively affect the formation of social interaction between people. This situation, when combined with the intensity of urban

life, can create a community of people who are disconnected from each other and cannot communicate. However, green areas; They are places where people can have fun, relax, participate in recreational activities, meet other people, chat, establish social relations and interact with each other (Mehta, 2014). With this thought, social activitys can be accepted as an indicator of the success of a green space. Because Gehl (1987) and Whyte (1980), who studied urban open spaces, state that successful open spaces should include opportunities for social activities. In this context, Mehta (2007; 2014) draws attention to the importance of the social interaction provided by the human presence in open spaces for people, but states that the human presence participating in compulsory activities cannot be an indicator of social interaction. It expresses that livable urban open spaces that allow social interaction should be defined by the permanent, fixed and human presence participating in social activities. Mehta (2007) states that these activities, which encourage socialization in urban open spaces, provide opportunities for easy interactions with other people in a comfortable and undemanding way. Thus, social interactions are experienced in which the citizens trust others, are familiar with, and establish visual and verbal long or short contact, otherwise these people are separated from each other and become alienated. For this reason, users are needed to transform green spaces in urban open spaces into a social space and to be a place where social interaction takes place. For this reason, the idea that "if there is user density and diversity in an urban green area, there is social interaction there too" forms the basis of this study. The formation of social interaction in a green area is ensured by people's preference for that area. Preference is a prerequisite for social interaction to take place. The combination of the cognitive features of the user and the physical and social features of the landscape makes the green area preferable.

2. Preference and Preference Variables in Urban Green Spaces

Why do users tend to prefer some urban green spaces over others? How do users distinguish urban green spaces? The answer to these questions is to reveal how users experience urban green spaces and why they prefer them. For this reason, it is very important to know the characteristics of the green areas preferred by the users. Nasar (1988) states that people pay attention to the visual quality of their environment and designers who know the characteristics of the relationship between the visual environment and human senses will more

successfully design environments that better adapt to the preferences of their users. This will contribute to improving the quality of life over time; because the liking felt in an environment can affect the experience, well-being and sense of well-being in that environment. This indicates that people will be attracted to an environment they like, and they will stay away from one that is not pleasing (Nasar, 1988). Kaplan (1989) preference; defines the tendency to make choices that keep individuals away from unsuitable environments and direct them towards desired ones, as an intuitive guide to behavior. Gault (1997), on the other hand, defines preference as a decision-making, choice, or evaluation process, which means that one landscape is liked more than another. Landscape preference; It is part of landscape perception and reflects the comprehensive results of a range of perceptual activities, such as sensory cognition, when the user faces the landscape. Understanding landscape preference helps users discover what type of landscape is most preferred based on the results of extensive assessments of the landscape. For this reason, researching the subject of which landscape people prefer has a long history. In particular, perception and cognition-based researchers have considered landscape preference as a result of evaluating the usefulness of the environment based on perceived information (Zhang et al., 2021).

Appleton (1975) argues that the reasons for individuals to prefer landscapes are based on the instinct of survival and states that individuals prefer landscapes where they will be hunters rather than prey. According to Appleton, the viewing distance that an area should provide to an individual; openness (visual dominance) and the possibility of security; Asylum (Visual protection) must be absolute. These two concepts in the landscape increase the chances of survival of the individual and therefore make that landscape preferable (Appleton, 1975).

In a psychoevolutionary framework, Ulrich (1983) summarized eight visual characteristics of landscape environments that influence preference evaluations. Emphasizing that these characteristics are important for psychological and physical health, he suggested that people make their first emotional assessments in an unfamiliar environment. Throughout this process, he evaluated the potential impact of structural aspects of the environment (complexity, organizational features, focus), depth characteristics (spatial depth, disoriented landscape), and elements of its overall composition (presence of threats, ground surface texture, and water) on human well-being.

Another landscape preference theory is Information Processing Theory created by Kaplan and Kaplan (1989). The theory states that the environment must have two basic features in order to be preferred; understand and explore. These features are related to the perception of the environment and can be provided by the information contained in the environment. Kaplan and Kaplan explain this important information in landscape preference with a preference matrix and point out that there are four factors that affect landscape preferences: consistency (immediate understanding), readability (inferring by understanding), complexity (immediate inference). exploration) and mystery (exploration to achieve results). If the landscape has these four factors, it is possible to understand and explore the landscape, and these factors represent the characteristics of the preferred landscape.

Today, cognitive and perceptual preference theories related to landscape have been integrated and these theories have formed the basis of various researches: Gault (1997) has revealed three basic concepts: complexity, readability and imaginability by associating landscape preference with human cognitive and experiential processes. Tveit et al., (2006) defined the conceptual framework of visual landscape with nine key concepts. These; management, coherence, complexity, historicity, visual scale, imaginability, complexity, spontaneity, and temporality. Hunter and Askarinejad (2015) created a conceptual model based on extracting the visual features of the landscape. This model includes: naturalness, structural coherence, structural form, clues of depth, openness and information gathering, accessibility, security and participation. Zhang et al., (2021), on the other hand, evaluated the relationships between visual features and knowledge-based variables that are effective in landscape preference. They built the theoretical framework they created in their research on the following concepts: consistency, complexity, clarity, order and depth. When these studies are examined, it is seen that the environmental characteristics (accessibility, security) that an open space should have in order to be used by people, to be preferred and to enable social activities, with the theoretical information obtained from the cognitive and perceptual preference theories of users (consistency, complexity, readability, mystery and psychological safety, interaction, participation) are evaluated together. Based on these ideas, some studies investigating the preferences of urban green spaces have focused on the relationship between landscape preference and landscape elements. It has been investigated how landscape elements affect people's green space preferences and experiences:

Type and density of vegetation (Van Vliet et al., 2021; Sharafatmandrad and Mashizi, 2020; Bjerke et al., 2006; Jim and Chen, 2006; Tarakçı et al., 2017); the size, aesthetics and accessibility of green (Bertram & Rehdanz, 2015; Jim & Chen, 2006); The presence of equipment (Rodiek and Fried, 2005; McCormack et al., 2010) affected people's preferences.

Cleaning and maintenance (Hoyle et al. 2017; Jim and Chen, 2006), silence, beautiful views water-the presence of other people (Liu et al., 2018; Bjerke et al., 2006; Jim and Chen, 2006); presence of plants and flowers (Wan et al., 2021; Hoyle et al., 2017; Rodiek and Fried, 2005; Bjerke et al., 2006); socialization and exercise opportunities (Liu et al., 2018; Arnberger & Eder, 2015) also play a role in users' preferences. In particular, the effect of the naturalness of urban green spaces on preference has been the subject of many studies, and it has been revealed that there is a positive relationship between naturalness and preference (Sowinska-Swierkosz and Soszynski, 2019; Hoyle et al. 2017).

Environmental factors and climatic conditions are also effective in the choice of urban green spaces, especially in the instant choice. These factors are; temperature, sunlight, shade and wind are important in supporting outdoor activities and providing the user with outdoor comfort. Especially sunlight is an important quality in the use of urban open spaces (Whyte 1980; Banerjee and Loukaitou-Sederis, 1992) and in the realization of social activities (Hass-Klau et al., 1999). However, although sunlight is an important factor in the outdoor preference of users in spring, users prefer shaded places in summer (Whyte 1980; Mehta, 2007).

According to the information obtained up to this part of the research, the content of the green areas preferred by the user is ecologically beneficial as well as beneficial on the psychological-physical health of the user and valuable in its social interaction. So what are the features that make up "these green spaces" and make them "preferable"? It is very important to find the answer to the question and make it understandable. In the light of the studies carried out in this context, the features that make urban green areas preferred by people and the variables that affect them are presented as follows (Table 1);

- Cognitive features
- Physical features and
- Social features

Table 1. Qualities and variables affecting the choice of urban green spaces

FEATURES AFFECTING THE PREFERENCE OF URBAN GREEN AREAS	
▪ **Cognitive features**	Readability, Consistency, Complexity, Mystery (depth, exploring, gathering information); Naturalness, Visual Scale, Accessibility (visual-physical), Clarity, Order, Imaginability, Historicity and Security (feeling psychologically safe)
▪ **Physical features**	The size, aesthetics and accessibility of green space; Presence, density and species of plant species; Diversity, Presence of water-reinforcements; availability of exercise opportunities, Silence; Presence of beautiful landscapes, Naturalness; Cleaning and maintenance, Climatic conditions
▪ **Social features**	Another organization; Good management, Opportunities of Socialization (donations, events that will allow for common uses-interactions) and Social comfort (security, familiar people)

Urban green spaces are everyday places for contact with nature and social interactions. They provide urban residents with a variety of environmental, aesthetic and recreational benefits associated with physical and psychological well-being and quality of life (Yılmaz et al., 2017). For this reason, the qualities necessary for the use and preference of green areas by people are very important. When the variables determined by these qualities are examined, "naturalness" appears as a common component. For this reason, the concept of naturalness will be discussed in detail, focusing on naturalness in the research.

2.1. Naturalness

The definition of the concept of naturalness dates back to the beginning of the 18th century, and with this definition, it was aimed to comprehend the naturalness represented by a landscape (Gimmi and Radeloff, 2013).

For this reason, nature was defined before the concept of naturalness, and the concept of naturalness, which expresses the criterion of being natural in urban green areas, was tried to be defined with the entry of nature into the city. While nature was defined as wild, dangerous and terrible (Nicholson-Lord, 1987) before the 18th century, nature was feared at the beginning of the 18th century; It has turned into an admired nature with its clean air and beautiful scenery. With the spread of agriculture, nature has no longer been a threat to humanity, and it has begun to be seen not only in controlled natural areas, but also in wild nature as beautiful-safe (Appleton 1975). In the 19th century, it was aimed to understand and interpret nature in order to make the best use of nature. However, the negativities brought by industrialization have made significant changes in people's behavior towards nature. Especially in the 20th century, people started to try to protect nature before they were completely lost, and the importance of nature extending into the city began to be emphasized. In this period, nature was seen as an opportunity to escape from the stress of the city, it was suggested to be preserved as it is, and the degree of being natural in it was very important. In this context, the concept of nature has undergone a constant change until today, and this change has resulted in the "degree of being natural", that is, the concept of naturalness, which the landscape contains in the 20th century. Therefore, the effects of naturalness on preference; The definition of naturalness has been the subject of various studies:

Naturalness is by many of the environmental psychology theories; In the biophilia hypothesis (eg Kellert, 1996; Kellert & Wilson, 1993), theories about restorative landscapes (eg Kaplan & Kaplan, 1989), and studies that naturalness shapes landscape preference (Hunter & Askarinejad, 2015; Tveit et al., 2006; Kaplan and Kaplan, 1989) have been introduced. The common point of all these studies is; the degree of naturalness of the landscape is a strong factor in people's preference for these landscapes and provides the user with positive effects such as aesthetic pleasure, healing effect and stress relief (Hoyle et al., 2019; Van den Berg et al., 2014; Carrus et al., 2013; Tveit et al., 2006; Yılmaz et al., 2016).

The concept of naturalness expresses how close a landscape is to the natural state and how far it is away from the anthropogenic effect (Clay and Smidt, 2004). This concept is used in both ecology and environmental psychology studies. In this context, naturalness is divided into two:

- Objectively ecological naturalness
- Subjectively perceived naturalness

Ecological naturalness is defined by the current state of an area's biotic components and ecosystem functions. Determining the level of human intervention in vegetation (Krapez et al., 2021) provides an example of objective evaluation of ecological naturalness.

Perceived naturalness is the user's subjective assessment of the human impact on the observable features of a field (Lamb and Purcell, 1990; Krapez et al., 2021).

Within the scope of this study, "perceived naturalness" was discussed and perceived naturalness was accepted as inversely proportional to the observable human influence in that area (Lamb & Purcell, 1990; Kardan et al., 2015; McMahan et al., 2016; Ode et al., 2016; Carrus et al., 2013; Krapez et al., 2021). However, it is stated that the naturalness perceived by researchers will vary depending on the observer's ability to describe human influence on a natural area, personal teachings, and sensory cognition. In this case, it has been revealed that the perceived naturalness of a landscape will not be related to its ecological naturalness and may even be very different from ecological naturalness (Lamb and Purcell, 1990; Tveit et al., 2006; Krapez et al., 2021). Kaplan and Kaplan (1989) explain the perceived naturalness in this context and state that there is no need for factors such as absolute "untouchedness" and "distance from the residential area" to ensure naturalness.

The components that affect the perceived naturalness are explained by various studies as follows (Table 2);

Table 2. Components that affect perceived naturalness

	COMPONENTS THAT AFFECT PERCEİVED NATURALNESS	
Natural features	▪ **Density of trees, species diversity**	Huai vd.,(2022); Kim ve Son, (2021); Hoyle vd., (2018); Southon vd., (2018)
	▪ **Presence of water**	Huai vd., (2022); Mangone vd., (2021)
	▪ **Presence of plants**	Herzog, (1989); Hwang, (2022); Pardela vd., (2022); Lamb ve Purcell, (1998)
	▪ **Type, leaf shape, height and age of the plant**	Kaplan ve Kaplan, (1989); (Tveit vd., 2006); Hoyle vd., (2018); Southon vd., (2018);Krapez vd., (2021)
	▪ **Presence of animal**	Huai vd., (2022); Dirik, (2008).
Field-related features	▪ **To be cared for**	Kim ve Son, (2021); Krapez ve ark., (2021); Tveit vd., (2006)
	▪ **Accessibility (proximity to green area)**	Kim ve Son, (2021); Krapez vd., (2021); Tveit vd., (2006)
	▪ **Mystery, depth, breadth**	Yılmaz, (2008)
	▪ **Use of natural materials**	Simonds, (1998); Karakaş, (2011)
Personal features	▪ **Providing personal benefits (calmness, peace, solitude, connection with nature)**	Krapez vd., (2021); Carrus vd., (2013)
Physical features	▪ **Noise**	Ode vd., (2009);Polat ve Akay (2015); Herzog vd., (1982); Huai vd., (2022)
	▪ **Presence of structural elements**	Krapez vd., (2021); McMahan vd., (2016); Ode vd., (2016); Kardan vd., (2015); Carrus vd., (2013); Lamb ve Purcell, (1990)

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CHAPTER VI

THE DESIGN STAGES OF THE DEĞIRMENDERE BASIN: CONCEPT-VISION GENERATION PROCESS

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1. Introduction

Design begins in the human mind, is non-linear and includes various processes that result in a product (Eren, 2022). For this reason, each designer's process of starting and developing the design is different (Yılmaz et.al., 2016; Yılmaz et. al., 2020). The design is based on the idea of creativity, it is a non-routine, defined, open-ended problem-solving activity (Bonnardel, 2000; Özkan et. al., 2016). It is an activity that requires multidimensional thinking and connecting between different objects and concepts (Bayramoğlu and Seyhan, 2021).

When dealing with design problems, the aim should be to ask the right questions rather than answers. Asking the right question is the most important start to find solutions to problems. The main emphasis of the design should not be on what the result should be, but on how the process will work. This process is called Design and Construction and is generally handled under two separate headings as Production Process (Programming, Design, Construction,) and Evaluation Process (occupancy-post occupancy evaluation) (Özkan et al, 2017).

Within the scope of this study, the design dimension of the production process in landscape architecture education has been examined and detailed.

2. Design Stage of the Production Process

There are many different definitions and approaches to the concept of design. Design as the task of identifying a problem and solving it; It includes processes such as detection, decision making, analysis, thinking and trial and error (Bayramoğlu et. al., 2019). The information obtained by learning reveals new knowledge with the change it creates in the mind. With the new synthesis of knowledge, the design problem gains a fictional quality and becomes a step of the complex relations structure. For this very reason, it can be said that 'every design problem has its own personality' (Erdem, 2009). Therefore, it should also be considered as the "creative process itself".

Design is to decide within uncertainties – to reduce diversity (Asimow, 1962, Best, 1969). In summary, design is the process of choosing among various solution options (Alpak et. al., 2018; Alpak, et al., 2019; Özkan et. al., 2017). Bayazıt (1994) said that design is a plan or something that is visualized by creating, shaping or producing a plan or sketch (Önal, 2011). It is a mental project or scheme in which the steps that lead to a result are laid out. To do this, a process is needed. This design process is the whole of the activities carried out by the designer with the perception-thinking-expression and visual-verbal tools used. Tools used in this process; process affects the product, which is the expression of an idea, and its perception (Anderson, 2011). Therefore, the design process is an activity in which the power of mental thought, the data collected by all senses from the environment and innate abilities are synthesized (Düzenli and Alpak, 2016).

Generally, the Design phase starts with a preliminary phase that starts with thinking in the mind, that is, notion generation, for the solution of the design problem. It starts with an abstract phenomenon created in the mind (Sketch Out In Mind). Then, an idea is generated on this Notion and the concept phase, in which the solution to be produced for the problem is first decided, is constructed (Image). Then, the vision phase, in which general decisions are made, the abstract idea formed in the mind, that is, the concept turns into concrete, and the existing field problems and thought are synthesized, is constructed. After the general decisions are taken with the vision, that is, the concept, the use of space (Schematic design) is made. In line with the possibilities offered by the

area (slope, wind, landscape, etc.), decisions are made about which activities can be organized and where, and while this is done, it is ensured that it includes an organization that includes size, form and position (Draft). Finally, the options for the use of this area are produced and the final product design is obtained (Design). (Özkan et. al., 2018). Within the scope of this study, the concept and concept development, vision creation parts are discussed and explained.

2.1. Notion and Concept

It can be said that the most difficult stage in the design process is the starting point. A conceptual thinking system is needed in order to facilitate this difficult stage and to fit the design to a strong quality (Eren, 2019). Design, beyond the work on the project, is a process that starts in the mind and progresses to a great extent here. As in all areas of life, the individual needs a preliminary preparation in order to take the first step in the act of designing. This preparation that develops in the mind takes place through conceptual thinking.

Design starts with a good or bad concept. Just as it is wrong to separate the content of an object as an object and a symbol, it is unhealthy to consider design separately from the concept (Turan & Altaş, 2003).

A concept, on the other hand, is defined as one or more concepts that have been brought to the level of a proposal by going through some processes in the mind. Since it is a form derived from the notion but taken one step further by interpreting it with a creative mindset, it is now a personal guide. A concept can be produced by associating many notions with each other, or it is possible to create many different concepts from one notion. Defining and presenting the design problem, which is the purpose of the concept study, or limiting it by drawing a frame by grasping all its dimensions is as important as the solution itself in the creation of the design setup.

The concept development phase, which constitutes the largest share in the design process, requires the designer to see many data together, to establish appropriate connections between them, and most importantly, to explain or establish all of them with a single structure. In other words, this effort can be called a theory development. The concept determined in the first stage of the design can be felt in many places when looking at the final product, or it can be felt in a single point that the designer thinks is right.

Within the scope of this study, it was evaluated that the students who received landscape architecture education started the design with a concept, developed it and turned it into a concept.

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2.2. Vision

Creating a vision in design is the first stage in which general decisions are taken, the abstract idea created in the mind, that is, the concept, turns into concrete, and solutions are produced for existing field problems. The design is the first stage in which the main decisions are taken in order to find solutions to the problems obtained as a result of the analysis, without working on the existing plan. In other words, there is no field use study at this stage. The question of how the problems can be solved is asked and the answers obtained are visualized. In line with these decisions, scenarios are created and clues about what the final product will lead us to are obtained (Kurdoğlu et. Al., 19). At this stage, in addition to developing a vision for the study area, predictions are made about what kind of supporting features the design to be made in a larger framework, such as organically connecting the design area to other channels that make up the city, contributing to the various needs of the citizens, developing or creating the green space system of the city, will be developed.

Within the scope of this study, it was evaluated how the students studying landscape architecture suggested solutions to their identified problems, how they scripted these solutions and how they established their relationship with the concept.

3. Findings

Karadeniz Technical University, Department of Landscape Architecture, in the 2021-2022 Spring Semester, was selected as the study area of the Değirmendere Basin within the scope of Environmental Design Project V course. First of all, the students did research on the field to use it in the design phase. Within the scope of this study, first of all, the researches done by the students as a group, and then the concept and vision they made individually were discussed.

3.1. Research Phase

This phase was completed with the joint work of the students. General information about the Değirmendere basin and the absolute protection areas of

the stream were investigated. And in line with this information, the ecological fiction of the area was created.

Table 1. General information about the study area

General Information of Değirmendere Basin	**Basin Absolute Protection Area**
Değirmendere Basin starts from the coast and divides into two branches in Maçka district. The eastern branch ends at Çakırgöl Mountain at an altitude of 3063 m, while the branch extending to the west ends on the Nişan Mountain at an altitude of 2660 m in the Zigana region. It has a very rich floristic structure with its geographical location, topographic, geomorphological structure and microclimate. On the other hand, as a result of anthropogenic effects in a large part of the area, the climax vegetation lost its natural structure in these areas and due to the deteriorated ecological balance, Picea orientalis (L.) Link. and Corylus maxima Lam. secondary plant communities emerged. The main vegetation types in the Değirmendere Basin are: a- Subalpine and Alpine vegetation b- Humid stream vegetation c- Forest vegetation d- Pseudomaki vegetation e- Dune vegetation	It is the land area with a horizontal width of 300 m starting from the line formed by the water at the highest water level and the land around artificial and natural lakes where drinking and utility water is supplied and to be provided. Balancing the watershed hydrology with stream systems, basin-scale tributaries and natural coastal ecosystem in the aquatic ecosystem; Natural drainage basin that collects and discharges precipitation waters of above-ground resources; It is the water resources of life and the biological reserve area. Stream improvement projects are the projects that should be carried out in order to collect all the rain water from the regions where the rainwater drainage networks have been completed and to deliver it to the sea. However, wastewater in residential areas is unfortunately discharged into streams and streams cause pollution of the environment.

In addition to the stream that will drain the rainwater, sewer lines to collect the waste water on both sides of the stream and green areas and service roads should be planned on both sides of the stream as the breathing areas of the city.

In line with this information, the ecological fiction that forms the infrastructure of the decisions to be taken during the design process has been created (Figure 1).

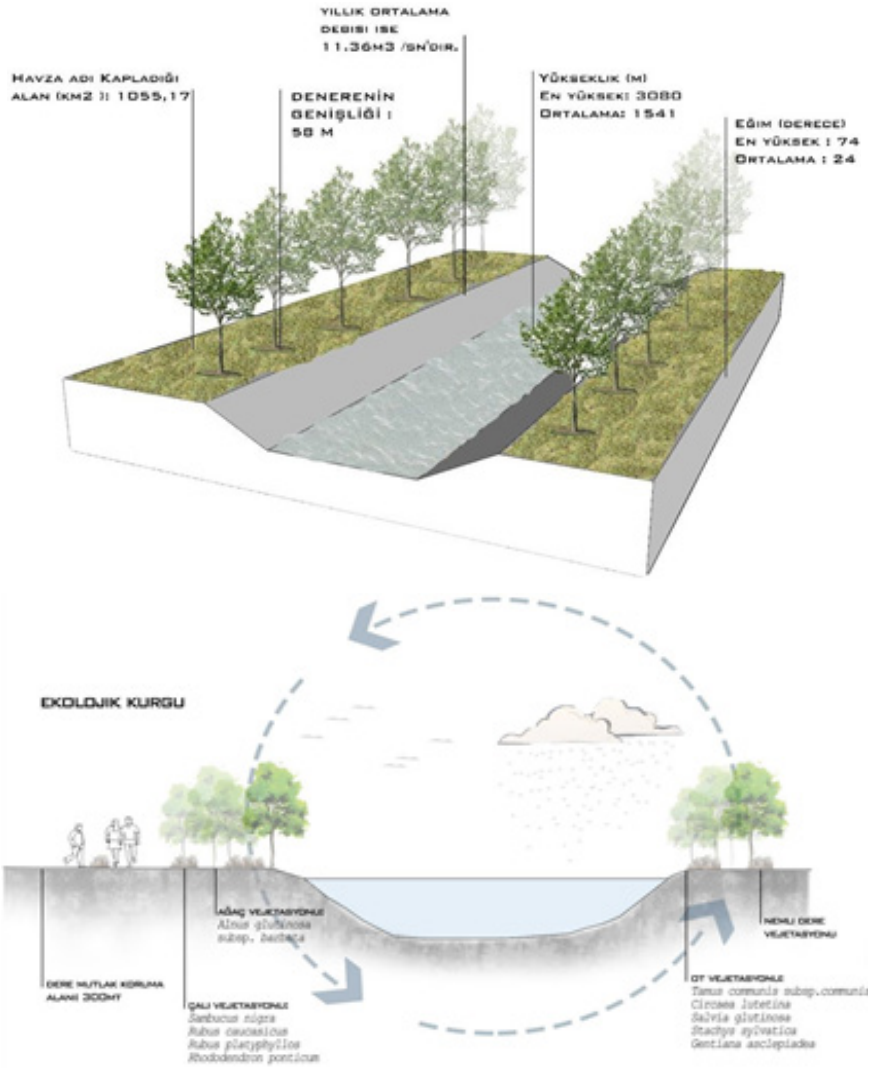


Figure 1. Ecological Fiction

Dune vegetation: This vegetation type, which exists at the point where the Değirmendere basin meets the Black Sea, has been completely destroyed and disappeared as a result of the coastal road and filling areas built in recent years.

3.2. Concept and Vision

In line with the data obtained during the research phase, each student presented his/her own conceptual approach to problem solving, vision, use of space and design development processes. At this stage, a student's process was evaluated.

• Concept-concept development

Table 2. Concept development

Notion
Integration of the Creek with the City**: CONJUNCTION** Conjunction: Literally means to come together on a straight line, to integrate. In my design, I want to integrate the creek and the city, to construct an area that combines the green infrastructure system with high ecological qualities and a balanced distribution within the urban texture. In this context, it is aimed to develop a holistic approach towards the improvement of ecological characteristics and to create a new experience route for the citizens and to provide them with nature. It is one of the primary goals to consider the existing stream as a unifying element, not as a city separator. The creek will offer opportunities in terms of both functional and visual appeal, the identity of the city it passes through, quality of life and socio-economic diversification in the city. From this point of view, what is suggested at this point with stream rehabilitation is to look at the urban streams as an element of the urban space, not with the approaches in which the stream is handled alone and from a purely technical point of view. Because, in addition to being one of the basic parts of the urban ecosystem; • Enriching the urban identity • Strengthening its image • As it is a basic built environment element that creates a point of attraction, its importance is increasing day by day. Contrary to the approaches that consider the creek as a singular urban element, this holistic approach will increase the livability of the city, will reflect on the cognitive maps of the city residents, and will improve taking responsibility for the city.

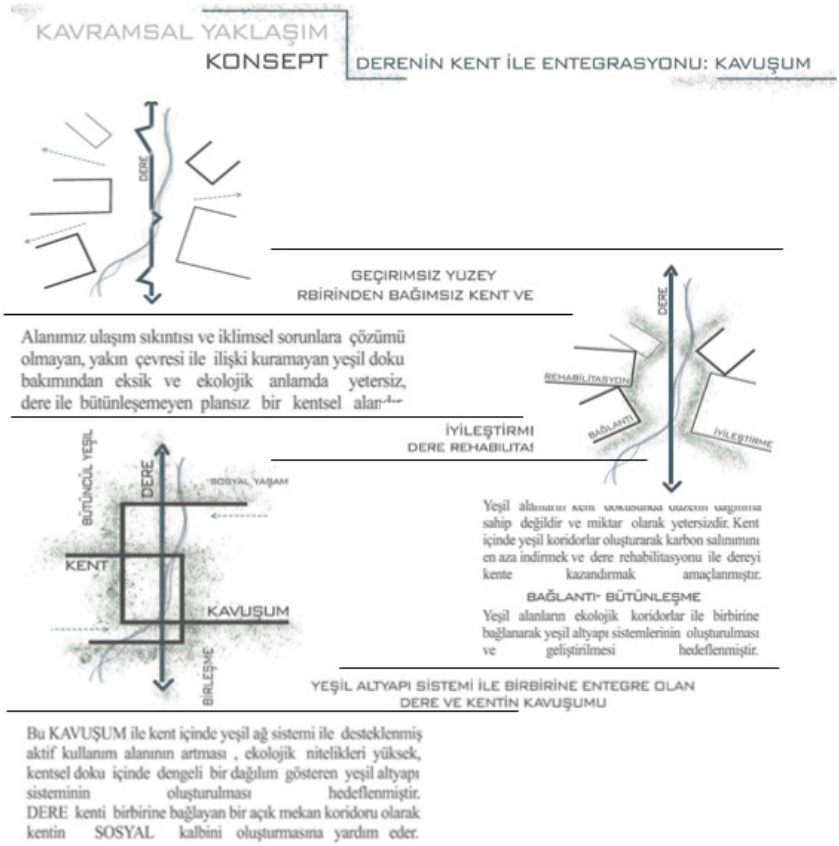
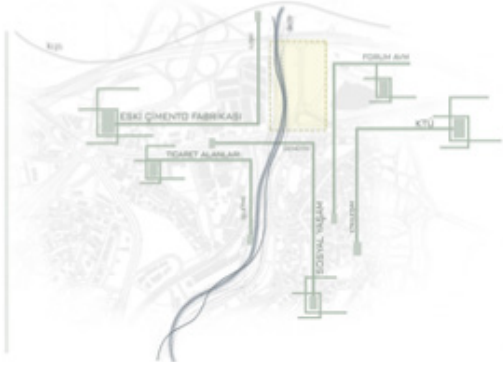


Figure 2. Concept development

- **Creating a vision**

First of all, a proposal for an installation that will connect the study area with the other organs of the city, a green area proposal to create a connected green area system, and pedestrian transportation proposals that can reach the study area by walking to other areas of the city in order to support the ecological balance are proposed (Table 3).

Table 3. Urban Relationship - Pedestrian Access and Green Proposal

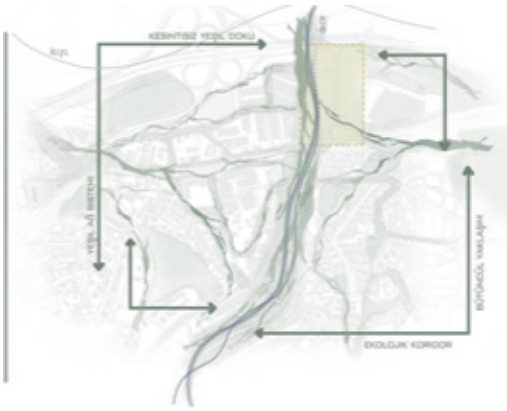


İLİŞKİ KURULACAK ALANLAR

TASARIM ALANININ YAKIN ÇEVRESINDE YER ALAN SOSYAL ALANLAR, TICARET ALANLARI, YERLEŞIM YERLERI VE KONUTLARI BIRBIRINE BAĞLAYARAK SOSYAL SÜRDÜRÜLEBILIRLIĞE HEM DE EKOLOJIK DENGEYE DESTEK VERILMESI PLANLANMIŞTIR. IKLIM DEĞIŞIKLIĞI ILE MÜCADELEDE YENI YAKLAŞIMLAR ORTAYA KOYUP, BÜTÜNCÜL OLARAK PLANLAMAK HEDEFLENMEKTE, DOĞAL BIR OLUŞUM OLAN DERE, EKOLOJIK YAKLAŞIMLAR ÇERÇEVESINDE KORUNARAK TASARIMA VE KENTE ENTEGRE EDILMESI PLANLANMIŞTIR.

YAYA ULAŞIM ÖNERİSİ

TRABZON KENTININ YERLEŞIM ALANI ÇOK DAĞINIK OLMAYIP ÇEŞITLI YERLEŞIM ALANLARINDAN YÜRÜYEREK KENT MERKEZLERINE KISA MESAFEDE ULAŞIM SAĞLAMABILMEKTEDIR. ANCAK BUNA IMKAN TANIYAN YAYA GÜVENLIĞINI SAĞLAYACAK YÜRÜME YOLLARININ OLMAYIŞI KIŞILERI ARABA KULLANIMINA YÖNLENDIRMEKTEDIR. ARABA KULLANIM ORANININ YÜKSEKLIĞI ISE KARBON SALINIMINA NEDEN OLMAKTADIR. BUNA ÇÖZÜM ÖNERISI OLARAK HEM ALANIMIZA HEM DE ÇEŞITLI BÖLGELERE GÜVENLI YAYA ULAŞIM YOLLARI ÖNERISI GETIRILMIŞTIR.



YEŞİL ÖNERİ

BIRBIRINDEN KOPUK YEŞIL ALANLARIN OLDUĞU BU ALANDA EKOLOJIK YAKLAŞIM ÇERÇEVESINDE, YEŞIL ALANLARIN BÜTÜNCÜL OLARAK KURGULANMASI VE TASARIMLARA ENTEGRE EDILMESI GEREKMEKTEDIR. BÖYLELIKLE HEM DIĞER CANLILARA YAŞAM HABITATLARI VE BIRBIRINE ENTEGRE EDILMIŞ DOĞAL ALANLARIN OLUŞTURULABILECEĞI HEM DE GEÇIRIMSIZ YÜZEYLERIN AZALTILARAK IKLIM DEĞIŞIKLIĞI VE DERE TAŞKINI ILE MÜCADELE EDILEBILECEĞI ÖNGÖRÜLMEKTEDIR.

During the research phase, the absolute protection limits of the bain were determined and it was determined that green areas should be constructed on both sides of the creek to form a border for protection. As a result of these determinations, general decisions were taken and scenarios were created (Table 4). These scenarios formed the key points of the design process and the result was designed to be reflected in the product. In addition, the idea of conjunction, which was conceived in the concept, was integrated into the vision stage both in a visual, syntactical, and functional, pragmatic dimension (associating the city with this area, connecting the two sides of the stream). All processes were associated with each other and the process continued. (Figure 3).

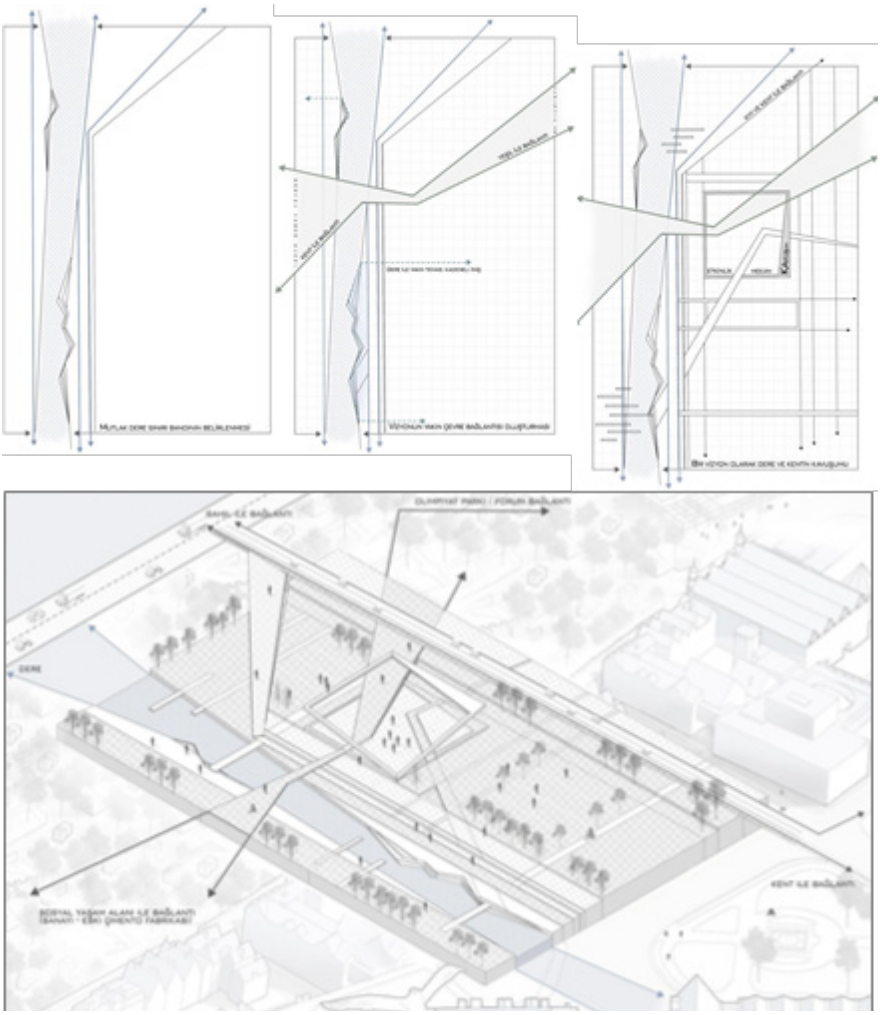
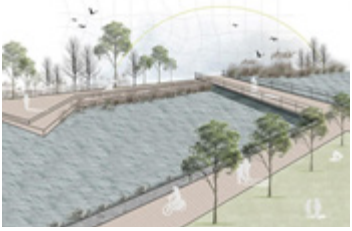
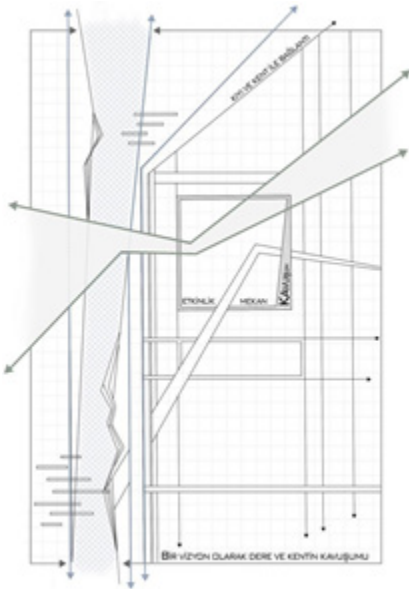
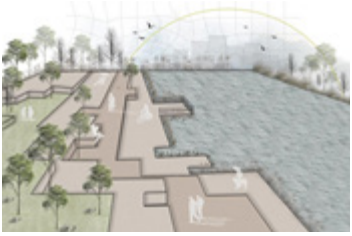


Figure 3. General Decisions

Table 4. Scenario Generation

Scenarios were created in line with the general decisions taken. Ideas have been developed about which area will be used for what purpose. These scenarios were used during the design phase.	 Scenario 1- Bain confluence
	 Scenario 2- Sitting- looking
	 Scenario 3- Travel axis

4. Results

Design is a system of processes that can be developed with multidimensional thinking skills. Setting up and managing the beginning of this process well, ultimately plays a key role in achieving successful open spaces. For this reason, it is necessary to shape the design starting from the problem determination phase. Beginning with what the problem is, how it should be approached, what the conceptual approach should be that will reveal the original side of the designer and distinguish it from others, is the main point of turning design from a complex and difficult state into an enjoyable process. With this study, the effect of defining the problem well on the concept and concept creation process is seen. It is known that the most difficult stage for both experts and students is the concept generation stage. Overcoming this difficulty is through getting to the root of the problems and trying to find solutions to those problems. Identifying

the right problems and producing solutions will enable us to develop the right vision, produce scenarios and ultimately produce successful designs.

In this study, primarily the main problem of the study area was determined. It has various problems such as being an inactive creek ecosystem, having transportation problems, being a detached area rather than an organic part of the city. However, with an ecological approach, the stream ecosystem can be integrated into the city and design. However, in order to do this, the absolute protection limits of the stream must be determined. This approach formed an idea on how general decisions should be taken before going to the design stage.

While integrating a detached and inactive stream ecosystem with the city, integrating the conservation approach into this process resulted in the determination of general decisions. And these results played a key role in the development of the concept as well. A balanced meeting. It is a pre-important criterion that the scenarios created as a result of this process overlap with the problem determination process. In the student project evaluated in this study, it was seen that determining the right problems and making general decisions about it support the correct construction of the scenarios. Looking at the result, it can be said that all processes affect each other. For this reason, planning the design process-oriented rather than result-oriented will be the right solution to obtain successful spaces.

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CHAPTER VII

ECOLOGICAL DESIGN APPROACHES IN SINGLE RESIDENTIAL ENVIRONMENTAL DESIGN PROJECTS

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1. Introduction

Design aims to develop solutions for a problem or problem. It is the process itself that is needed to prepare the plans that will be needed for an event. One of the most important purposes of design is to create a harmonious whole by combining different parts. In this way, a strong organization is created (Pile, 1997; Alpak et al., 2017). Designing is achieved by envisioning, shaping or producing to make a plan or sketch. It is also a plan or something envisioned; It is the process of preparing the schemes or plans necessary for an activity (Newel and Simon, 1972). It gives shape to what is envisioned by making plans or sketches. Although it is not related to reality and accuracy, design is actually a set of extraordinary events specific to the person (Booth, 1989). It is not a clearly finished and concluded phenomenon, it reveals how it could be or how it should be.

In landscape architecture, on the other hand, within the professional discipline of design, suitable spaces for people are realized in a certain system and form. The space starts with the design process. It is then analyzed in terms of human activities in making, producing, analyzing and shaping decisions. This process is completed with the research, definition and determination of the problem, the period of obtaining information, the generation of an option, the selection and development of one of the options, the evaluation and the result product (Düzenli and Alpak, 2016). Before designing, it determines the framework and boundaries of the problem to be solved, clarifies and presents its originality (Alexander, 1971). Ecological design takes nature itself as a model within landscape architecture design principles and theories. It requires bringing solutions that are compatible with natural processes and the structural and ecological characteristics of the area. The main goal is to develop a self-sufficient sustainable system that can be a part of the urban ecosystem. With its ecological landscape design, it works with minimum natural resource consumption and minimum waste. It is aimed to establish a sustainable system that is compatible with its environment, thus contributing to urban sustainability practices (Erdoğan Onur, 2012; Emery, 1986; Kurdoğlu et.al., 2018). For this reason, it is important that the ecological approach in landscape design and management contributes to the sustainable city goal of urban designs.

This phenomenon, which emerged with the concern of protecting nature and natural resources, brought the improvement of urban life quality to the agenda. It has an environmentally friendly transportation system that takes into account all aspects of human life, guides people to live and live without excessive consumption (Ünal, 2014). “Ecological design” or eco-design is to design the built (artificial) environment to integrate it with the natural environment. It aims to shape the built environment on a regional scale. It requires determining the content, function and functioning of the designed product and observing the built environment throughout its entire life cycle. The effects on the natural environment through interaction, the problems related to inputs and outputs, transportation, etc. are resolved and a harmonious, seamless and symbiotic integration with the natural environment is achieved (Yeang, 2006). They are cultural ecosystems where living and non-living things form a whole. Therefore, cities should be in harmony with other systems around them such as lake, coastal and forest ecosystems. In addition, they should cause minimal damage to the environment. From its ecological definition, not only natural structures, but also time It encompasses everything animate and inanimate. It includes biophysical

and socio-cultural elements. The biological and physical side of man; it includes the economic, political and intellectual activities of people (Türkman, 2000). It encompasses everything animate and inanimate, and includes biophysical and sociocultural elements. The first of these covers the biological and physical side of man, and the second covers the economic, political and intellectual activities of man.

However, today, the intensive use of land brought with the aim of obtaining the highest benefit harms the natural structure. Most of the time, designs created with a high aesthetic concern tend to impose a different landscape character on the area and change the aesthetic perception of the users from natural to artificial over time. This change in aesthetic values negatively affects the lifestyle and consumption perception of users (Bradley, 1982).

2. Ecological Design In Environmental Design Projects

Ecological design concepts should be developed in order to protect natural resources and to provide a sustainable and livable environment. In order to ensure the continuity of nature, the relations between the various elements of nature should be handled in a holistic manner. It requires the use of local resources as much as possible in its plant and structural design. In this context, climate change action plans prepared at urban scale should be provided. In sustainable energy action plans, it is necessary to create energy efficient buildings, take into account the fight against environmental problems and protect renewable energy sources. In the ecological design model, it is important to realize all these principles that determine a sustainable city center and to prevent environmental problems. When the ecological environmental design examples are examined, there are many different design principles of the projects.

Wheeler (2003) summarized in 9 items what should be done within the scope of the sustainability of cities that are green, safe, human scale, identity, attractive and comfortable for all members of society:

- Compact and efficient land use
- Less motor vehicle use, ease of access
- Efficient use of resources, less pollution and waste
- Restoration of natural systems
- Establishment of quality housing and living environments
- Healthy social ecology
- Sustainable economy

• Ensuring public participation
• Preservation of local culture

In this study, the drawings of KTU Landscape Architecture Department 3rd semester "single residential environment" student projects (ÇTP II) were used. As the study area, the single residence and its surroundings were given to the students as a study area. The projects of 3 students were selected and examined with the ecological design approach in environmental design projects. During the semester, the students were taught the concept of ecological. The concept was evaluated as a concept, and in this context, students were expected to design their users and activities accordingly.

The design process of the students covers 16 weeks. 1-7. Between weeks, pragmatic function is expected to be revealed. 1-4. During the week, each student is expected to determine their residential user profile (needs and wishes, age groups, etc.). In this direction, users are asked to determine their personal-social needs and create a Needs List. In these weeks, the concept of ecological design is examined and the concepts are prepared accordingly. Based on this list of needs, they are expected to create their Activity List. They are asked to write a Scenario in which the activities relate to each other, transform it into a Relationship Diagram, and make a Stain Diagram on the area, where the activity will be held, its location, proximity-distance and access to each other, depending on the slope. Then, sketches are made with the determined concepts and the sketches are shaped and transformed into designs. As a result of these stages, interrelated spaces that respond to user needs and activities are constructed. This stage is not a short process, it is expressed as a model by working on it for weeks.

2.1. Findings from Study 1

In study number 1, the student identified the concept of ecofriendly as a concept. It has also designed its scenario accordingly and determined the needs of the residential users. In this context, he proposed the scenario of fruit-vegetable gardens for natural nutrition to its users as being ecologically friendly. Gathering areas and seminar venues have been designed to organize seminars to conduct research on biodiversity. In the single house garden design created for this purpose, the needs are to feed, to recycle, to organize ecological seminars and to grow ecological plants. The spatial organization is formed from the combination of user requirements and preferences and aesthetic decisions.

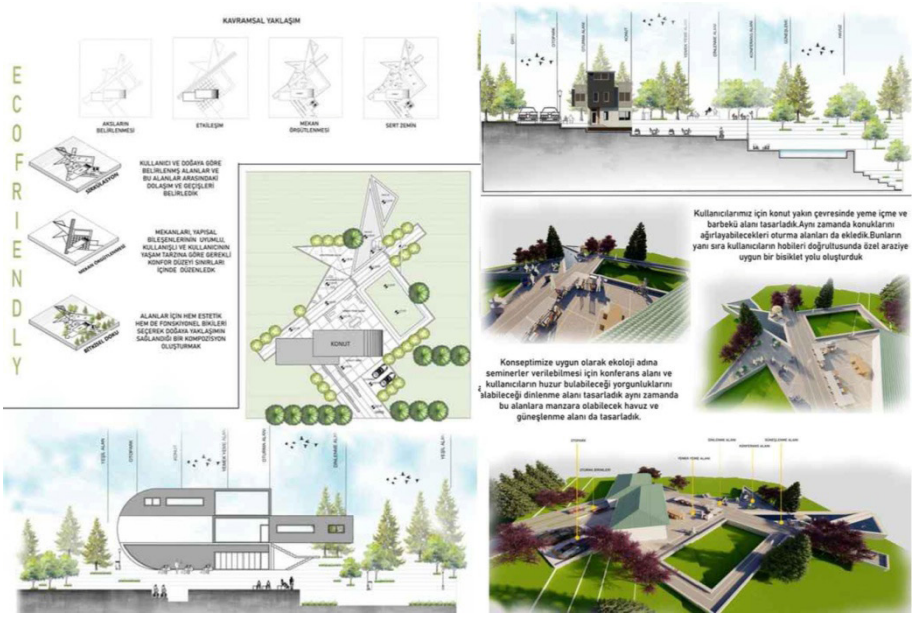

Figure 1. The study of the first student

2.2. Findings from study 2

In study number 2, the student identified the concept of recycle as a concept. In its scenario, it provided a recyclable life opportunity for its users. In order to produce natural, sustainable and healthy foods for their nutrition, it has designed cultivation areas in the immediate vicinity of the residence. They determined different plant areas and habitats of different animal species. It has provided energy generation to be used in outdoor uses with solar energy systems around the residence. In addition, waste storage units in used waste recycling units have organized rain storage areas to manage rainwater. It is aimed to save water by collecting rainwater from the roofs with pipes and collecting it in the underground water tank.

Storing and using rain water in ecological structures is an effective method. Building materials and products have been selected according to sustainable principles. A small wind rose was used to obtain energy from the wind, which is one of the renewable energy sources. While providing the user health and comfort at the highest level in the design, attention was paid to minimize the use of resources and energy consumption. It has been used in its natural state by using natural materials such as wood and stone, with little processing. Thus, less energy is consumed and less water consumption is achieved.

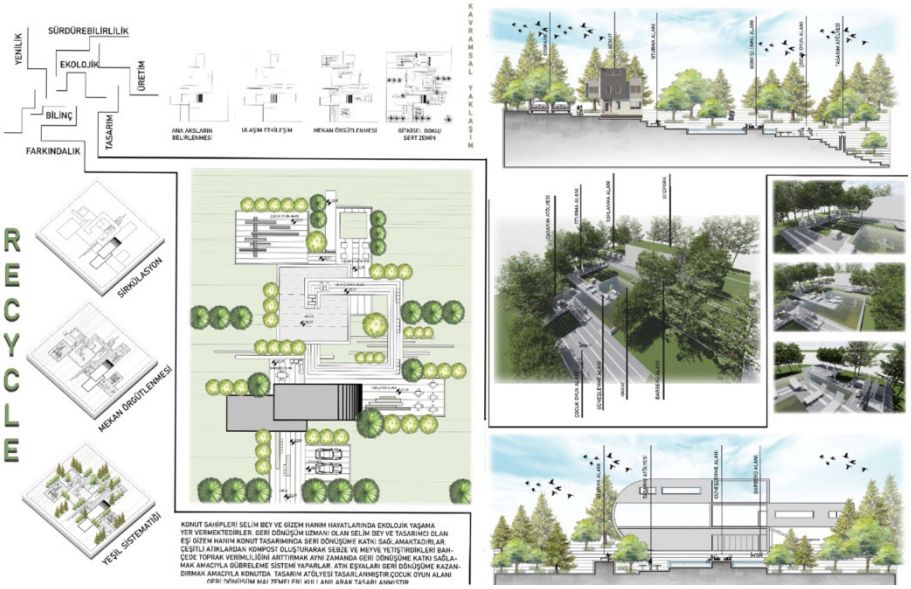

Figure 2. The Study of the Second Student

2.3.Findings from study 3

In the study number 3, the student determined the concept of life transformation as a concept. In its design, the student aimed to provide an ecological life opportunity intertwined with nature. For this purpose, it has adopted the principles of biophilic design elements. He designed tropical butterfly gardens and plant growing-exhibition areas for user biologist and ecologist couples. A design concept has been created by aiming to increase the soft and permeable floors by reducing the hard floors as much as possible. In order to benefit from the topography of the land in the most effective way, excavation-filling work was carried out to the minimum level possible, avoiding intensive interventions.

In order to carry out energy efficiency more effectively, planted surfaces have been created on the existing house. In order to reduce energy consumption and contribute to the insulation of the house, appropriate planting was done at strategic points around the house. Plants that are suitable for local conditions and that do not require much maintenance were chosen instead of exotic plant species with high maintenance needs and high costs. At the same time, aesthetic concerns were also taken into account in plant designs. In order to get the most benefit from solar energy, the activity areas are designed according to the angle

of the sun. In this way, the utilization of high savings potential and, accordingly, the efficiency in the buildings where energy efficient building technologies are used.

Based on the functioning of the natural ecosystem, the application areas called sustainable agriculture or permaculture, vegetable and fruit growing areas in harmony with nature, are intended to be used as natural fertilizer by producing compost from organic wastes. These applications provide interaction between nature and people in urban areas, especially in residential areas.

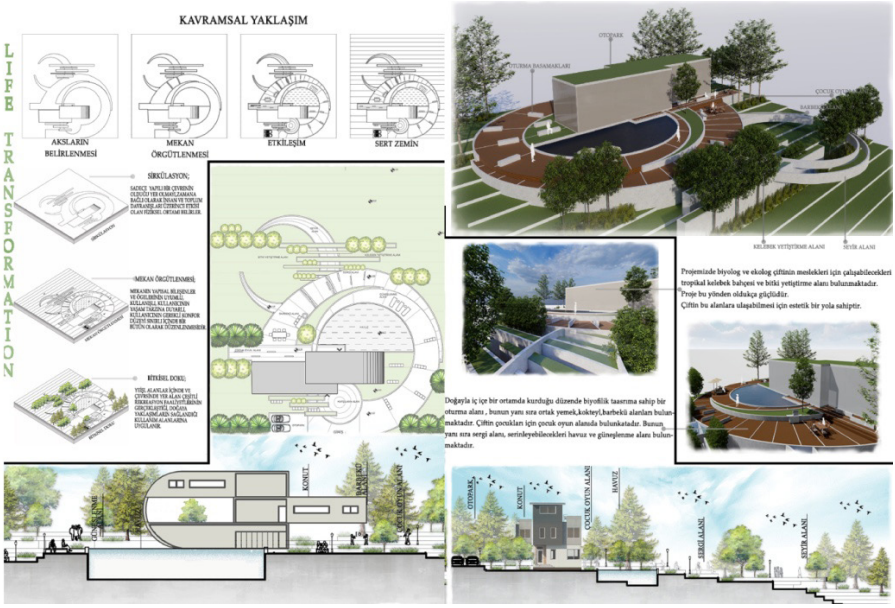

Figure 3. The study of the third student

3. Conclusions and Recommendations

Today, the ecological balance has deteriorated as a result of the gradual decrease of natural areas. Sustainable urban development needs to be realized and planning processes should be placed on an ecological basis. It requires a design approach that strengthens the ecology-economy-energy relationship for a life in harmony with nature. Ecological housing design aims to create economical, long-lasting structures that are sensitive to human health during the design, construction and use of houses, and their environmental effects are minimized. Artificial living conditions in cities bring very important environmental problems. Ecological design should be aimed at creating sustainable urban design systems

that are self-sufficient and can be a part of the urban ecosystem. In addition, it is based on principles such as effective use of building land and resources, efficient use of energy, efficient use of water, efficient use of materials, indoor comfort and human health, and waste management. Systems that produce their own energy by using renewable energy sources, consist of recyclable materials and protect the environment are important.

In this context, sustainable and ecological design;

- Ecological planning approaches developed by McHarg (1969), which aims to include nature and natural processes in planning and design studies, and which are still valid today, should be evaluated; Preservation of the existing landscape character, Design in accordance with ecological conditions and climatic data, Use of local resources in design, water-efficient landscaping, Xeriscape, energy-efficient landscaping, permaculture, Use of renewable energy resources, Green roof and green wall applications. Considering the dynamic process of nature, the results it will reveal over time should be evaluated.
- Inventories of natural and cultural resources should be taken and changes should be followed by repeating them at certain times.
- The ecology-economy balance should be established very well, and the use of environmentally friendly energies should be supported in activities where the amount of waste is high, such as transportation and production. When choosing materials in sustainable building design, reusable or recyclable materials should be preferred. It should be ensured that waste generation is prevented and natural resources are saved.
- The balance of open green spaces should be increased in urban designs, bio-diversity should be protected and the continuity of natural ecosystems should be ensured. Existing vegetation, stream, flora, fauna, etc. natural resources should be evaluated and developed. It is necessary to develop and use the existing vegetation in planning, and to use plant species specific to the region. By ensuring the rational use of the natural environment, solar energy utilization, natural air conditioning and green cover should be provided by damaging the natural environment as little as possible wind directions, heat, radiation should be evaluated in planning and urban design.
- It should be aimed to protect the plant and animal potential and even to increase it in terms of quantity and variety by protecting the environmental ecosystem values. For this purpose, biodiversity conservation should be aimed in design approaches.

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CHAPTER VIII

TEXT-TO-IMAGE GENERATION A.I. IN ARCHITECTURE

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1. Introduction

Artificial intelligence (AI) could play a greater role in the design and construction of buildings as they continue to develop. AI-powered systems could be used to manage and control various building operations, including heating and cooling, lighting, and security. These systems could utilize historical data to optimize building performance and reduce energy usage. Machine learning-based algorithms are capable of analyzing data, recognizing patterns within the data, and making predictions.

On the other hand, thanks to the development of AI algorithms, it is now possible to create images from given text. Text-to-image generation is the process of creating a visual image based on a given text description. The resulting images are often highly realistic, making it possible to create a wide range of visual content using this technique. As AI technologies continue to advance it is likely that text-to-image generation technique will become an increasingly important tool in the field of architecture. As the transition of algorithms from 2D to 3D generation, it could also be used to create interactive, immersive experiences for users to explore different design options. AI is revolutionizing the way we visualize ideas through text-to-image generation. Tools such as DALL-E 2 and Midjourney have opened the door to a plethora of visual creations through AI. These tools are going to be field-tested by architects and designers for use in conceptual design.

AI enables designers to explore a wider number of design ideas from a new perspective. These systems maximize the likelihood of serendipity, hence

expanding the spectrum of creative capacities beyond traditional methods. They facilitate the manipulation of data and the generation of inventive variations of answers to creative issues.

In this study, the history of artificial intelligence was explained first, followed by an examination of the relationship between artificial intelligence and architecture. After a brief explanation of the required algorithms for text-to-image generation, the artificial intelligence platforms Dall-E 2, Midjourney, DiffusionBee, and MotionLeap are introduced. Finally, the architectural, interior, and urban design applications of this technique were evaluated.

2. Artificial Intelligence Legacy

In the early 20th century, science fiction popularized the concept of artificially intelligent robots. It began with the "heartless" Tin Man from The Wizard of Oz and continued with the Maria, impersonating humanoid robot from Metropolis. A generation of scientists, mathematicians, and philosophers had infused AI into their cultural consciousness by the 1950s. Alan Turing, a young British polymath who researched the mathematical potential of AI, was one such figure. "Why can't robots use existing information and reason to solve issues and make decisions?" as recommended by Alan Turing. This was the logical structure of his 1950 paper, Computing Machinery and Intelligence, in which he demonstrated how to design and evaluate intelligent machines (Turing, 1950).

Allen Newell and Herbert A. Simon created "Logic Theorist," the first AI software, in 1955. In addition to proving 38 of 52 mathematical theorems, this program discovered new, more elegant proofs for several axioms. In 1956, American computer scientist John McCarthy coined the phrase "Artificial Intelligence" at the Dartmouth Conference. AI was officially recognized as an academic discipline for the first time (Newell & Simon, 1956). The researchers subsequently emphasized the creation of mathematical problem-solving algorithms. Joseph Weizenbaum invented the first chatbot in 1966 and dubbed it ELIZA (Weizenbaum, 1966). In 1972, the first intelligent humanoid robot, WABOT-1, was built in Japan (Shirai & Fujisawa, 1974).

1974 through 1980 marked the beginning of the AI winter period. AI winter refers to a time when government funding for AI development was severely lacking.

Following the AI winter, the company returned with Expert System. It was designed so that expert systems mimic the decision-making skills of human

experts. The first national conference of the American Association for AI was held at Stanford University in 1980 (Wielinga, 1980).

The years 1987 through 1993 constitute the second AI Winter. Due to its exorbitant cost and unsatisfactory outcomes, investors and the government quit funding AI research.

In 1997, BM Deep Blue became the first computer to defeat the world chess champion, Gary Kasparov. In 2002, with the release of the Roomba vacuum cleaner, AI made its debut in household goods. In 2011, IBM's Watson won the game show Jeopardy, which required it to answer challenging questions and solve complex riddles. Watson had proved its ability to grasp natural language and solve complex issues rapidly. The chatbot "Eugene Goostman" won the renowned "Turing test" in 2014. And last, in 2017, Google DeepMind overcame Lee Sedol in the game of Go, which has a 5000-year history and more game possibilities than there are atoms in the universe ("How Google's AlphaGo Beat Lee Sedol, a Go World Champion - The Atlantic," 2016).

AI has now achieved an extremely advanced degree of development. The study of deep learning, big data, and data science is currently flourishing. Amazon, Google, Facebook, and IBM are currently harnessing AI to create cutting-edge technology. Among these include visual perception, speech recognition, decision making, and translation. Such systems are gradually making the transition from research laboratories to industrial use.

3. AI and Architecture

AI is utilized in a variety of fields, including architecture. AI can be used in architecture for tasks such as building design and simulation, building performance optimization, and the generation of building layouts. For instance, AI algorithms can be utilized to generate designs optimized for energy efficiency or sustainability. Additionally, AI can be used to simulate the behavior of a building, allowing architects to test and refine their designs prior to construction.

Through the development of generative design tools, AI is being utilized in architecture in a specific way. These are computer programs that use AI algorithms to generate design alternatives based on a user-supplied set of constraints and objectives. For instance, a generative design tool could be given a set of requirements for a building, such as the number of rooms and the overall size, and then generate multiple design options that satisfy those criteria.

A further application of AI in architecture is the use of virtual assistants. These AI-powered software programs can assist architects with scheduling, project management, and communication, among other tasks. A virtual assistant could, for instance, assist an architect in keeping track of deadlines and managing their workload, thereby freeing up time for more creative tasks.

The use of machine learning algorithms to improve building performance is a possible future application of AI in architecture. For instance, an AI system could be trained on historical building data to learn about the factors that influence the energy efficiency or sustainability of a building. This data could then be utilized to optimize the design of new buildings, making them more sustainable and energy-efficient.

As mentioned earlier, AI in the field of architecture is still in its infancy, and there is great potential for future developments and advancements. Other potential future applications of AI in architecture include the following:

Construction tasks, such as laying bricks or painting walls, could be completed by robots and drones powered by AI. This could increase the efficiency of the construction process and reduce the need for human labor.

Sensors and monitoring systems powered by AI could be installed in buildings to collect data on the performance of various systems and components. Then, this information could be used to predict when maintenance or repairs will be necessary, allowing building owners to schedule these tasks in advance and avoid unplanned downtime.

Overall, the application of AI in architecture is a broad subject with a great deal of potential for future advancements. It is likely that AI technologies will play a greater role in the design and construction of buildings as they continue to develop.

4. Fundamental Algorithms for Text-to-Image Generation

Following is an explanation of the most important Text-to-Image Generation terminology and ways for understanding it. Machine learning, or ML for short, is an area of AI that offers computers the ability to learn without being explicitly programmed. AI is fundamentally based on learning. During this learning process, the algorithm is given options to choose from and goals are established (Abdi, Valentin, & Edelman, 1999). Without being explicitly programmed to do so, it has the ability to autonomously learn from past mistakes and better itself. Algorithms that employ ML are capable of analyzing data, recognizing patterns within the data, and making predictions.

These algorithms are designed to improve themselves continuously through learning and the application of that learning to fresh datasets (Bernstein, 2022).

Deep Learning is a subfield of machine learning also known as DL. Using artificial neural networks, robots are equipped with the ability to learn through the processing of data. DL enables computers to solve complex problems regardless of the diversity or organization of the datasets they employ. In this instance, learning occurs whenever a continuous feedback loop is utilized to adjust the algorithm's actions. The system rewards all appropriate behavior and punishes all inappropriate behavior. Its method is designed to modify actions so that rewards are maximized (He & Deng, 2017).

Natural Language Processing (NLP), a subfield of AI, is responsible for giving computers the ability to read, comprehend, and imitate human language. Most voice assistants incorporate NLP. Computers utilize machine language to communicate. In a similar manner, computers struggle to comprehend human languages. NLP employs advanced algorithms to convert unstructured verbal data into a format that computers can comprehend (Nadkarni, Ohno-Machado, & Chapman, 2011).

Computer vision, commonly known as CV, is an area of computer science that aims to simulate the human visual system so that computers can "see" and comprehend the content of still images and films. CV enables machines to recognize the content of images, paving the door for object recognition and labeling. As an example, CV is a vital component that permits driverless cars. CV-equipped vehicles can see other vehicles, signs, and lane markers, allowing them to continue forward safely and preventing them from colliding with obstacles. The automatic tagging function available on some social media platforms is an additional application of computer vision (Brownlee, 2019).

5. Text to Image Generation Methods

Text-to-Image Generation refers to computer approaches that can convert human-written textual descriptions, such as keywords or phrases, into visually portrayed concepts with the same semantic meaning as the text. Researchers in the field of image synthesis initially used supervised approaches and text-to-image correlation analysis to identify the greatest possible match between text and visuals.

Images utilized for applications such as image classification often contain a single item that must be labeled. Comprehending complex scenarios with computers could make this problem considerably more difficult. One of these duties is to provide captions for photos. This situation has two causes

of difficulty. In addition to object identification, the system must first model language and commonsense knowledge in order to generate a caption that is semantically intelligible and syntactically fluent. This enables the system to distinguish significant semantic elements within an image, comprehend their relationships, and generate a coherent description of the image's overall content. Moreover, due to the intricacy of the scenes in the photograph, it is impossible to capture all the subtle distinctions between them using the simple category attribute (He & Deng, 2017).

In 2014, computer scientist Ian Goodfellow invented generative adversarial networks (GANs), which was the true turning point.(Goodfellow et al., 2014). Two competing neural networks are responsible for the process. The first, known as the generator, generates new images, while the second, known as the discriminator, compares them to a training set of samples. This is comparable to presenting a forgery to an art critic as the genuine artwork. If the output photographs are of poorer quality than the input images, the discriminator will continue to reject them. After training is complete, the discriminator can be deactivated while the generator continues to provide high-quality output. Refik Anadol's efforts, which incorporate different types of GANs, are fascinating illustrations of this technique in action (Anadol, 2022).

Image Recognition, often known as Machine Vision, is one of the more recent successes in the field of machine learning. However, visual "hallucination" is a comparatively recent occurrence ("WDCH Dreams - Refik Anadol," 2019). In 2015, a Google developer named Alexander Mordvintsev made the groundbreaking discovery that a neural network could be taught to operate in reverse. It is now able to generate false visuals and recognize real ones. This enabled him to create the computer vision program DeepDream, whose hallucinogenic effects provoked an outcry in the artistic community.

Diffusion modeling is the most recent and efficient technique for producing images. For the diffusion model, a deep understanding of mathematics is required. Simply, you begin with an image and continue to add noise to it without ever reviewing your work. Each new step is considered the beginning. Each of these processes can be performed independently of the others and without reference to any previous images. There is nothing original about the resultant image; only random noise remains. Dhariwal and Nichol suggest that the diffusion model is the superior picture synthesis technique.(Dhariwal & Nichol, 2021). AI may now "dream" in the visual realm because to breakthroughs in hardware for processing enormous datasets and machine learning techniques.

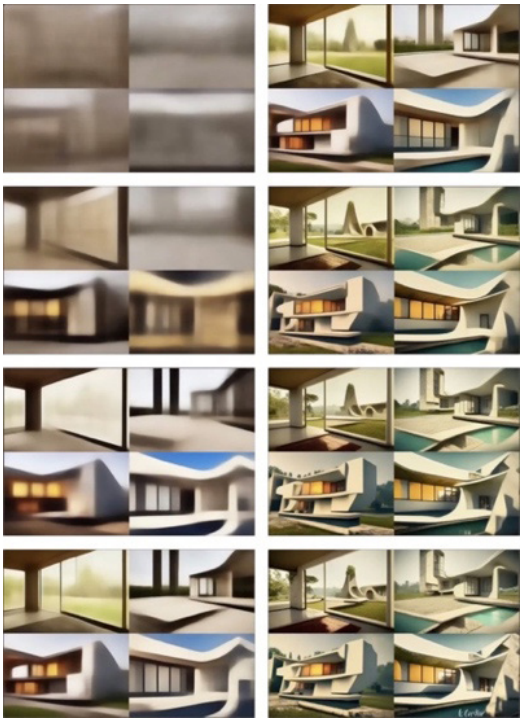

Figure 1. *Sequences of The Image Created by Diffusion Modeling*

5.1. Dall-E 2

OpenAI created DALL-E 2, a large-scale AI language model. Using a combination of natural language processing and computer vision techniques, it is able to generate images from textual descriptions. DALL-E 2's ability to generate a wide variety of images, from photorealistic depictions of objects and scenes to more abstract, stylized images, is one of its defining characteristics. This makes it an effective tool for creative endeavors like design, illustration, and art.

The simple and intuitive user interface of DALL-E 2 makes it easy for users to generate images based on their own text descriptions. To use DALL-E 2, a user simply inputs a textual description of the desired image, and the AI model will generate the corresponding image. The user is then able to evaluate the generated image and provide feedback to the model, allowing it to gradually learn and improve.

Dall-E 2 is a text-to-image AI with the impressive ability to generate highly realistic images from text descriptions. The user interface of Dall-E 2

is designed to be both intuitive and powerful, allowing users to effortlessly generate high-quality images from their text descriptions. The user interface of Dall-E 2 is distinguished by its simplicity. With clear instructions and a straightforward layout, the interface guides users through the process of creating their own images. This simplicity enables those with little to no experience with A.I. technology to create stunning images quickly and easily.

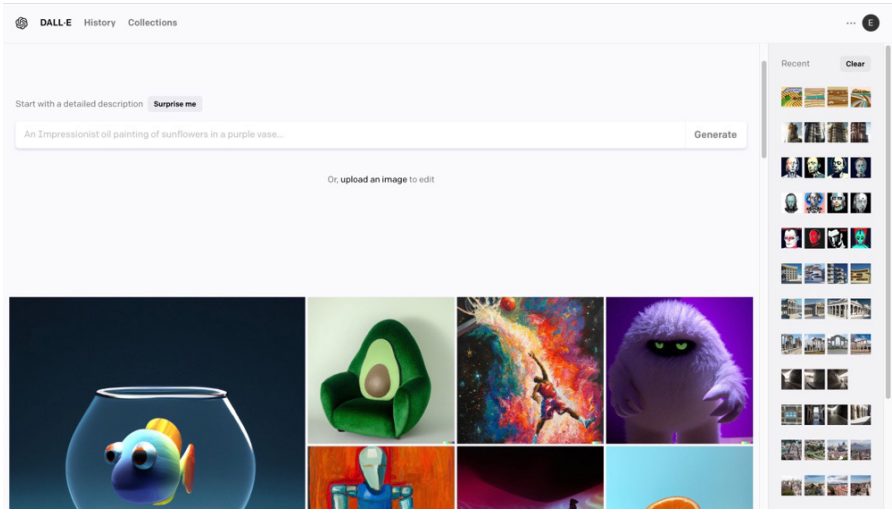

Figure 2. *User Interface of Dall-E 2*

Another important aspect of the user interface of Dall-E 2 is its adaptability. The interface enables users to modify their images in a variety of ways, including adjusting the color scheme and altering the image's perspective. This versatility enables users to create images that are unique and tailored to their specific needs and vision.

But perhaps the most impressive aspect of the user interface of Dall-E 2 is its ability to accept a variety of inputs. The AI technology underlying Dall-E 2 is capable of processing text descriptions of varying length and complexity, allowing users to generate images from even the most detailed and complex text descriptions. In conclusion, the user interface of Dall-E 2 is an integral component of the technology's power and value.

5.2. Midjourney

MidJourney is a text-to-image AI program that enables users to enter text and generate a corresponding image. This technology has a variety of potential applications, ranging from assisting artists and designers in quickly sketching

out ideas to assisting those with visual impairments in comprehending written content.

The field of art and design is a possible application for MidJourney. By enabling users to generate images based on their written descriptions, MidJourney can aid artists and designers in rapidly sketching out ideas and concepts. This can be especially useful for those without a strong background in traditional art techniques but who wish to explore their creative ideas.

MidJourney's complex interface and prompting procedure are its key characteristics. A user need only enter the desired text into the program and click the "generate" button in order to generate an image. Then, MidJourney uses advanced machine learning algorithms to analyze the input text and generate a corresponding image. Midjourney is accessed via the online communication software Discord. A user will be allowed to produce a limited number of images with Midjourney tool before he/she is required to subscribe. User has around 25 free executions of the /imagine command and other queries (variations, upscales). These are also referred to as "jobs" or "GPU-minutes". In the top row are four buttons for upscaling the selected image: U1, U2, U3, and U4. Upscaling an image creates a larger version of the image with approximately 1024x1024 pixels. This will generate additional details by default. In the bottom row, the V1, V2, V3, and V4 buttons allow you to create Variations of the selected image. Creating variants will generate four new photos that are similar to the selected image in manner and layout. You can click on the image to expand it, then right-click and select Save image to save it to your local computer.

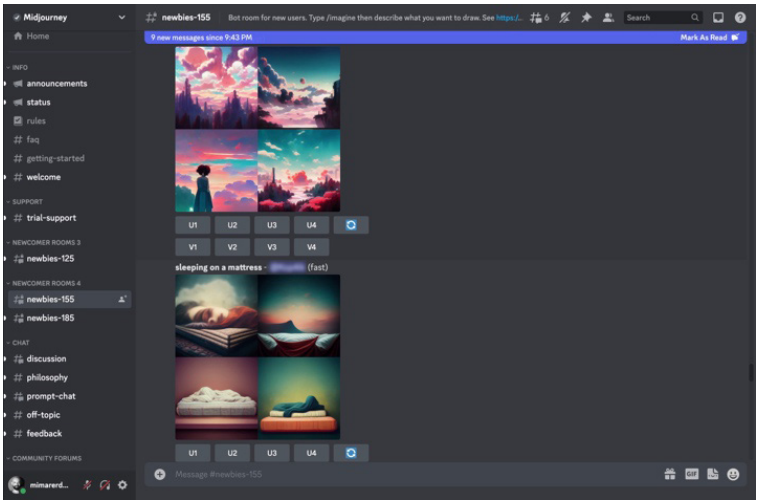

Figure 3. *User Interface of Midjourney*

5.3. DiffusionBee

DiffusionBee is a state-of-the-art text-to-image AI program that enables users to create photorealistic images from text descriptions. The program generates high-resolution images that can be used for a variety of purposes, including advertising, social media posts, and artistic expression.

DiffusionBee is distinguished by its user-friendly interface. The program is designed to be user-friendly and intuitive, even for those unfamiliar with text-to-image AI technology. To generate an image, users need only provide a brief description of the desired scene. Using this description, the program will generate a photorealistic image in mere seconds.

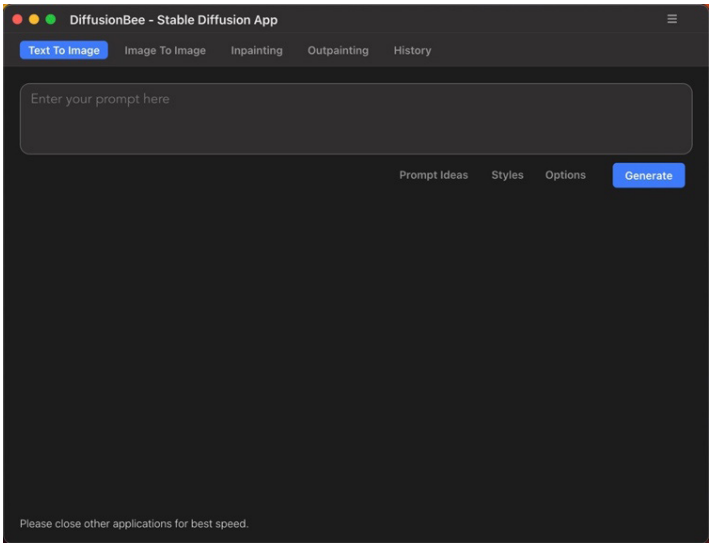

Figure 4. *User Interface of DiffusionBee*

Advertising is one of DiffusionBee's most important applications. Without the need for expensive photography or graphic design services, the program enables businesses to create visually stunning advertisements with ease. This can save businesses time and money while creating advertisements that are certain to attract the attention of potential customers.

DiffusionBee's applications extend beyond advertising to include social media posts, blog articles, and other forms of digital content. By providing a quick and simple method for creating professional-looking images, the program can help users improve their online presence and create more visually appealing content.

DiffusionBee is an effective and user-friendly text-to-image AI program that provides a variety of benefits for businesses and individuals. With its sophisticated algorithms and user-friendly interface, the program enables the creation of stunning visual content in a few simple steps.

5.4. Motionleap

MotionLeap, a mobile application for image manipulation, has a revolutionary new text-to-image AI that has spread globally. MotionLeap's user-friendly interface enables users to easily generate high-quality images from text descriptions, making it an indispensable tool for bringing ideas to life.

The user interface of MotionLeap is characterized by its simplicity. It is designed to be intuitive and simple to use, allowing users with little to no experience with A.I. technology to create impressive images quickly and easily on the go. This simplicity is achieved by guiding users through the process of creating their own images using clear, concise instructions and a straightforward layout.

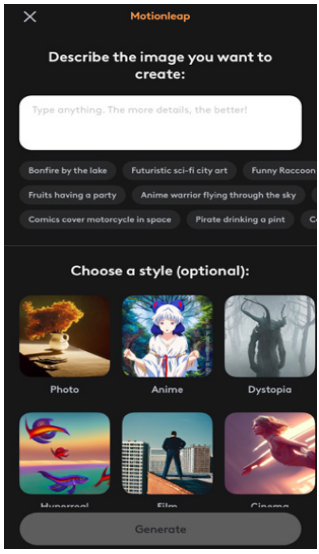

Figure 5. *User Interface of MotionLeap's Text-to-Image AI Module*

Flexibility is a crucial aspect of MotionLeap's user interface. The interface enables users to modify their images in a variety of ways, including adjusting the theme altering the image's style. This versatility enables users to create images that are unique and tailored to their specific needs and vision.

However, the speed of MotionLeap's user interface may be its most impressive feature. The AI technology underlying MotionLeap can process text descriptions and generate corresponding images in a matter of seconds, allowing users to bring their ideas to life quickly and easily.

In conclusion, MotionLeap's user interface is an integral component of the technology's power and value. With its simplicity, adaptability, and speed, MotionLeap's user interface enables users to create remarkable images from text descriptions with ease, making it an indispensable tool for anyone seeking to bring their ideas to life with portability.

5.5. Comparison of Text to Image Tools

In the field of text-to-image generation, Dall-E, Midjourney, DiffusionBee, and MotionLeap are cutting-edge AI technologies with impressive capabilities. While all four AIs are highly developed, there are significant differences between them that set them apart.

One of the most significant differences between the four AIs is the manner in which they process text descriptions. Dall-E employs a deep learning neural network, Midjourney employs a more conventional machine learning strategy, DiffusionBee employs a novel diffusion-based algorithm, and MotionLeap combines neural network and machine learning techniques. This indicates that each A.I. has its own strengths and weaknesses when generating images from text descriptions.

The user interface is another key distinction between the four AIs. The user interface of Dall-E is designed to be simple and intuitive, allowing those with little to no experience with AI technology to create images quickly and easily. In contrast, the user interface of Midjourney is more complex and may require greater technical expertise to navigate. The user interface of DiffusionBee is highly customizable, allowing users to fine-tune their images according to their particular needs and preferences. And MotionLeap's user interface is adaptable and user-friendly, enabling mobile device users to generate high-quality images from text descriptions with ease.

All the three AIs except DiffusionBee can generate images from text descriptions in a matter of seconds. However, Dall-E has the added benefit of being able to process a broader range of input, such as text descriptions of varying length and complexity. This makes Dall-E a more versatile tool for users who need to generate a wide range of images from various text descriptions.

Overall, Dall-E, Midjourney, DiffusionBee, and MotionLeap are all highly advanced A.I. technologies that can generate extremely realistic images from textual descriptions. All four A.I.s are valuable tools for anyone seeking to bring their ideas to life, despite their key differences.

6. Notable Text-to-Image Generations in Architecture

With only a few words, one can construct visually amazing worlds from the void. Tools such as DALL-E 2 and Midjourney have opened the door to a plethora of visual creations through text-to-image generation, a new and rapidly expanding field of AI.

In a most recent study of the author, a fusion between today's amorphous and complex forms in terms of parametric design, mixed with geometrically pure and clean classical modern architectural works has been created. Using text-to-image generation method, it is possible to combine seemingly incompatible ideas, such as new architectural streams with a deceased diva of architecture. In this manuscript, the 'Parametric Architecture' stream, which started to shape today's modern architecture, and classical modern architecture pioneer Le Corbusier, who was a great visual revolutionary who made a huge impact exactly a hundred years ago, were juxtaposed and their reproductions were created by using the Midjourney platform (Yildirim, 2022).

Figure 6. *Le Corbusier Meets Parametricism; Prompt; "A Le Corbusier Villa in The Parametric Architecture Style, Photorealistic, Unreal Engine, Exterior Shoot, -Quality 2 -Ar 3:2"*

With neural networks trained on billions of photos and their text descriptions, these tools can decode basic sentences or word scatterings in the form of startlingly detailed and attractive visuals within seconds. These tools are being field-tested by architects and designers. Some are beginning to employ them as potent new channels for visualizing early-stage thoughts, testing out approaches to ongoing projects, and even providing non-designer clients with an opportunity to participate more actively in the design process (Berg, 2022a).

Foster + Partners, the largest architecture company in the United Kingdom, has been experimenting with AI and machine learning techniques throughout the conceptual design phase of projects. "In addition to using reference images or studying precedents online, we can now use these tools to quickly illustrate an idea or a feeling that we want a particular space to evoke" says the head of Applied R+D at Foster + Partners, Martha Tsigkari. This aspect of machine learning is becoming a powerful tool for generating ideas (Berg, 2022b).

Figure 7: *AI generated architectural images by Howard Harrison and Andrew Kudless (Berg, 2022b)*

These programs are part of a larger movement to democratize creativity by making more sophisticated tools accessible to a wider audience. While there are concerns about the influence these technologies could have on professionals in the construction industry, many consider them as potent tools that could improve the design process.

The anxieties center on the themes of enhancement and automation. Although they sound similar, automation and augmentation represent distinct

processes: automation seeks to replace humans in executing tasks, whereas augmentation seeks to enhance human capability. If designing is viewed as a collaborative process, then technology can play a crucial role in enhancing it, but only if human and tool skills are enhanced in tandem (Florian, 2022b).

The capacity to integrate unrelated thoughts is one of the most interesting qualities. This capability may have ramifications for the domains of architecture and design, as it enables architects and designers to draw inspiration from apparently unrelated notions. As it reduces the time between purpose and implementation, the AI generative models empower designers to explore a wider number of design ideas from a new perspective. They facilitate the manipulation of data and the generation of inventive variations of answers to creative issues (Florian, 2022a).

Some academics refer to these systems as "Artificial Serendipity" since they maximize the likelihood of serendipity, hence expanding the spectrum of creative capacities beyond traditional methods (Pieters & Winiger, 2016). Architects are currently utilizing these techniques to investigate difficult challenges such as urban planning and the potential of existing locations. Others combine architectural keywords with current architectural cliches, references to pop culture, and diverse art styles in order to design buildings or simply investigate the nature of design trends and technology.

7. Potentials of Text to Image AI Usage in Architecture

The most possible application of text-to-image generation in architecture is during the early design phase. Using a text-to-image generation tool, an architect could quickly generate a visual representation of their design concepts from a written description. This could aid the architect in rapidly iterating on various design concepts and exploring a vast array of options.

Another potential architecture application of text-to-image generation is the visualization of building plans and layouts. Based on a written description or set of floor plans, an architect could quickly generate 2D or 3D visualizations of a building's layout using a text-to-image generation tool. This could assist in making the building's design more accessible to clients and contractors. Generation of realistic images of buildings or other structures for use in marketing materials or presentations, for instance:

- Create immersive, interactive experiences that enable users to explore and evaluate various design options.

- Create detailed 2D drawings automatically.

- Generate images of unbuilt buildings or structures, allowing architects and clients to visualize the completed product.

Another potential application of text to image generation in architectural design is the creation of 3D models. Currently, the Text-to- 2D Image Generation model can only serve as an inspiration for concept design. According to recent research, however, Text-to-3D model will be possible in the near future (Koh, 2020); (Liu, Wang, Qi, & Fu, 2022). Creating 3D models of buildings is currently a laborious and time-consuming process that requires specialized software and a high level of technical expertise. Using text to image generation, architects could simply describe their desired structure in natural language, and the system would generate a 3D model automatically. This would not only save time and effort, but also make it easy for architects to experiment with various design concepts.

Throughout particular with respect to 3D form generator AIs, the creation of animations and virtual tours is a potential application of text to 3D generation in architectural design. Creating animations and virtual tours of buildings is currently a difficult and costly endeavor that requires the use of specialized software and high-end hardware. Using text to image generation, architects could describe the desired animation or virtual tour using natural language, and the system would generate the animation or virtual tour automatically. This would not only save time and money, but it would also allow architects to experiment with different camera angles and movements quickly and easily.

There are several challenges to the widespread adoption of text to image generation in architectural design. First, the technology is still in the early stages of development, and there is a lot of work to be done before it is ready for widespread use. Second, the quality of the generated images is not yet comparable to that of professional software, and there is a possibility that they will not be accurate or realistic enough to be used in the design process. Third, the use of natural language is not always precise, and there is a risk that the system will misinterpret the architect's description and generate an incorrect image.

Despite these obstacles, the potential advantages of text-to-image generation in architectural design are substantial. Text to image generation

has the potential to revolutionize the design process by enabling architects to generate 3D models, photorealistic images, animations, and virtual tours rapidly and easily. Text-to-image generation is likely to become an essential tool for architects in the near future, allowing them to rapidly experiment with different design concepts and create visual representations of their designs.

7.1. Potentials for Interior Design

Text-to-image conversion has the capacity to revolutionize interior architecture as well. With the ability to generate realistic images from text descriptions, interior architects can create visualizations of their designs quickly and easily, allowing for more effective client communication and stakeholder collaboration.

Rapid production of high-quality visuals is one of the primary advantages of text-to-image generation in interior architecture. Instead of spending hours or even days creating detailed 3D models or intricate computer-generated images, interior architects can simply describe their design in texts and have the computer generate a realistic image. This not only saves time and effort, but also allows for greater flexibility and experimentation, as designers can generate multiple iterations of their designs rapidly in order to explore various options.

Text-to-image generation has the potential to improve the accuracy and precision of interior design visualizations in addition to accelerating the design process. Interior architects can ensure that the generated image accurately represents their vision by providing a written description of the design rather than relying on a sketch or a rough 3D model. This can aid in preventing miscommunications and misunderstandings, as well as in identifying potential issues or problems with the design before they become major obstacles.

Another potential advantage of text-to-image generation in interior architecture is the ability to customize and personalize designs with ease. With the ability to generate images from textual descriptions, interior architects are able to create client-specific visualizations quickly and easily. For instance, a designer could easily generate multiple versions of a design with different color schemes or furniture placements to demonstrate to a client how their space could appear under various circumstances. This level of customization can contribute to enhancing the client's experience and fostering trust and confidence in the design process.

Figure 8. *Prompt; "Le Corbusier's Interior Designs Mixed with Parametric Design Style"*

In addition, text-to-image conversion has the potential to democratize interior architecture. Text-to-image generation can make the design process more accessible to a wider range of people, including those who may lack the technical skills or expertise to create detailed 3D models or complex computer-generated images, by providing a more accessible and intuitive method for creating visualizations of designs. This can help to promote a more diverse and inclusive community of interior architects, as well as innovation and creativity in the field.

Despite the numerous potential benefits of text-to-image generation in interior architecture, there are also a number of obstacles and restrictions that must be considered. Text-to-image generation algorithms require high-quality training data in order to produce accurate and realistic images. This is one of the greatest obstacles. Generating a large and diverse dataset of interior design images annotated with corresponding text descriptions is a difficult and time-consuming task, and it is unclear how well current algorithms can handle the specific challenges of interior architecture.

7.2. Potentials for Urban Design

Text to image generation has the potential to revolutionize urban design by providing a more efficient and intuitive way for designers to create and visualize their ideas. This technology uses natural language processing to convert written descriptions of an urban environment into a visual representation, enabling designers to communicate their designs to clients and stakeholders more efficiently.

One of the primary advantages of text to image generation in urban design is the ability to create and modify designs quickly and easily. Historically, designers were required to manually create each design element, such as buildings, roads, and trees, using specialized software. In order to create realistic and accurate representations of the design, this process is time-consuming and requires a high level of skill and knowledge.

With text to image generation, however, designers can simply write a natural language description of their design, and the software will generate a visual representation automatically. This enables designers to create and modify their designs quickly and without requiring extensive knowledge of specialized software. This can save designers time and resources, allowing them to focus on the creative aspects of their work as opposed to the technical details.

Moreover, text-to-image conversion can improve team collaboration and communication in urban design. Historically, designers had to rely on verbal or written descriptions to convey their concepts to clients and stakeholders. This can make the design difficult to comprehend and lead to misunderstandings or incorrect interpretations.

With text to image generation, designers can easily create visual representations of their ideas that can be easily comprehended by clients and other stakeholders. This can enhance team collaboration and communication, as well as ensure that all team members are on the same page regarding the design.

Another potential advantage of text-to-image generation in urban design is the ability to generate a variety of design options rapidly and easily. Traditional design methods can make the generation of multiple design options time- and resource-intensive. Using text-to-image generation, however, designers can easily generate a variety of design options by writing different descriptions of their designs. This can aid designers in exploring a broader range of design options, leading to more creative and innovative designs.

Figure 9. *Prompt; "Future City, Smart City, Sustainability, Eco-Design, Biomimicry, Topology Optimization"*

Moreover, text-to-image conversion can enhance the precision and realism of urban design representations. Traditional design methods frequently rely on manual input, which is susceptible to human error and can result in design inaccuracies. Text-to-image generation, on the other hand, allows the software to automatically generate a visual representation of the design based on the written description, which can help ensure that the design is accurate and realistic.

Text-to-image generation in urban design is similarly constrained by the need for high-quality training data, as in the interior design section. To generate accurate visual representations of a design, the software must be trained on a large and diverse dataset of urban design elements. This can be a difficult and resource-intensive process that requires considerable time and skill to create.

In addition, complex or abstract design concepts may not be accurately represented by text-to-image conversion. While the technology can produce realistic visual representations of concrete design elements such as buildings and roads, it may struggle with more abstract or conceptual concepts. This may restrict designers' ability to fully explore and express their creative ideas using this technology.

Despite these limitations, text-to-image generation has the potential to significantly enhance urban design by providing designers with a more efficient and intuitive means of conceptualizing and visualizing their ideas. Text-to-image generation has the potential to revolutionize the way urban design is approached and executed due to its ability to generate a large number of design options quickly and easily, improve collaboration and communication within design teams, and increase the accuracy and realism of design representations.

8. Epilogue

The outcome is undeniably fascinating, but these examples only serve to highlight the AI's role as a producer of concept art that lays out the building blocks, as opposed to producing fully immersive illustrations to tell stories. It is also the earliest example of a compositional uniformity, with prominent characters in the center and details based on other keywords surrounding them.

Suddenly, architecture projects emerge from large datasets crunched by graphics processing units (GPUs) running sophisticated deep-learning algorithms capable of surpassing humans' ability to process data in unprecedented quantities (Campo & Leach, 2022). Questions regarding the nature of architecture and AI are gaining a tremendous amount of momentum as public interest in the methodology continues to rise.

The potential applications of text-to-image generation in architecture remain largely unexplored, but this technique has the potential to significantly enhance the efficiency and efficacy of the design process. As AI technologies continue to advance, it is likely that text-to-image generation will become an increasingly valuable tool in the architectural field.

Overall, text-to-image is a powerful and versatile AI tool that has the potential to greatly improve the efficiency and effectiveness of the design process in architecture. Their user-friendly interface and ability to generate a wide range of images make it an exciting and valuable tool for architects and other creative professionals.

Due to the development of GAN algorithms, the subject scales of AI research are expanding (Wang, Chai, He, Chen, & Liao, 2022). With the exponential growth of hardware and software technologies, Artificial Intelligence Aided Design (AIAD) enabled the construction of the most complex buildings and, eventually, cities that our civilization has ever created.

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CHAPTER IX

NEUROLOGICAL APPROACH TO SPATIAL QUALITY

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1. Introduction

The interaction between human and the built environment has long had the potential to generate important knowledge for researchers. The dynamic relation between the person and the built environment, which is revealed by the perception and the experiences of the individual, affects the psychological health and quality of life. Therefore, information obtained from people's responses to the space should be used in design decisions to create a better harmony between the person and the built environment. The scientific definition of psychological health includes various aspects such as the person's physical characteristics and social conditions. However, 90% of human life is spent in the built environment, architecture is considered one of the most important components of health and its effect is reflected in the long term (Schoenberg and Ruf, 2018).

The most important factor for designers is the perception of the users and the quality of the design. Human perception is realized through various senses. The quantity of all design factors perceived by users in a space determines the quality of the space. The quality of the place means meeting the needs of the people and therefore high user satisfaction. The quality of people's life is affected by social, sociological, economic and psychological conditions.

Human is not a passive creature, but an active system that perceives processes and gives meaning to stimuli. It is known that the brain's capacity to consciously process information from the environment is less than one percent of its unconscious processing capacity. An individual's behavior cannot be explained without determining the society, perception, beliefs and attitudes (Cüceloğlu, 2004). People take the information about their environment and the places they live in through their sense organs and translate this information into their own conceptual world, and they make a judgment about the environment. However, most of these stimuli affect individuals at a subconscious level. Environmental stimuli from spatial elements are also transformed into the physiological data. But even if people are affected by the stimulus, they will not be aware of it at times. The type and quantitative characteristics of stimuli directly affect the perception of space and the physiological values of the organism.

Although different parameters have been determined to measure the quality of space in the studies in the field of architecture, the common point of the studies is to measure the spatial quality by evaluating the effects of the spaces on the users (İnceoğlu and Aytuğ, 2009). The studies that have come up to date on the effect of spaces on users have mostly been based on interpretation using classical methods. However, the measurement of the effect of the space on people can also be done with the help of brain mapping technology, which can show the mental state of the person in an architectural space with symptoms such as interest level, participation, attention, recognition, concentration (Gegenfurtner et al., 2017; Schoenberg and Ruf, 2018). The way to determine the emotions and psychological states of people in spaces more accurately and based on data is to receive real-time data. Such techniques are suitable methods for examining users' reactions to architectural designs.

A better understanding of person responses to the space enables more successful designs to be made. The development of the research field of environmental psychology day by day has led to an increase in the interest in environmental-behavior issues and different specialties to include the subject in their own studies. Over time, the changes in science and technology have led to the emergence of the neuroscience and the neuroarchitecture paradigm with interdisciplinary collaborations. Recently, researchers have been using neuroscience to obtain more advanced and accurate information in their studies of people's experiences in the built environment, as well as quality. However, based on environmental psychology, there is not enough information on the behavioral, neural and mental mechanisms of users regarding the emotional-

perceptual experience of the space and environmental preferences. Neuroscience techniques allow the neural activities of the user to be recorded while they were in the architectural space. Neuroarchitecture, an interdisciplinary branch, has focused on expanding conceptual criteria through experimental frameworks based on the interaction between the brain and architectural space (Eberhard, 2007; Robinson et al., 2015).

Neuroscience has great potential to uncover why and how these effects happen. In this type of research, scientific tools used to measure brain activities have begun to be used instead of qualitative analyzes. The lack of research in this area and the fact that the effect of architecture on people is not fully known threatens human psychological health.

Combining architectural research with neuroscience based on human experience has been a tremendous approach. Today, the increasing attention in the potential for collaboration between neuroscience and architecture has led to the establishment of a theoretical and methodological basis for interdisciplinary studies. This interdisciplinary field of study will also be very effective in the evaluation of spatial quality by examining the reactions of people to architectural designs.

2. Architectural Space and Perception

Space is the concept obtained by the combination of plane elements in which people can move and act, or by carving three-dimensional masses. According to Gür (1996), "space is a 3-D expression of the intervals, distances and relations of person with person, person with object and object with object". On the other hand, the built environment is a part of the physical environment, in which natural conditions dominate, that is formed by the using of ways such as determining, limiting, enclosing and arranging in order to meet the required function or functions (Yıldırım Erniş, 2012).

Depending on the function in each space, different physical environmental conditions may be required for the user to perform different actions. For example, while working spaces where silence is required in some cases, a harmonious architectural form may be required in which high noise levels can occur in some spaces, or a cooler environment may be required for physical work while a slightly warmer environment can be provided for mental work. In addition to these, the features of the space may also differ according to the user characteristics such as age and gender. For example, even if the function

of the kindergarten and university structure is the same, the differences in age and age-related education level cause the changing the physical environment conditions. In addition, depending on their function, the physical characteristics and placement of furniture such as tables, chairs, armchairs, curtains and carpets, affect the perception of the space and therefore the perception of quality. The fact that all these features in a space are selected and positioned in accordance with the function of the space and the user group contributes to the formation of spatial identity. This identity can change the perception of quality in the person by causing a different perception on the users. Therefore, it is important to know what the physical components that make up the identity of the space individually and holistically mean and their effects on the user, in terms of increasing spatial quality and user satisfaction. Most research on the quality of space is based on perception and information processes. Component and physical environment characteristics of the built environment also affect the perception, image and behavior of individuals while experiencing the space. However, in the perception of space, individuals' personality, socio-cultural etc. features also play an important role.

Rapaport explains the process of perceiving the environment as three successive stages: environmental perception, environmental cognition, and environmental assessment. While the perception of space is an event of perception, the concept of space is an event of knowing. In Rapaport's filter model, culture and personality factors function as filters between the perceived form and the real form of the environment (Polatoğlu, 2013).

In order for the mental process to start in the perception of the space, there must be a stimulus. Environmental stimuli from spatial elements also include physiological data. For this reason, the type and quantitative characteristics of stimuli directly affect the perception of space and the physiological values of the organism. Cognition is formed by making sense of the perceived object at the level of consciousness thanks to environmental stimuli. The process, which starts with the sensation, continues with the perception and ends with the cognition, takes place in a certain period of time and passes through various stages. Stages of the detection process; attention and selection, organizing the obtained data (grouping according to the Gestalt approach), interpreting the data by associating it with previous information, and remembering again.

Different behavioral patterns are managed by the certain zones in the brain. In order to analyze the brain, it is possible to divide it into two main systems: the first is the subconscious fast thinking (System-I) and the second is the conscious

slow thinking systems (System-II). The subconscious system is fast, automatic, intuitive, implicit, impulsive, and emotional, while the conscious system is slow, cognitive, evident, analytical, and reflexive. All human actions and reactions are managed by these two systems (Kahneman, 2011).

However, behavior, decision making and performance issues differ between these systems. The subconscious system is much faster than the conscious system and comes into play when an athlete's body reacts instantly during a match. Another benefit of the subconscious system is that it needs less energy to work than the conscious system. Many of the brain's actions are automatic, as conscious thoughts are tiring and require a lot of glucose. Another important difference of System-I is that it can process much more information. It both controls the body's automatic behaviors and senses the environment. If persons could consciously notice all the stimuli coming from the environment, the brain would be overloaded. The subconscious mind, which has the capacity to notice much more information, transmits only the relevant data to System-II to be processed. In addition to, system-II has a very logical intelligence. Most new situations are controlled by the conscious system until they become automatic. System-I is unconscious, automatic and impulsive, and also is prone to prejudiced behaviors, and the effect at this level is different from the effect at the conscious level. Both systems can process all messages from the environment. All this is reflected in people's behavior and well-being. Neuroarchitecture has proven that spaces can directly affect the way the subconscious works. Therefore, it is obvious that studies at this level can help designers more.

Subliminal effects may not appear in a survey response or during an interview. Therefore, the traditional methods such as surveys/question papers are not enough to get users' opinion. Brain mapping techniques such as PET or fMRI are used to see more clearly the brain's response to each stimulus from the environment and to understand in detail how behavior is affected (Paiva, 2018).

The person receives the information about the environment and the places he/she lives in through his senses and translates this information into his own conceptual world, making a judgment about the environment or space. Physical environment elements (such as smell or sound) in a space also play an important role in the formation of imaginary perception. It is essential that architects understand the building users and the intended use of each space within the building. Therefore, with the help of neuroarchitecture applications, it will be possible to create more efficient and quality spaces by understanding the brain. Only when brain information, building purpose and user factor are taken into

account, quality buildings that appeal to subconscious and conscious systems in the brain can be designed.

When a user enters a building, they may be affected after a brief exposure. These effects mostly occur after a few seconds to a day of interaction. As a result, the changes in heart rate, blood pressure, emotions and mental states occur. Such effects appear as a rapid response to architectural stimuli. For example, an individual who goes to a common work area for a few hours to write an article can provide the best mental state to do his best, such as light, acoustic, order, temperature, color and form, or may reduce its performance due to physiological reactions that will occur due to the poor quality of the space.

The human body is an important factor in the brain-environment relationship. Emotions are produced in the brain and experienced by the whole body. It is seen that an architectural space that evokes emotional reactions attracts more attention than other stimuli. Emotions, one of the key elements that can affect mental states, causes behavioral changes by reflecting how people consciously or unconsciously feels. The short-term effect of emotions is affecting the way people perceive the world. Criteria that affect the quality of the space, such as cultural symbols and physical elements, can trigger human emotions.

On the other hand, when the brain is exposed to a similar stimulus (such as a person's home or workplace) for a long time and repeatedly, it can be seen that these stimuli cause some changes in the brain. It should not be ignored that the effects of long-term exposure can have very important effects on the brain development of children as well as adults. Areas such as kindergartens, homes, neighborhoods, schools and workplaces can have lifelong effects on the brain.

3. Spatial Quality

The concept of quality is a multi-layered / dimensional concept that can be perceived differently depending on various branches of science (Economy, Health, Education, Architecture, etc.). Quality is the set of features that allow needs to be met. They are also associated with individual characteristics. The word quality is generally defined as the property of being good or bad. The developments made by George Edward et al. between 1920 and 1950 have an important place in the development of the concept of quality, the importance of which has been understood and emphasized since the early age. However, it is known that the foundation of the concept of quality was laid in Japan and the development of the concept of quality was carried out in this country (Gülersoy et al., 2005).

The first approach to the concept of quality, developed over space, is based on the concepts of "Utilitas, Firmitas, Venustas" (commodity, firmness, delight), which the Roman architect Vitruvius defined as the conditions of a successful architecture in his work titled "De Architectura", which is still valid today was created. Therefore, a building that is functionally efficient, structurally sound and visually appealing is qualified as quality. Jan Gehl, the parameters that should be found in a quality urban area; defined with three parameters as protection, comfort and pleasure, and developed an individual-centered approach to analyze the quality of public spaces (Gehl, 2004). Some researchers focused on user satisfaction in the evaluation of physical environmental factors in spatial perception and environmental quality.

Özsoy et al. define quality as "suitability for use and ability to meet needs" (Özsoy et al., 1995). Dengiz stated that concepts such as efficiency, fitness for purpose, and user satisfaction are the main concepts of today's quality understanding. In theories dealing with perception and information processes, a set of comparative concepts and terms such as complexity, variety, visual dispersion, perceptual richness, order, readability, clarity, and coherence are often used to describe factors. When all these theories are taken together, we can say that concepts such as function, complexity, aesthetics, construction and order are among the important basic spatial quality parameters of architecture. The quality perceived by the individual is a psychological construct and includes subjective evaluation. Such assessments are documents of an individual's feelings. Rapaport considers spatial quality as noticeable differences in design. The diversity of perceived or observed order is one of these elements (Dengiz, 1998).

DQI (The Design Quality Indicator), which was established in England in 1999 with the support of many companies and institutions, primarily focused on the evaluation of school buildings and their surroundings in terms of spatial quality. The approaches developed by DQI are still used today (Figure 1).

Figure1: DQI spatial character parameter main principles (DQI, 2014)

Van der Voordt (2005) examines spatial quality in four different groups. The first of these is functional quality. In practice, it is how convenient a place is for the activities carried out. The second title, aesthetic quality, relates to how beautiful, stimulating or original the building is perceived and experienced. It is also about whether the building is representative of a particular style or building period, or to what extent the building evokes different meanings. Technical quality, on the other hand, is about how safe, healthy, indoor climate, temperature, humidity, illumination, natural light and acoustic elements the building can achieve, how much of it can be accessed by eco-friendly and energy-saving. Finally, economic quality is related to how much of its financial resources are used effectively and efficiently (performance-based wage rate).

When the studies carried out on interior space and environmental quality until today are examined in general terms, it is seen that while the researches up to a certain period only focus on the physical features and structural structure of the space, the studies carried out after a certain period concentrate on the subject of user experience and space perception. The first study in the literature related to perception, cognition and memory was carried out by Lynch. By revealing the image of the city in the eyes of the public, he explained the importance of the perceptual and sensory experience of the city. Advances in environmental and behavioral research highlight the importance of spatial quality, spatial perception, sensation, emotion, and memory.

Modernist design has given priority to the aesthetics of design, focusing on how objects look. Such one-dimensional thinking ignores the innate and functioning design order. When the spatial quality is evaluated, the effect of the space on the person is important with a holistic view. It is the loss of one's self as a result of individual alienation, fragmentation and becoming unrelated to daily life. This situation can also explain the poor quality of the place. Another definition supports these ideas by saying that people are alienated due to the deficiencies in contemporary urban theories and the problems encountered in daily life (Heynen, 1999).

In building designs, the importance and effects of space quality should be considered. Spatial quality helps improve brain plasticity. Buildings should be planned as a whole and their usage requirements should be taken into account. An operating room area should be practical and have a simple design to help staff perform well, while an enriched rest room for medical staff can be made. In addition, interior gardens can be planned for patients and their relatives.

The difference between enrichment and chaos in terms of spatial quality is important here. Although the shape, color, proportion, sound and smell in nature have certain patterns, lights, skies that are disproportionate to human perception, traffic jams, busy streets, horns and construction sounds in big cities such as Hong Kong and New York are chaotic environments that have excessive information without a pattern.

It is a known fact that the physical environment has an impact on the perceptions of users. However, it can be said that the quality of the environment may affect the perception of the users, so the performance of the users in terms of space perception will also change. In this respect, perception of space, perception-behavioral performance and spatial quality are inseparable parameters. The 'insufficiency' that will occur in any of these parameters will directly affect the other parameters. In this case, certain factors must be evaluated in terms of space and users in this cycle in order to create quality physical environments and direct the perceptions of users (Göregenli, 2013).

Poor quality and chaotic environments can cause long-term adverse changes in the brain and health. Prolonged exposure to numerous environmental stressors such as stress, crowds, air pollution, noise, lifestyle and spatial organization can greatly affect individuals (Goldhagen, 2017).

On the other hand, the stress caused by being affected by the architectural space greatly affects the brain. A poor quality space design negatively affects the users physically, psychologically and socially. In places that individuals frequently visit, stress can create permanent effects and cause mood, anxiety disorders and worsening of cognitive functions over time. In contrast, quality spaces that offer a variety of stimulation can help improve the learning process by reducing stress levels, preventing many physical and mental illnesses. For example, a public building that provides privacy, accessibility and ease of wayfinding can have a major impact on the stress level.

The factors of the physical environment can be measured and rearranged to provide the appropriate conditions, but in order to evaluate the physical environment factors from the user's point of view, the satisfaction levels should also be determined as a result of the user experience. As a result of the users' process of experiencing and perceiving the space and the measurement and analysis of the effect of the space on the user with accurate data, it will also help to create "quality" interior spaces that provide "suitable" physical environmental conditions for the user.

3.1. Main Factors Influencing Spatial Quality Perception

Social Factors: There is a complex and multifaceted relationship between the social structure and the society's perceptions of time and space. Our social structure and relationships affect our perception of space and time, as well as our views on social behavior. In this respect, it can be accepted that space is structured according to society, and society is structured according to space. Accordingly, all social actions and social relations can also be expressed spatially, or a place can cause a social action or social communication. In this respect, all spaces designed also reflect the characteristics of the society in which their users live, according to the place where they are designed. The spatial distribution of these social relations varies according to time.

Design Factors: Color, texture and materials of the surfaces of the components that make up the space, and the density of the space elements, the way they are placed, style, color and texture play a very important role in spatial perception (Özdemir, 2015). The design factors that make up the space can be listed as form, size, color and texture. The first element that affects the visual perception in the interior is the form. In the philosophy of aesthetics, form is defined as the opposite of an aesthetic object's perception and essence. The shapes of the objects also affect the perception of the space. In addition, form is among the determining factors that enable objects to be distinguished from the environment. The perception of the form in the interior takes place thanks to the three-dimensional forms existing in the perceived space. However, interior space itself is a three-dimensional form. The perception of this three-dimensional form that makes up the space is provided by the perception of the elements that make it up. Perception of the volume of the space allows the determining the width-length-height by following the horizontal and vertical lines. Accordingly, dimensional perception occurs following the perceptions of depth, width and height. Just like everything else on Earth, every volume in it has a dimension. The dimension, which we can also express with numerical values, comes to the fore with its psychological effect more than the numerical value when the user is in the space. The proportional structure arising from the form strengthens the spatial perception in most spaces by strengthening the perception of space. For example; if the windows in a room cut the deaf part of the wall vertically, it may create the impression for the users in the room that the ceiling is higher than it is. It can be said that factors such as sociological, psychological, anthropological, religious and political are very effective in the process of creating the perception of space and form.

Another element that follows the form in the perception of interior is color. Color is an indispensable phenomenon. Color and its effect on people are very important in the space where life takes place (Özdemir, 2015). Differently colored surfaces play an aesthetic role in the perception of the whole as long as they create unity and integrity in the space. In this respect, it can be said that the colors brought together according to the Gestalt principles are effective in the perception of space. The shape, which the artist makes concretely sense with the line, is a limitation made with the line, in Aristotle's words. When it comes to adding expression to this constraint, we first encounter color. The surface bounded by the line is enriched with color. Color is used to emphasize the character of the building, to highlight its material and form, and to group its different parts. Carl Petersen showed how the correct use of color can create a different effect on user perception at the Faaborg Museum. He used color in architectural space, not to emphasize materials and structure, but to define spaces and spatial elements. Seeing colors through our sense of sight is actually the physical perception of color (Rasmussen, 2016).

Another factor that is effective in the perception of the interior is the materials used on the surfaces in the space and the textures of these materials. Texture, literally, can be defined as 'qualities that appeal to the sense of touch'. The textures of the materials preferred within the space design may cause different effects on the space perception of the users. For example; Treated smooth-surfaced materials and textures will have different effects on the user compared to untreated rough materials and textures.

All these factors chosen for space design should not be the result of a coincidence because there is a close relationship between these factors and the conceptual thoughts that the designer wants to give. In this respect, it should be taken into account that different choices remind people of different emotions and experiences and therefore affect quality. A good space organization brings along a quality space perception.

Environmental Factors: Thoughts are realized by the senses. In other words, thoughts that occur in the mind are formed by seeing, hearing or touching. When examined from an evolutionary point of view, it is thought that tactility first emerged, then auditory and finally visually. The user in a place acquires data from the environment he is in with the help of environmental factors. The user tries to feel the space with all his senses in order to create an image of the environment in his mind.

Thermal comfort is an important factor in the context of the quality perception of the space. In this context, parameters such as air temperature, radiant temperature, air velocity and humidity should all be taken into account. Different combinations of environmental variables of thermal comfort conditions provided indoors; it can also be interpreted through user values that cannot be interfered with, such as physical activity and metabolic rate. These are called as individual factors. There are sensory sensors on the skin that can detect the senses and convert them into electrical signals that the brain can understand. The aforementioned sensors create a connection between the outside world and the nervous system, and ensure that signals such as touch, vibration, and temperature are transmitted to the body's perception system (Canan, 2015). Therefore, thermal comfort evaluation can be made by considering the effect of physical factors on the skin.

Apart from the physical increase in temperature, the colors used in the space are also effective in the perception of space. For example; warm colors (red, yellow, orange, etc.) that evoke fire and therefore heat cause us to perceive the space as warmer, while cold colors (blue, green, etc.) cause us to perceive the space as colder. Colors are also effective in estimating the time we spend in the space we live in. It has also been determined by experiments that the textures of some materials create a warmer or colder effect as a result of perceiving the space as a whole. It has been observed that a smooth textured surface creates a cold effect, while a rough surface creates a warmer effect.

Although it is known that the most important sense of human is sight, perhaps another equally necessary sense is hearing. All sounds such as music, bird chirping, indoor crowd humming, and noise of city are created by pressure waves in the air. The intensity of these waves causes high-pitched sounds, and the shortening of the distance between the waves causes low-pitched sounds. The height of the waves determines the sound intensity.

Sounds of space affect the perception of space. This effect is directly related to the acoustic properties of the space. Especially the reverberation time is very important in the perception of space. As a result of the long reverberation time that occurs due to the different space format features, it creates the feeling that the space is smaller than it is. The fact that the materials used in the formation of the space have different absorption factors due to their textural characteristics also allow them to be used as a factor affecting auditory perception. On the other hand, the presence of music in the space changes negative emotions and this has a positive effect on the tendency to stress. At the same time, it can increase the

time spent in the space without getting bored. Emotional responses result from the amount of attention and the level of attention evoked by specific sounds. For example, in a study conducted in the field of neuromarketing, it was revealed that in-store music affects product preference (Lewis et al., 2012).

The perception that occurs as a result of seeing is called visual perception. The working systematic of the visual mind is faster than the real brain. Most of the perceptions in the outside world are visual and the sense of transmitting the perceived to the brain is simple. The environment is supposed to be seen clearly, but in fact, a very small area is clearly seen. Their job is very easy, as the wizards can get them to look wherever they want. The eyes are constantly in motion to achieve unity in the outside world. Visual perception is the basic element in an individual's perception of the environment. The design quality of the space (size, color, texture, form) is an indispensable element in the interpretation process of the visual stimulus. In perceiving the environment, the brain's trust in the sense of sight lies first. The realization of visual perception depends on the presence of certain quantitative and qualitative distinctions in the light coming into the eye from different parts of the visual field.

Dim light, spot light, natural light, etc. Various types of light can cause emotional changes in people. In some people, as the brightness increases, the intensity of emotion may decrease. One study investigated the effect of light on behavior and revealed that various types of lighting do indeed alter brain activity rhythms, and that the right hemisphere of the brain specifically responds. This proves that lighting has a significant effect on the individual's conscious or subconscious reactions (Bandler and Grinder, 2012).

People perceive olfactory stimuli as well as all other stimuli in the place they are in. The olfactory bulbs are actually part of the limbic system, the deepest, most primitive part of the brain. Except for smell, all other emotional systems have to take a long and winding road for transfers and sharing. However, odors are directly connected to the emotion and memory center. How a space smells can also affect the user's perception of spatial quality. Depending on the past experiences in the user's memory, this situation can trigger emotions such as the feeling of spaciousness, comfort and health and change people's behavior.

4. Neuroarchitecture

Although space quality and human experience have been studied extensively in architectural and built environment studies since the 1960s, the

role of the human brain in the experience of architectural space has been involved since the early 2000s. Today, with the re-priority of the relationship between the user and the environment, and the developments in neuroscience and cognitive sciences, effects of architectural space on the brain are made sense by means of evidence-based data. According to Ellard, the nervous system and the brain are bombarded with messages at all times and in every experienced situation. This reveals the importance of our brain in experiencing space (Ellard, 2015).

Knowing the historical background of this field allows researchers to better understand the impact of neuroscience on architecture. The 21st century has spawned several new neuroarchitecture trends arising from the intersection of neuroscience and architecture currents (Sussman and Hollander, 2021).

The term neuroarchitecture first appeared in an interview about the design of a building in the fall of 2003. Here, Eberhard and Gage explained the reason for the collaboration between architects and neuroscientists (Eberhard and Gage, 2003). This led to the formation of the first university research unit on neurocentric architecture in San Diego called the Academy of Neurosciences (ANFA, 2003). In order to examine human experiences in a place with neurocognitive approaches, first of all, it is necessary to know the differences of some terms such as neuroscience, cognitive science, neuroarchitecture and cognitive architecture. The most comprehensive branch in this subject is cognitive science, which is related to the processing of the mind and refers to different types of thinking and includes subjects such as the perception, learning, decision making and emotional experience (Thagard, 1996).

Neuroarchitecture studies aim to reduce stress, increase cognition, long-term productivity, and desirable psychological and emotional responses to the environment. As a result, it aims to improve the quality of life. Architects' work in neuroscience focuses on the environmental features that trigger physiological and neural responses in the built environment, such as feelings of comfort or anxiety. Architectural design based on the neuroscience can improve creativity and comfort of space users. The development of neuroscience in architecture creates a new environment for designed environments to be a more suitable platform for cognitive activities. In general, the aim of neuroarchitecture is to study the effect of architectural space on the neural system. This is also an indicator of perception and psychological well-being (Pykett, 2015).

The brain is a complex phenomenon and difficult to understand and explain. In order to understand the reason for the brain's reactions to the environment, human experiences, thoughts, behaviors, emotions and knowledge should be

taken into account (Zamani et al., 2022). Therefore, the deeper the researchers' knowledge of the human brain, the better the understanding of the effect of space on the brain.

4.1. Neuroarchitecture Measurement Techniques

4.1.1. Neurometric Measurements

Different neuroimaging techniques are used to understand brain functioning. The most common among these are functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and magnetoencephalograms (MEGs). Electroencephalography (EEG) and Event-related potentials (ERP) are psychophysiological measurement techniques used in central nervous system measurements.

fMRI: Although fMRI device is considered the most advanced brain scanning method today; researches the magnetic properties of hemoglobin, which plays the main role in the transport of oxygen throughout the human body. Thanks to this technique, the increase in the level of blood flow in the brain can be measured. This method determines which parts of the brain are activated by various stimuli to which the subjects are exposed and the activation levels in these regions. In this way, information about emotional feelings such as happiness, sadness, anger and pain arising from architectural spaces can be collected (Ural, 2008).

The advantage of fMRI is the balance between temporal and spatial resolution, allowing brain scans to occur in less than three seconds. This advantage shows that fMRI is a promising futuristic research method in the field of neuroarchitecture. However, the difficulties of this technique include the fact that the person is being scanned while lying on his back in a long, narrow and noisy tube during the experiment, the high cost and size of the device, and also that it can limit the richness of environmental stimuli arising from the way the experiment is conducted (Figure 2) (Kenning et al., 2007).

PET: PET is a successful neuroimaging technique that detects gamma rays emitted from low-dose radioactive nuclei given to the individual with a special camera, determines their distribution in the body and converts them into three-dimensional images (Figure 2). It is an interactive-based method used to identify functional examples of the human brain. PET device is important in subjects such as imaging the heart and brain and is used by nuclear medicine specialists especially in the detection of cancer cells. Although this technique is not widely

used in research in the field of architecture, it is an important brain imaging technique (Cherry et al., 2008).

MEG: The MEG device measures the weak magnetic fields generated by the neuronal activity of the brain (Figure 2). This device has superconducting quantum wave sensors, which are necessary for examining and measuring weak magnetic signals in the brain. Developed by the scientists of New Mexico University, this device has the best imaging thanks to its 3-D and time-dependent resolution and uses the most advanced technology (Çakar, 2010). For example, it is a method that can be effective in examining the temporal sequence of decision-making stages during spatial experience.

Unlike the EEG, the MEG device measures small magnetic fields, not electric potentials. Since the measuring probe does not have to come into contact with the scalp, it is expressed as a very useful method. Similar in format to fMRI, MEG shows the stimulated areas in the brain. As with fMRI, MEG takes a snapshot. But MEG is faster. However, in addition to these advantages, it should be noted that MEG is more expensive than fMRI. However, MEG method is a method that can be applied both on virtual environments that can be performed in the laboratory and in real environments (Kenning et al., 2007).

EEG: All functions of the brain, from the most ordinary to the most complex, are realized by electrical activities. The EEG method is a method that enables electrical monitoring of brain activity (Figure 2). EEG is the observation of electrical signals that occur during the operation of the human brain. Since no electric current is given to the individual, pain or pain is not felt. Electroencephalography allows the measurement of small electrical potentials, which are basically the source of brain waves produced by neurons. They are signals that are formed as a result of the electrical interaction of the nerve cells that make up the brain. Since the human head has a very strong and protected structure, it is difficult to observe this activity directly from the structure of the brain. Instead, the data obtained from the electrodes placed on the scalp surface are strengthened and the oscillations seen in the brain waves are examined and recorded. These measurements made from the head surface consist of the sum of the voltage coming from the lower part of the brain. EEG signals can be used in a wide range of fields, from psychology to marketing, especially in medical sciences. Portable EEG devices with wireless technology can be used in the field of architecture, since classical EEG devices are fixed and difficult to use in this field. Such devices can help to observe the brain activities of the subjects in real space experience (Schoenberg et al., 2018).

fMRI PET MEG EEG

Figure 2: Neuro-measurement devices

4.1.2. Biometric Measurements

Biometric measurements are used to measure biological and physiological responses. Subconscious responses are transformed into biometric responses via nerves. These are reactions such as involuntary contractions, skin conductivity, eye movements, blinking, pulse, blood pressure, sweating and respiration. Measurement of biometric responses is carried out with techniques such as Eye-Tracking, Facing Coding (FACS) and Electrodermal (EDA).

Other techniques are also available in neuroscience research. These techniques take place through a number of useful digital tools. Wearable devices, small portable computers equipped with different sensors, wristbands with sensors, body tracking systems, digital tools such as GPS are important in the neuroarchitecture research. Bio-information combined with GPS technologies and mobile camera systems enables emotional and sensory responses to be elicited in the built environment in real time. Devices such as cameras, microphones, and virtual reality (VR) glasses are also widely used in neuroscience and architectural studies. In addition, crowdsourcing through smartphones is another method that helps to collect data in such studies.

Eye Tracking: The eye tracking technique is easy to apply, low cost and one of the most frequently used methods among the biometric measurement methods. Fixations and saccades are the most basic actions of eye movements. There are many eye tracking methods available to study eye movements. By focusing on the eyes of individuals, it is possible to measure the movements of the eyes, where and for how long they are looked at, by determining which part of an image or environment is focused on. Eye movements generally consist of uncontrollable movements that occur at the subconscious level (Girişken, 2015). This technique provides a real-time recording that helps assess visual attention. In addition, the change in pupil size can be used in the study of emotional

arousal. Thanks to new generation technologies, eye tracking is a technique that can be used while experiencing an environment with VR glasses in virtual reality environments, as well as images on the screen such as computers and phones, and even while visiting real places (Figure 3).

Thanks to the eye tracking analysis method, it can be determined where, how long, when and how many times the stimulus was looked at. The obtained data are interpreted in millisecond scale and by converting them into graphics with x-y coordinates. These data are presented in the form of a gaze map that determines which area/object, how long and how many times the user looks, and a temperature map that shows where and how much he concentrates. In this way, the elements that the users focus on the most, that attract the most attention or that do not attract attention can be determined (Maughan et al., 2007).

EDA: EDA is the electrical activity originating from sweat glands and adjacent epidermal and dermal layers and recorded with electrodes placed on special areas on the skin surface (Figure 3). EDA is used as a general concept covering all electrical events in the skin. With this method, which can be used in neuroarchitecture research, the response of the skin according to its electrical permeability can be evaluated. In this method, the visual stimuli shown to the subjects or the level of exposure of the subjects while experiencing a real or virtual architectural space can be measured. When the individual is excited, the electrical permeability value of the skin also differs. Thus, the state of excitement can be easily measured with sensors. Polygraph machines are also built on this principle. Another name for this technique is galvanic skin response (GSR).

Depending on the activity of sweat glands, it is observed that there is a change in electrical resistance, especially in the palms and other areas without hair. The change in the electrical resistance of the skin due to a stimulus is an extrasystemic response of the autonomic nervous system and can occur with the activity of sweat glands and factors that give pleasure and create stress (Girişken, 2015).

Living things show what they feel not only with their brain activities, but also with other parts of the body. It is known that when people are exposed to a stimulus that will excite them, when they are afraid, worried or feel pain, they also give a skin-like reaction, similar to the acceleration of their heartbeat. Depending on the measurement of physiological responses such as heartbeat, blood pressure, skin conductivity, and salivary stress hormone, it can reveal the instant emotional states of the subjects. Therefore, the change in the reactions

that arise depending on the characteristics of the space will be an indicator of the effect of that space on the individual.

FACS: The place where people unconsciously reflect their feelings and thoughts is their face. Although the brain's face detection system is complex and its working principles are unknown. Areas associated with face detection, just below the lobe, are located in a region called the "fusiform cortex". Studies show that this area becomes active when a face photograph is shown to the participants (Canan, 2015).

Through the FACS, the feelings experienced by individuals are determined based on their facial expressions. The system was developed by psychologist Paul Ekman (1971) after that Carl-Herman Hjortsjö initially described this system with 23 facial movements. Compound movements of 43 different facial muscles are measured by this system, creating thousands of different facial expressions. For this test, it is important in many cases that the emotion flows so quickly that it cannot be seen with the naked eye. The system involuntarily determines the emotional reactions of the subconscious and can detect specific emotions by associating them with stimuli (Figure 3). Depending on the facial expressions as a result of perceiving the architectural space, the value, arousal and dominance dimensions of emotion can be evaluated.

Architecture is a continuous spatial experience. As a result of architectural experience, biological and physiological changes arise due to environmental factors. Therefore, this technique can be used in order to detect the change in emotion and emotion in the context of spatial quality as a result of some changes that occur in the human mind while moving from one place to another.

Eye tracking (in real/virtual environment) GSR Face Coding

Figure 3: Biometric measurements

4.1.3. Psychometric Measurements

In addition to biometric measurements and neurometric measurements, psychometric measurements can also be used in spatial quality research. Thanks

to psychometric measurements, while brain responses can be measured, it can be determined how long the behaviors and reactions take place in implicit association tests. For example; The Implicit Association Test (IAT) is a psychometric measurement test created by Greenwald et al. to determine the attitudes of individuals about a certain concept. According to this test, concepts with the same segmentation in the human mind automatically associate each other.

Personal reporting surveys and face-to-face interviews can also be used in this context, in addition to other methods. These questionnaires are usually prepared by an expert and are used to report the mental state of the person. BRUMS, POMS, PANAS and SAM are among the self-report questionnaires (McNair et al., 2003).

5. Conclusion

Today, people generally spend their time in the built environment. This experience has a direct effect on the brain. Depending on the nature of the space, the behavior, performance and health status of individuals may change. Therefore, spatial quality has a direct impact on people's health.

Although humans are rational beings, most of the processes that take place in the brain are unconscious and do not follow logic. For this reason, information (image, sound, design) from environmental stimuli can be perceived by the person unconsciously and change their behavior without their being aware of it. Considering the impact of the built environment on human health, the importance of spatial quality also emerges. Neuroarchitecture, on the other hand, will help architects to design better quality spaces by investigating the unconscious system in the brain of the users so that they can lead a healthier and higher quality life in their designs. These designs can also provide positive effects such as strengthening cognition and memory, reducing stress and negative emotions. For example; important designs such as schools that improve learning and memory, and hospitals that accelerate recovery may emerge.

The aim here is to get the user's interpretation through a survey, as well as to provide access to the subconscious, to more accurately determine the effect of the built environment on the user through the real-time data received. With the help of these data, architects and interior designers will be able to design better quality spaces and increase the health and quality of life of people.

No matter how great the neuroarchitecture findings, there is a very important detail that should not be forgotten. There is no set of rules that leads to right or wrong answers. Each project should be made taking into account the

originality of each case. Individuals are unique based on their genetics, culture, and life experiences. Neuro-architecture deals with the responses that the brain has to give to certain stimuli in each situation. Therefore, architects must be able to interpret this data and analyze each situation uniquely.

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CHAPTER X

RE-DISCOVERING THE STRUCTURAL POTENTIAL OF TIMBER: A GEM FOR SMART DESIGN FOR SMART MANUFACTURING

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1. Introduction

In today's architecture, structural design along with a unique assemblage is considered to express the limitlessness of architectural imagination, knowledge of engineering, digitalisation and production. Architects seek to manipulate the material and its limits, as Candela and Nervi did with concrete. The incredibly thin reinforced concrete shell of Los Manantiales and the thin concrete dome supported with lamella ribs and Y-shaped perimeter buttresses of Palezzetto dello Sport were two showcases nearly built same year, 1958, and still are two icons that must teach to the next generations of architects in schools.

Architecture is one of the disciplines that evolved with the digitalisation, which clearly replaced the practice of modelmaking. Modelmaking has been deemed the first steps to design and to find the satisfying form and spatial making of a site. However, today it is the final step to demonstrate the architectural design after all the proposals, variations and regarding simulations are tested on a range of software. Otto's soap bubbles experiment to find free forms was a threshold in architecture. Hanging chain model to design the structural standing of the Mannheim Multihalle was a remarkable start of tension structures. It would not be wrong to say that it felt like with the advances of the digital design tools in architecture, we finally caught the mastermind of Otto and took it from

there to the future architecture, which we called parametric design. Today, many architects and students are mesmerised by the state-of-art buildings of Hadid, which display extreme free-forms that seem impossible to build.

Speaking of the materiality in structural design, timber often left the last. Because it is a naturally available source of building material, unlike concrete and steel, and is the primary material to build a shelter from the very early ages of humankind. Timber is deemed rather conventional and is less preferred than concrete and steel. All know the traditional timber buildings across Europe, America, and Anatolia and so on. The past timber has separated it from concrete and steel. When thinking of an extraordinary large-scale design, architects tend to choose the latter two. However, with the advances in the manufacturing industry, timber composite products now compete with steel components. Similar structural configurations can be implemented in steel and in timber when speaking of large-span structures. In addition, both can be designed in one project as a complementary process. Timber competes with concrete as well in terms of building residential blocks and multi-storey buildings. As with the precast concrete components designed for a project, timber composites can be manufactured and designed to erect on site too. To say, timber is a quite sufficient material to build an extraordinary design in one architect's mind.

The paper explores the contemporary design approach in timber, the process of its structural design and the assemble technologies through the contemporary examples. By that, it is aimed to discuss the place of timber in today's architectural design and the increasing trend to prove the potential novelty and the buildability in timber by means of various structural designs. The paper, accordingly, focuses on a set of purposefully selected examples and studies their structural configurations and architectural design aspects. The paper outlines the contemporary timber construction in three levels. The first one discusses the parametric design approach, which has been highly popular for the last decades. It uncovers its applicability with the method of stacking timber and how a simple design idea has potential to display some aesthetic results. The second one is about smart design and smart manufacturing. Smart design can be deemed a continuum to parametric design. It involves large span design and on the side of smart manufacturing it deals with specific-to-project joint detailing while considering the smart use of materials with the least waste while keeping the structural performance at most. The third one is kinetic design, which also comes along with parametric design. This can be deemed the highest level of technology that architectural design achieved. Timber can be tricky as

material and technology in the kinetic aspect to form the whole building shape or partially the facades. The paper sheds some light on the future of timber design and the construction technology accordingly.

2. Parametric Design from Stacking

Stacking timber is one old method of building shelter. Today, the technique is remembered and re-materialised other than sawn timber in some cases since the development of the composite timber products. The good thing about the stacked timber is that one can design permanent structures as well as temporary installations. Because it has simple joint detailing, it can be deconstructed on one site and reconstructed on another site, as what happened to Ark22 in Morocco, designed by Stephane Malka and Oulalou+Choi as a part of the master plan of COP22[1] meeting complex (Figure 1). The structure was designed as a grand gateway entrance. The stacked timber blocks have one size only, 75x100mm, and the whole system is self-supporting with a height reaching at 12 meters and to 50 meters in width.

Figure 1. Ark22, represents the Moroccan traditional arch from stacked timber as entrance (URL 1; URL 2).

Stacking timber allows for the temporary installation and makes it possible to use the material in different stages of its industrial processes. For example, C-Shore (Figure 2) is a pavilion designed by the students at the University of British Columbia School of Architecture and Landscape Architecture. They considered the duration needed for the air-dry process of the freshly milled cedar timber for an ongoing nearby construction site. C-Shore has a cubic design with a void inside to create a seating-relaxing area for the students on campus

1 *Abb*. For 2016 United Nations Climate Change Conference, took place between 7th and 18th November 2016 in Morocco, Marrakesh.

during the air-dry process. The students installed the stacked timber structure in a manner to ensure the appropriate airflow between the stacks and it is expected to dismantle the structure after three years to produce planter boxes for the use of local primary schools to support their ecological curriculum.

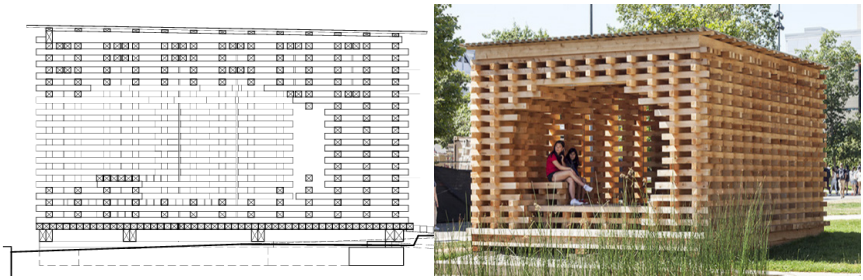

Figure 2: C-Shore Pavilion (URL 3).

Timber is a versatile material and the method of stacking also can be applicable to large scale projects as well as small scale installations. One example of this is Zeibak and Dow's Hegemonikon for the Sukkahville Design Competition in Canada. The designed cubic shape was a stack of plywood and formed as parametric voids inside. Each side of the cube is almost 3 meters (Figure 3). Simply, an arbitrary void inside a cube can create an interesting installation design, which just fits to the aim of the short-term public projects. Another similar installation is the Custore Pavilion, in Poland, which was located inside of a shopping centre and to attract customers. The reason of this kind of installation was the ability to deconstruct and to transfer to another mall and easily to reconstruct it (Figure 4).

Figure 3: The Hegemonikon Cube (Fruto, 2012).

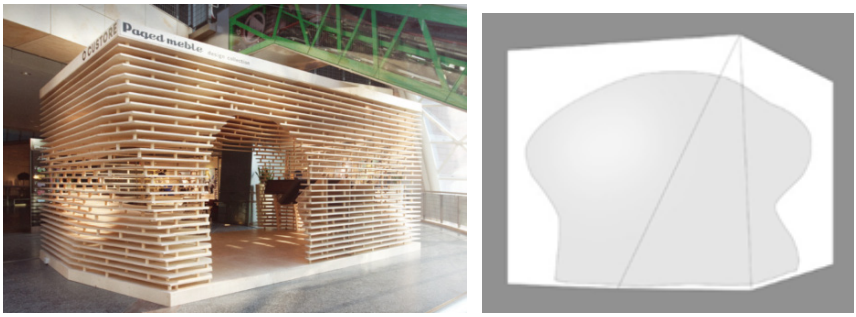

Figure 4: Custore Pavilion (Fruto, 2013).

The Genesis Pavilion installation was designed by award-winner architect David Adjaye (Figure 5) for Design Miami 2011 and it has not a horizontal stacking as usual, but a vertical stacking design. The design has a triangular shape and an egg-like void inside opens the sides as the passage and the middle of the roof for daylight. While the sizes of the timber components used are the same in cross-section, they vary in the length and the interior end surface, which is parametrically designed and cut.

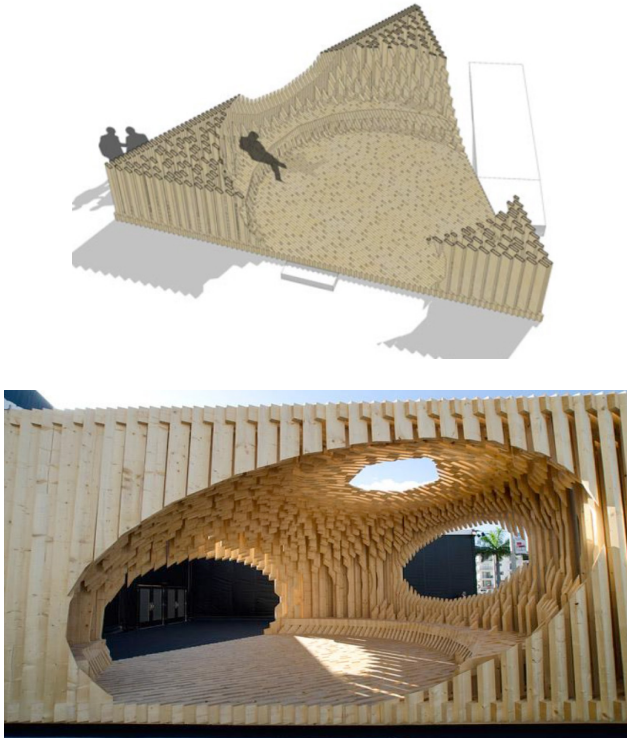

Figure 5: Genesis Pavilion has vertical stacking (URL 4).

The geometry makes the cube popular too in terms of allowing for easy dimensioning, cutting and assembling on site. However, geometry and architecture have an intriguing relationship. Structural design or surface geometry, architects and designers like to push the limits of the material as well as the assembly. The Gyroid installation (Figure 6) at the outdoor space (between 2013-2015) at the Exploratorium in San Francisco, USA (URL 6) is another example of how smart design and smart manufacturing co-ordinately can produce a precisely gradual shape. Gyroid is a mathematical shape that is entitled Infinite Periodic Minimal Surfaces Without Self-Intersections, which was proved by Karsten Grosse-Brauckmann and Meinhard Wohlgemuth in 1996 (URL 5) The pioneer of free-form structures, Frei Otto began to experiment with his famous soap bubbles as early as 1961. Minimal surface, the roofing mathematical model, has long been a source of inspiration for architectural design (Emmer, 2013).

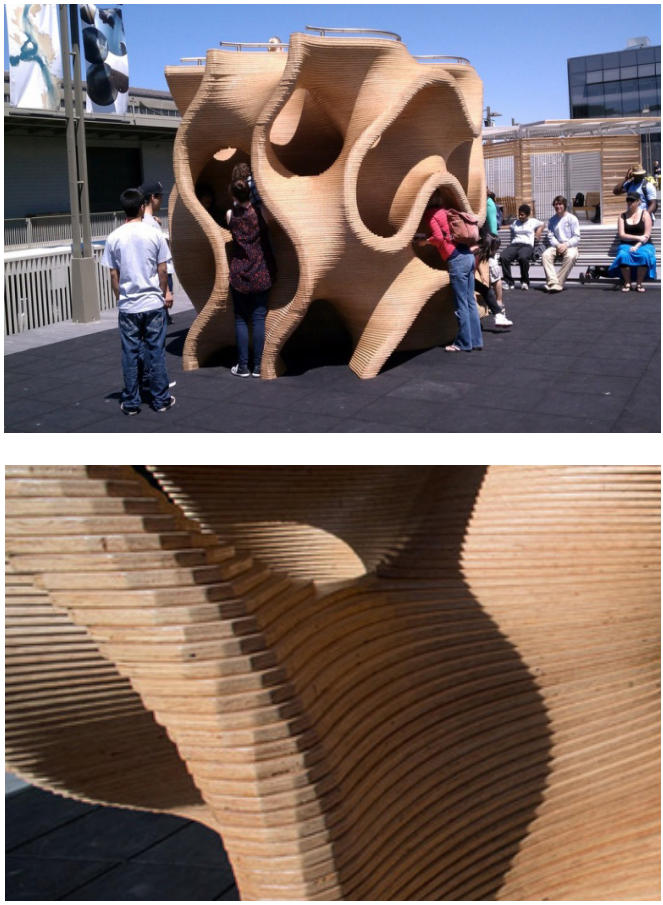

Figure 6: Gyroid Pavilion (URL 6).

3. Smart Manufacturing With Smart Detailing

3.1. Computational Design with Timber

Construction sector rapidly took the advantages of digital development in technology in the last decade. Parametric architectural design dominates the sector today. This particularly assisted to reinvent the capacity of timber construction, which used to be kept aside considering the low level of novelty in traditional design and construction. However, with the adaptation of the digital technologies in timber design, we have a specialised branch in the sector that is called robotic timber construction. Such contemporary approach in design as well as in production allowed timber to gain back its popularity and allowed architects to achieve extraordinary designs not only on the screen but also to have them built on site in unconventional ways (Wagner et al., 2020).

Timber is a lightweight material and is easy to configure in different geometries and different scales, from small installations to large scale hangars and terminals, etc. with industrial structural lumber products. Timber proves it is a competing material with steel and concrete in strength as well. The fabrication of Buga Wood Pavilion (Figure 7), which is defined as a segmented wood shell, was an exemplary work of robotic timber construction. The Pavilion was designed and built in a little more than one year in 2019. The 30 meters span and 500 sqm area it had was designed in 376 pieces of hollow cassettes, which was uniquely designed for the Pavilion. The system was nothing like a traditional timber construction. The cassettes had to be interlocked to each other continuously on a curvilinear surface that stands on the ground and open at three sides. The geometry gained its stiffness with its shape and with three spines at the sides.

The parametric design allows space for architects to use materials in extraordinary ways. For example, the Autobahn Church Siegerland in Germany (Figure 8) was entirely built with OSB panels. The exterior walkway of the building was designed as a typical timber frame structure. The church's central rectangular area had waffle parametric form. The Church has 240 sqm areas and was built in 2009.

Figure 7: The Buga Pavillion structure (Wagner et al., 2020).

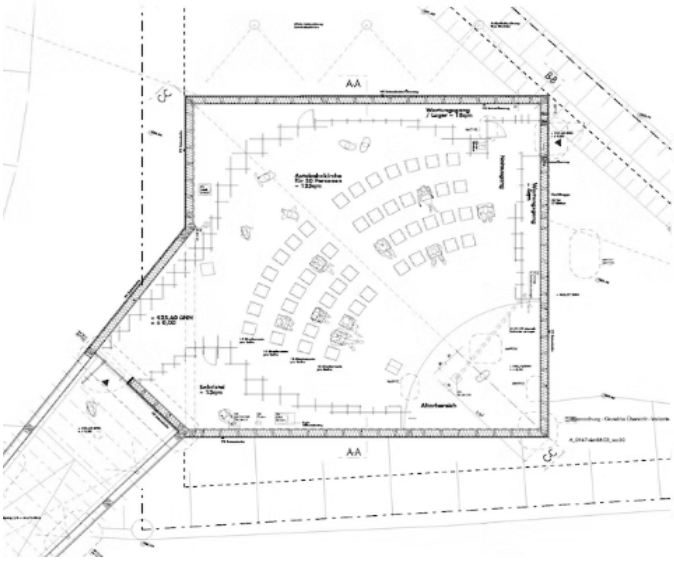

Figure 8: The Church's inner structure has been constructed with OSB panels and as waffle (Arquitectura Viva, 2019).

Not only as the surface geometry or the stacking method, the curvilinear grid structures, other than geodesic dome structures, can also be built with timber. For instance, the façade of the Allianz Riviera Stadium (Figure 9) in Nice is the largest timber-metal space-frame structure ever built and covered with an ETFE membrane. The translucency allows a readable wooden grid structure particularly with a move upwards at the grand entrance. The seated area can host 35thousands visitors.

Figure 9: Allianz Riviera Stadium in Nice (URL 7).

Working with digital models introduces the benefit of 'machine-readability'. Stefańska et al. (2021) studied the effect of structural and architectural optimisation in free-form finding and concluded that such cooperation in generative design can help to decrease the weight of structure by up to 40%. Generative design gives opportunity for simultaneous structural analyses, and this serves for more efficient building design in terms of material preference, total cost and time saving. Timber design has been popular for experimental projects, such as Savill Garden and the Weald and Downland Museum Gridshell in the UK. Digital fabrication technologies and generative design also favour timber as material due to its easy processability. This is found as a significant aspect of efficient design in terms of buildability of an unconventional design with novel details. Gawell and Grabowiecki (2021) attribute technological design of structures as a modern detailing in architecture. They categorised detailing in architecture into three eras. The first one is ornamentation-based design, as that in the history of Baroque. Details are to hide the interior and exterior structure. The second era is the well-known 'Less is more', which highlights the architectural design through simplicity in structure and material

technology. The third era is the interaction between technology and art, which shapes contemporary construction. The use of digital tools in architecture is not only for the sake of creativity, but also for the economy. Technological architecture deals with extraordinary design as well as the reduction of construction waste and operation costs. Thus, the structure and the manufacturing technology replace the ornamentation as a wow factor. It addresses the need of intriguing design creativity for architects on one hand, and the less complicated but optimised manufacturing solutions for the contractors on the other hand.

Abrishami and Martín-Durán (2021) focused on the DfMA – Design for Manufacturing and Assembly – and divided the design considerations into four steps:

1. **Preparation phase:** the beginning stage of design and BIM object library is essential.

2. **Design and pre-construction phase:** 3D model using BIM object library is tested and buildability and the technical design stage are validated according to needs and legal requirements.

3. **Construction/Assembly and Close-Out phase:** the final model with detailed production strategy and information are forwarded to the manufacturer. The components are delivered to the site and precisely confirmed with the 3D model using equipment such as laser scanners, drones, and photogrammetry.

4. **Use and Demolition/Reuse phase:** this involves facility management to keep the track of energy consumption and the need of maintenance particularly for the components manufactured with warranty. Tracking the life-cycle stage ends with the end-of-life stage; this clearly defines how to demolish or disassemble and reassemble if planned for any further use.

Khidmat et al. (2022) utilised multi-objective optimization and building performance simulation to design the geometric alternatives while simultaneously receiving the potential daylight optimisation results for a two-story hyperboloid-shaped timber house made from Japanese local trees. The computational design approach helped to discover the parameters for the form with minimum force loads and maximum building volume. Scheurer and Stehling (2020) discussed the prefabrication of timber and its move from being experimental scale to the digital turn it guided finally and truly in the AEC industry. Free-form projects including Centre Pompidou Metz, La Seine Musicale and Swatch HQ Buildings, all designed by Shigeru Ban, are 'non-standard curvy' projects that changed the direction of timber construction by changing the perception that dominated the industry for years. The movement initiated with BIM in the construction sector

and this triggered the need of precise component production like happens in automotive sector and many other industries, which involved the application of IPD (Integrated Project Delivery) and DfMA (Design for Manufacturing and Assembly) approaches, from the design stage to the manufacturing stage, to increase the quality of the work and also to track the cost and the schedule that are very often exceeded in AEC industry.

Computational design also changed the way of building with traditional timber. For a long time, the industry replaced timber joints (dowel joint, dove-tail, half-lap joint etc.) with metal plates, mostly steel, in building large span timber structures and timber frames. With the computational era in architectural design, traditional timber joints have begun to modernise and adjust according to each unique timber design. Timber folded plate structures, for example, are self-supported and the material used, OSB or plywood, give a space to builders to design how to join the sides of plates to each other with traditional techniques. According to Rogeau et al. (2021), smart engineering and manufacturing software and tools (CNC and IRA) made it possible to re-emergence of traditional joinery techniques (Figure 10). Design of the Urbach Tower is a showcase to prove how computational design can make such a slender surface-active shell structure real in standing with such unique joints. The tower has 14.2 meter of height and a perimeter up to nearly 5 meters. With the geometrical advantage of surface-active shell and the material advantage of CLT panels, the twisting body of the tower was divided into twelve curved panels through the height of the tower and 90 mm in thickness. This resulted in the span-to-thickness ratio per panel of 158/1, successfully displaying how computational design with smart manufacturing technology can ensure efficiency in material use without forgetting the forces and strength. Bechert et al. (2021) emphasised that the design process was simultaneous between architectural design, engineering estimations and fabrication optimisation, which was the reason behind such influencing design. Qiao et al. (2021) designed and tested a timber frame structure, using Scotch pine as source material. They aimed to model, modify and test the performance of the mortise and tenon beam-column joint technique with the computational design and robotic construction technology. They concluded that mortise and tenon required high precision in design and robotic processing, but also utilising such tools enables to increase the integrity of the joints and assuring the performance as well. A pavilion structure (Figure 11) designed and built by the students at the University of Michigan Taubman College of Architecture and Urban Planning is another example. The pavilion was digitally designed with complex algorithms and the robotic construction was utilised when building the

frames horizontally and piece-by-piece. Then, the structure was erected on site as the students positioned each uniquely dimensioned frame vertically at their precise positions (Arashi, 2022).

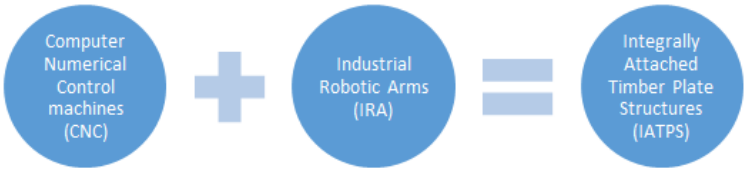

Figure 10: The evolution of making modern timber plate structures with traditional timber joints (Rogeau et al., 2021).

Figure 11: Adel Design Research (ADR) studio's Project at the University of Michigan Taubman College of Architecture and Urban Planning (URL 8).

Application of robotic technology with timber has been giving numerous outstanding examples. Another mind blowing example is the Bubble Pavilion, which was constructed at the Higher Technical School of Construction Engineering at the University of Seville. The pavilion was only cut from plywood panels by utilising computational parametric design and computer aided manufacturing tools. The form is a self-supported vault formed from bubble-shaped hexagonal cells (Figure 12).

Figure 12: The project undertaken by Roberto Narváez at the University of Seville (URL 9).

3.2. From Parametric To Kinetic Design

Kinetic architecture took the conventional ways of building, from manual art-crafts, to mechanical thinking and to embedding intelligent systems into far technological ways of building. Ramzy and Fayed (2011) divided the development of kinetic architectural applications into four stages. These are,

- ❖ Primitive kinetic systems (pre-industrial revolution),
- ❖ Premature kinetic systems (industrial revolution),
- ❖ Developed kinetic systems (twentieth century),
- ❖ Advanced kinetic systems (the age of artificial intelligence).

Also they divided modern kinetic architecture into three categories depending on the system configuration: deployable kinetic structures, dynamic kinetic structures and embedded kinetic structures. Megahed (2016) focused on

the questions an architect might ask during the process of a kinetic design and concluded that the application of a novel design approach into a kinetic design had five strategies in order (Figure 13).

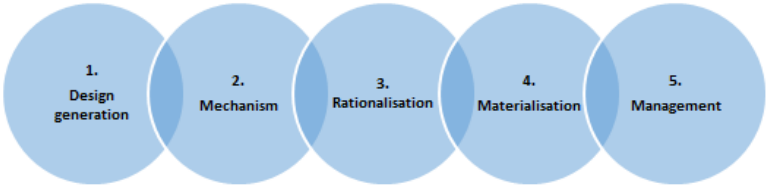

Figure 13: Five design strategies of kinetic architecture (Megahed, 2016).

Design generation is the base of architectural thinking. Mechanism investigates how the technological aspects and mechanisms support the design idea. The rationalisation concerns the justification and evaluation of the entire design and the representation status. The materialisation concerns the accurate and appropriate development of design and its process. The management is a process that deals with the entire construction period as well as the maintenance and lifecycle cost of a kinetic design (Megahed, 2016).

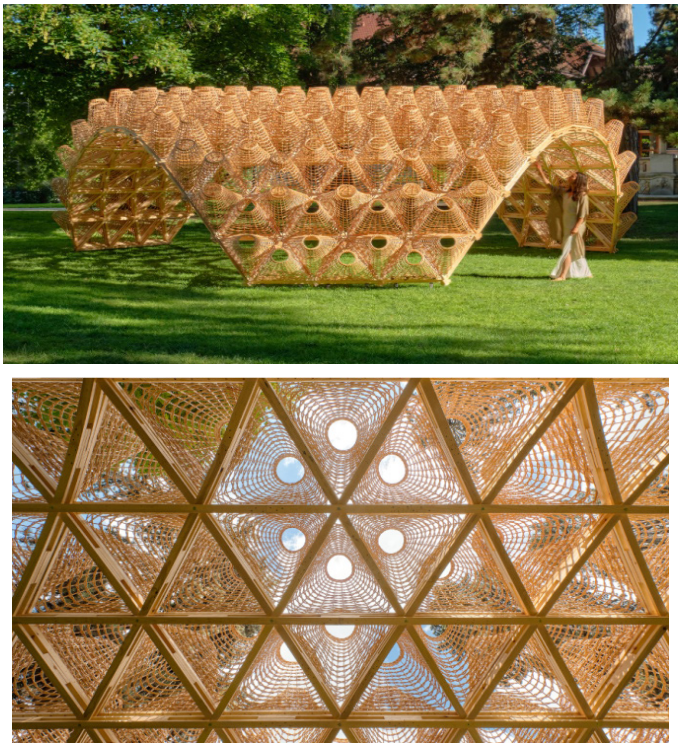

Figure 14: The Wicker Pavilion (URL 10).

Timber has a great potential at coupling with geometry. Gyroid is almost the ultimate example of stacking timber with the machinery support of digital design and robotic construction. Similarly, origami has a sense of kinetic in architectural design. Rigid origami structures, i.e. foldable surfaces, have clear rules of shape that can remain as it is or move as deployable structures depending on the need of the environment, the need of larger volume or vice versa, the change of the function etc. Osorio et al. (2017) studied the rigid origami architectural geometry and defined them in three groups: static structures, deployable fixed structures and deployable kinetic structures. Nevertheless, all to give the sense of kinetic and has potential to display transformable architectural solutions. The Wicker Pavilion, designed by Didzis Jaunzems Architecture, uses simply 262 wicker baskets to shade a timber shell, which is static as a vault but the lightness gives the kinetic feeling (Figure 14).

4. Kinetic Facades

"Associating the term *kinetics* with a building may seem absurd because the building has always given the idea of fixity, but certainly it refers to a new way of conceiving architecture", as Santina (2018) stated. Kinetic in architecture refers to "...movement of some parts of the structure without affecting the stability of the building". Kinetic facade with high performance means a facade system that adapts optimally to the environmental inputs in a very efficient way. High performance kinetic architecture is a rising design trend that becomes a paramount criterion at achieving a sustainable, communicative and energy efficient building design (Megahed, 2016). Today, there are examples of smart-kinetic designs. "Kinetic architecture seeks to incorporate collective creativity beyond individual disciplines" as Paio (2017) stated.

Kinetic design on facades is a type of responsive skins of buildings. This involves skin design, mechanism design and the test of integration process, which should be considered from the beginning of the architectural design. Kinetic design on facades is preferred largely based on the environmental weather conditions, daylight needs, or the possible user adjustments (privacy, scenery etc.) (Tabasi and Banihashemi, 2022). Multi-objective optimisation approach is also applicable to kinetic facade design in terms of testing the dynamic operations, sizing of the shading material, positions on facade, and so on (Kim and Clayton, 2020). Today, multi-objective optimisation is an unavoidable part of computational design. Because, architects and engineers

need to understand whether the design would work as expected and what results it could give if the kinetic design concerns environmental issues. From the engineering perspective, structures that are capable of counteracting the forces with transformation in shape or redirecting the load path are deemed adaptive structures. Therefore, adaptive structures are beyond the kinetic structures and adaptive structures equipped with learning interfaces – deep learning – which enable them to anticipate the external changes and then to decide the reaction are intelligent structures (Senatore, 2018). For example, as a simple example, a coffee store of 10sqm has a facade that moves upwards on one side with 49 robotic metal arms. The project was completed in 2019. The mechanism behind the moving facade is shown in Figure 15.

Figure 15: A coffee store by LAAB Architects in Hong Kong (Harbour Kiosk, 2019).

As Johnsen and Winther (2015) wrote, the static glass facades give low performance considering the environmental changes during the year. The development of the dynamic facade system emerged from the necessity to provide better optimised performance during the whole year and the lifetime energy consumption costs. A dynamic facade system ensures better energy and cost performance depending on the changes of the exterior climatic conditions. Johnsen and Winther (2015) also referred to the development from the dynamic to intelligent facade systems that can decrease the total energy need by half. Sheikh and Asghar (2019) also investigated a proposal of a dynamic facade on a tall structure and concluded that the total energy load can be decreased by 32%. These studies highlight how significant it is to design the facades of buildings according to the contemporary developments in kinetic design.

Timber is naturally kinetic too. Three students' laboratory research (Nan et al., 2020) at the University of Virginia, School of Architecture, showed that hygroscopic behaviour of timber can be useful at creating a hygro-sensitive kinetic facade as their research title "*Hygrosensitive Kinetic Facade: A full-scale meteorosensitive shading system based on wood's self-actuated hygroscopic behavior*" received multiple awards from academy as well as the private sector. Maple-spruce bi-layered plywood were built as wavy rows for sampling and tested under various humid environment and the moisture content results were compared and the relative behaviour as well. Extending and shrinkage behaviours were as shown in Figure 16.

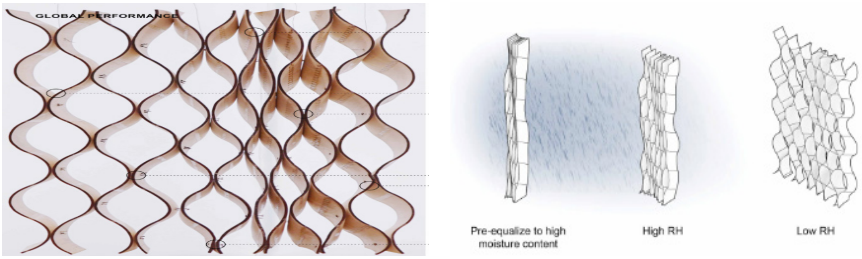

Figure 16: The research of Zhenfang Chen, Liwei Liu, and Mingyue Nan on Hygrosensitive Kinetic Facade (Nan et al., 2020).

5. Conclusion

Timber has long been a nature friendly and also user friendly material. With the latest development in the world of designers, it also has become a digital design friendly material since it can be formed in any shape and

fabricated with any small detail. All these are achievable with the emergence of smart design and smart manufacturing tools and software. Researchers and architects put timber as material in the first place particularly when it is about to design an unconventional structure, facade or roof. Additionally, the attitude from being static has changed to being kinetic in terms of gaining the ability to move depending on the environmental features input. The paper aimed to highlight the potential timber has and the possibility of the future parametric and kinetic design with timber. It is hoped to raise excitement for the researchers, young architects and designers to prefer timber to design a state-of-art project by introducing a few of the interesting examples built in timber.

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CHAPTER XI

ARTISTIC GLASS AND CERAMIC PANEL IN ARCHITECTURE, EXAMPLES ON THEIR USAGE AND APPLICATION

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1. Introduction

Glass, in its most general definition, is called a product or structure that is formed by combining inorganic materials (such as silica, soda, limestone) within a certain recipe, and cooling in a controlled manner after reaching certain fluidity with a certain temperature. German scientists refer to glass as "a liquid super-cooled physico-chemically". The definition of "super-cooled liquid" for glass is also seen in the definition by materials engineers. Chemists, on the other hand, refer to glass as "liquid".

The known history of glass goes back to 5000 years, and in the oldest known recipes, it was roughly formed by materials such as silica, limestone and soda. With the start and use of flat and blown glass in Syria, which was a part of the Roman Empire in the 200's B.C., it spread to Europe in a short time. These glasses produced by the Romans were used in the window openings of the villas in Pompeii and Herculaneum (Schittich, et al. 2007, p.24).

The first artistic use of glass traces back to Gothic architecture in the 12th and 13th centuries. The use of colored glass in religious buildings in an orderly manner added aesthetic value to the architecture, while allowing light to enter the architectural structure.

The development of contemporary glass art, on the other hand, emerged with the idea of turning the same material into a different, original form with a new breath and touch, by moving away from the traditional structure of glass art (like master-apprentice relationship, skills, belonging to the objects, manufacturing in the traditional manner). In glass art, as in other fields, the artist considers the originality of his/her work, the feature of being the first example, and the producibility of the form he/she designed. Being able to apply a drawn design differs in glass, compared to other arts. Because the working range, attitude towards time and temperature of glass differs. The artist's involvement in the process by knowing the working range of glass as a material and its attitude in the working process would increase the level of his/her command on the material and its usability. Thanks to these tendencies and the aware behavior towards the material, the artists also create their own production styles. With the original works and designs that emerged as a result of abovementioned fact, contemporary glass art has quickly succeeded to take its place among other art disciplines.

Ceramic is expressed as a product or structure that emerges as a result of the combination of materials in certain proportions and with certain plastic values, shaped and fired with various methods and techniques. If an object is shaped as powder or mud, then baked, and if it gains strength without changing its original shape, this technology is called ceramic (Sayar, 2017, p.1) The production, art, science and technology as a result of subjecting the inorganic materials existing in nature to a production process are also called ceramics. Ceramic making emerges in different productions and forms for the benefit of humanity in the process from the first human to the present. This understanding of production continues its development process in every age by adapting to the necessities of the time. When the application examples of the first use of ceramic art in architecture are examined, it is seen that this dates back to very old times.

Decorating architectural structures with tiles or ceramics was first used in Egypt around 3000 BC, and later in the 12th-6th century BC in Mesopotamia and Iran (Öney, n.d., p. 13). The use of tile by the Turks goes back to the Uighurs, and then passes to the Ghaznavids and the Karakhanids (Yetkin, 1986, p. 211). The glazed pottery/ceramic technique, which is understood to have been brought by the Hakanli (Karakhanid) Turks from China and Uyghur provinces, spread all over Turkestan and Sirderya (Esin, 2006, p. 13). In Islamic architecture, the first examples of it began in the 9th century

(Öney, n.d., p.13-14). It did not take long for ceramics to interact with the Turks after the bonds established with China through neighborhood, trade and marriage. With the acceptance of Islam by the Turks, its use in all religious and public buildings increased. Along with public and religious architecture, Arabic calligraphy stylized with glazed and unglazed bricks in caravanserais brought a different interpretation in terms of design application and motif values. The expression of the linear and geometric structure of the Kufic script with glazed and unglazed bricks or glazed tiles accelerated the development in this sense. It was to such an extent that the Chinese influence could be seen in the nature or figurative stylizations made by the Turks and Seljuks. This interaction changed over time within our own understanding of art by embracing a different trend.

The development and modernization in the application of glass and ceramic art after the Republic opened a new era in Turkish ceramics and glass art. The fact that glass and ceramic art panels have been used frequently in the interior and exterior areas of architectural structures is an indication that these branches of art have now gained a serious momentum. This acceleration has created a great space for itself with the rapid change and development in the hotel and accommodation sector, with the growth of the tourism sector, along with the increase in social structures, and the inclusion of structures such as cultural centers, religious buildings, and large company buildings in the urban architecture. Thus, these branches of art have taken their place in the interior and exterior spaces of modern architecture with missions such as aesthetics and functionality.

2. Processes for Structural and Artistic Practice in Architecture

With the beginning of the structural construction in the architectural structure, the determination of the artistic area should start. Artistic applications to be made on the architectural structure in our country can never be realized during the creation of an architectural project. Although the architectural group displays any area as an art panel application area in the visual project, this is never a matter of attention during the construction of the building. The idea underlying this reason is that a problem that will not constitute a general problem in the mechanical and static evaluations of the building can be resolved after construction in any case. This constitutes a big problem when it is decided to build the art panel after the completion of the architectural structure. This has

become a common occurrence. During the rough construction of the area where the artistic application would be made, elements such as the mechanical and static project, the dilatation area, and the vibration range that would occur in the building should be taken into account, and the area processing and determination should be made. Otherwise, it would be inevitable for the artwork to be applied to cause problems in the post-assembly periods. Another obstacle is that due to the problems that have not been resolved before in the area where the project would be implemented, either the construction production of that area is to be done again or the cancellation of the project would come on the agenda. In the artistic panel applications planned to be made in architecture, the architectural application group and the artist should be in constant contact and carry out the process together.

3. The Relationship between Formality, Functionality and Aesthetics in Art Panels Applied in Architectur

Along with the efforts to search, find and define the beautiful since the Antiquity, aesthetic/art descriptions have been made conceptually and theoretically on a large scale. The concept of social taste, which derives from human's all senses and includes satisfaction and benefit, diverges from physical satisfaction and benefit over time, creating a different field of appreciation under the name of "aesthetics", produced by the imagination dominated by emotions (Ünal, 2021, p.197).

When the art of ceramics and glass is considered in terms of formality and functionality, aesthetics as a third element, i.e. the feeling of looking beautiful appear as an inseparable part. It is seen that both art fields are often stuck in the art-craft dilemma in terms of production techniques and methods. Glass and ceramic as disciplines, have a characteristic transmitting knowledge, skills and techniques that support each other in traditional, modern, cultural, abstract, concrete and industrial terms. In this case, the common stakeholder of formality and functionality in glass and ceramic art should be aesthetics. Thus, in glass and ceramic arts, formality, functionality and aesthetics are phenomena that cannot be separated from each other. In addition, even in all products designed in the field of industrial glass and ceramics, whose main purpose is functionality, formality and aesthetic value judgments are always at the forefront even at the design stage.

4. Artistic Surface Applications in Architectural Buildings

A building, in its simplest definition, is a simple sheltering area built by the first human in accordance with the conditions of the geographical texture, with the concern of sheltering, protection and isolation from other areas. This structuralization process has progressed positively with human beings, and the structures have shown differences in every period and geography. Over time, human beings have begun to make aesthetic touches to the area they live in, the architectural structure and the social environment. Although there are different reflections under this desire to decorate and glorify, embellishing as a practice also reflects the tendency to see and show the living space beautiful.

The association of space and art panels in city architecture also feeds the sense of belonging to the city where space and art are located as a means of cultural interaction. It is of great importance in creating collective and urban memory in the human-city, human-space relationship. Especially glass and ceramic art panels applied in architectural structures in public spaces turn into an interaction that the residents of the city are aware of. When the name of the building is mentioned, the effect of the artwork, which is identified with the building, on people reinforces the person's sense of belonging to the city. Art moved to public spaces, with the expansion of its borders, leads the artistic experiments and actions of people who have just started this business. Thus, the artist takes place at the center of the artistic communication, artistic interaction and sharing process with his/her activity. In terms of the relationship between the artist, the work and the audience, there is an interaction in a different dimension. People from all walks of life take the place of the audience in the art gallery, causing radical changes on the audience.

This approach paves the way for bringing the art down to the public, and enables the creation of a different museology idea. The works made public with this logic, and the opening of this free circulation path between the viewer and the work accelerates the emergence of a new understanding of gallerism.

5. Relationship between Architectural Structure and Artist

An artist is a person who has the ability to interpret and transform phenomena, events, thoughts, expressions or concepts that we see or cannot see, perceive or cannot perceive, into an abstract or concrete work, with his/her own aesthetic, thought and point of view in his/her inner world.

Events, facts, positive or negative situations in social life have always been the subject of material for these people with high sensitivity and awareness, who are one step ahead in all reactions of the society. This point of view and behavior may vary in some projects. The artist ceases to be the sole decision maker in the process of artistic designs and reproductions in architectural structures and public spaces. In the background of this lies the effect of the artist's sense of responsibility towards the geography, architectural structure, public space and the audience. Before anything else, the artist and the space fuse with each other. This fusion and coalescence forms the basis of the physical and conceptual relationship that the work would form with the architectural structure. In addition, there is a constant interaction of knowledge and ideas between the architectural group that designed the architectural structure and the artist, and the aesthetic and conceptual bond that this work would establish with the entire architectural structure is of great importance.

The artist, who started to design a work in an architectural structure, designs the work, first of all, by analyzing many instruments such as the physical conditions of the area, static values, scaling in the right proportion with the space, the space-work-audience relationship to be established in the area, the integrity of perception, the correct light direction determination, and the correct orientation in the space. Since the designed work would ultimately be a part of the architectural structure, the artist should create a sense of belonging to the building in the work. At the design stage, the artist would convey the socio-cultural and artistic message he/she wants to convey in the work, along with all these ties.

When we look at the relationship between architectural structure and art in our country, the collective memory of people about the architectural structure increases the quality of being permanent due to the effect of art on visual memory. In today's Turkey, glass and ceramic panel applications in architecture have been frequently encountered in public buildings, universities, private residences, religious and social structures, hotels and public areas.

6. Glass Panel Application Process and Examples Regarding Artistic Use in Architecture

When it comes to artistic glass panels planned to be made in architectural areas, everything should be planned down to the last detail from the design process to the end of the application. One of the most effective factors in this planning is the transparency of the glass material. This transparency greatly

affects the perception of the artifact. Thus, attention should be paid to the light reflections that would occur on the surface of the design or the glass color to be chosen, and the color transitions reflected on the work in the area where it is exhibited. All light reflections and color transitions change the perception about this work. There are different coloring and application methods at the point of creating works with glass material. The artist can use the glass material transparently and color it after the firing process, as well as create works with colored glass material. Apart from these applications, he/she can also make coloring by applying coloring materials (paint, oxide, transfer material) between two transparent glass materials. In these applications, coloring is closely related to the use of artifact creation technique.

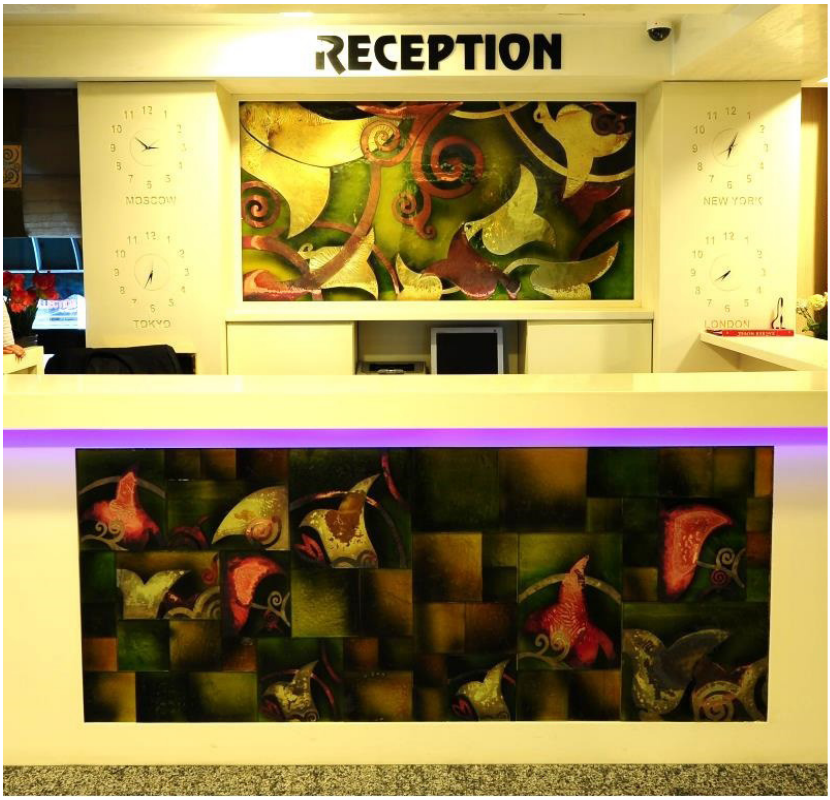

Figure 1. Fusion Technique Application Example (Kamuran Karaağaç Archive)

Figure 2. Fusion Technique Application Example (Kamuran Karaağaç Archive)

The work in Figure 1 and 2 has been produced with the application method called fusion technique. The project was applied in the reception area and lobby of a hotel in Laleli, Istanbul

Figure 3. Fusion Technique Glass Panel Ceiling Application Example (Kamuran Karaağaç Archive)

Figure 4. Fusion Technique Application Example (Kamuran Karaağaç Archive)

The project in Figure 3 and 4 has been created with the application method called fusion technique. This project was used in the spa section of a hotel in Belek region of Antalya. In these applications, a design was created by using some metals (copper, brass) within the fusion technique. Coloring was done after the firing process, and the dyes used are fixed with photo treatments.

Figure 5. Example of Application for the Pattern Molding Technique (Kamuran Karaağaç Archive)

In the application seen in Figure 5, pattern molded surface, which is one of the application areas in the fusion technique, was used. In this form of application, molds, which we call auxiliary materials and which have an important place in the transfer of the texture that gives the work its visual quality, are used. These molds also vary according to the way of use and application. This application was used in the spa section of a hotel in Belek region of Antalya.

Figure 6. Detail from the Example of Pattern Molding Technique (Kamuran Karaağaç Archive)

All the details on the mold surface are transferred to the work in the application form and techniques made on this type of mold surface. Mold preparation process has an important place in these applications. A deformation or unwanted details that would occur on the mold surface are transferred onto the work after the firing process.

Figure 7. Mixed Technique Glass Panel
Application Example (Kamuran Karaağaç Archive)

This work, which was produced with a mixed application technique, was applied in the suite of a hotel in Belek region of Antalya. This type of technique is an application method that allows operations such as adding, removing and reshaping on glasses with special components that allow working with open flame.

In this method, the thermal expansion coefficient of the glass subjected to work should be very low and the shock resistance should be high. In this working principle, glass, subjected to an open heat source directly or by softening, can give different reactions. The attitude of the glass here is closely related to the structure that makes up the components in it. In this project, several production methods and applications such as fusion, hot glass blowing, and buckling are performed.

Figure 8. Mixed Technique Glass Panel Application Example Detail (Kamuran Karaağaç Archive)

7. Ceramic Panel Application Process and Examples Regarding Artistic Use in Architecture.

When we look at the methods of applying art in architecture, there are many similarities in artistic ceramic panel and glass applications. In this process, the general frameworks and disciplines of the ceramic material for operation, logic and application show similarity with the glass material. When we look at the essence, ceramic material has its own preparation, production and assembly processes as in glass. When these processes are examined, in fact, as in all production processes, we encounter rules and restrictions depending on the material used.

Figure 9. Mixed Technique Ceramic Panel Application Example (Kamuran Karaağaç Archive)

The beginning of the artistic ceramic panel design process begins with the scaled up drawing and coloring of technical and artistic drawings on the paper surface. Then, it is placed on the three-dimensional space in the computer environment and its appearance in the space and its relationship with the building are examined. Evaluations and studies are carried out on subjects such as the color, form, aesthetic and conceptual bond that the work establishes with the architectural structure, and the message it wants to convey.

As in the example of the artistic ceramic panel, which we applied in Figure 9, care has been taken to preserve the color, shape and plastic values from the design to the finished work. The work was created with a mixed technique application method called mixed-media. In the panel, three-dimensionally shaped and painted glass compositions, replicas of original manuscripts that we applied with a special printing method on wood, relief textures made by free style forming, and ceramic tile compositions, each of which is a separate design, are included. Small compositions that seem to be independent of each other form the design by showing a unity throughout the panel. Each small unit forms a large but distinct whole in total. This project was applied to the library entrance foyer area in the public university in Istanbul, Göztepe.

Figure 10. Detail of Application Example of Mixed Technique Ceramic Panel (Kamuran Karaağaç Archive

Figure 11. Detail of Ceramic Panel Application Example Project (Kamuran Karaağaç Archive)

The ceramic panel applications seen in Figure 11, 12, and 13 are details from a large-scale project we completed. The project was applied outdoors in Keçiören District of Ankara province and the wall height is 6 meters on average. Outdoor assembly of the panel was made using chemical dowels and U-bolts. In areas where human traffic is intense, attention should be paid to installation

in such projects in order to prevent ceramic pieces from falling and accidents from occurring. The ceramic adhesive material to be used in the assembly must maintain its strength and elasticity in outdoor hot and cold weather conditions and in cases where temperature differences are experienced day and night. Such materials should be flexible as content, and they should have a high load-bearing ability both horizontally and vertically

Figure 12. Detail of Ceramic Panel Application Example Project (Kamuran Karaağaç Archive)

Considering the problems to be experienced after the application in outdoor projects, attention should be paid to the assembly and assembly area preparation stages. Many factors such as all kinds of climatic conditions, day and night temperature differences of the region, strength of the application wall, application time and interval should be reviewed. It is also important that the work is durable and permanent against time and all conditions for a long time after the application, as well as its creation.

Figure 13. Detail of Ceramic Panel Application Example Project (Kamuran Karaağaç Archive)

8. Conclusion

The use of ceramic and glass materials in all areas of architectural structures shows the diversity and accessibility of the material. One of the important factors in the use of these two materials is their preferability. There are many reasons and desires under this preferability. The shaping of these materials, which we have touched at every point of our lives for centuries and allowed to enter our living spaces, reaching the desired form, and turning them into works in terms of artistic and aesthetics, stems from the success of the artists in the creative process. In this study, the development process of ceramic and glass materials is mentioned with their definitions. Along with the working processes for structural and artistic application in architecture, the subjects of formality, functionality and aesthetics are included in the art panels applied in architecture. In the surface applications in architectural structures, the desires and tendencies of mankind from the first structuralization tendency to aesthetics, form and decoration are explained. The effects of the work of art on the urban culture and its practices on the people who share the city are interpreted from an artistic point of view.

The progress of the relationship between the architectural structure and the artist in the right direction contributed positively to the artist's creation of a work of art. Examples of glass and ceramic panels that we applied in architecture are given.

While the fact that glass and ceramics can be processed and easily shaped as materials and their acceleration towards modernization with their traditional structure is explained, the efforts of our artists to carry this tradition into the future are also conveyed. These efforts have an important place in the modernization of glass and ceramic art and its spread to the world.

Along with the contributions of the glass and ceramic panels we made to the contemporary urban culture, the sense of belonging in the individuals who share the urban culture and create a common living space is also mentioned. In the trilogy of architectural structure, human and work, interaction, communication and creating practices also contain all the messages that the artist wants to give. The artist's transfers from tradition to the future by processing a material such as glass and ceramics demonstrate his/her attitude and ability to reach the dimension of universality from tradition.

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Figure: 1-13 Kamuran Karaağaç Kişisel Arşivi.

CHAPTER XII

A CONSERVATION PRINCIPLES-BASED ANALYSIS OF HISTORICAL BUILDINGS FUNCTIONED AS MUSEUMS

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1. Introduction

Historic buildings are locations that serve as a physical representation of the various civilizations' lifestyles, ideologies, aesthetics, and technological potential that have coexisted throughout history. Historical settings and structures retain the information necessary to preserve the past and guarantee cultural continuity by bringing the past into the present and the future in a world that is changing rapidly. Although historical buildings, which are considered to be architectural heritage, are reused as a result of economic, social, and cultural changes, ensuring the movement of the historical texture, the quality of these applications represents an important parameter for the quality transformation of the built environment. In this regard, a topic that has received a lot of attention recently is the components to be taken into account in the design of buildings to be created in the historical setting, as well as how the design criteria and procedures should be.

The evolution of historical environments has always occurred concurrently with the development of society. Every civilisation has created habitats that

reflect its own culture, worldview, and way of life, or it has decided to alter the environments it has lived in in response to the changing situations over time. The institutions and customs that evolved based on previous eras' lifestyles no longer have a place in modern life as a result of the social, economic, and cultural changes brought on by this movement in societies. On the other hand, modern activities and technological advancements have created new needs that necessitate the reorganization of outdated structures. Due to all of these changes, it has become necessary to build new structures within the historical context of existing structures, or to add to existing historical structures that still hold the marks of the past.

The purpose of the study is to examine how historical structures that were formerly utilized for a variety of purposes are being transformed into museums within the framework of generally accepted conservation guidelines provided by conservation science. First, in this context, the principles in international regulations and by-laws regarding the re-use of historic buildings and new additions to historic buildings have been identified, and in this context, a brief analysis of the approach of the by-laws to the problem of re-use and modern additions has been made in the historical process. With reference to international conservation texts and a reading of 8 examples that were built for various uses but are now used as museums, the guidelines and maxims to be adhered to in the reuse of historic buildings as well as the relationship between the historic fabric and the additions have been determined.

2. Contemporary Annex Concept in Historical Buildings According to International Texts

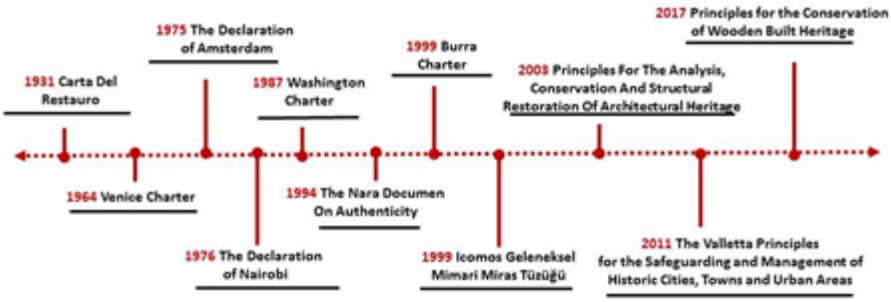
The conservation of historic buildings, which are among the most important representatives of cultural heritage, requires the preservation of physical and spiritual values and their transfer to the future (Feilden, 2003). Re-functioning and contemporary addition, which is one of the most frequently used conservation methods today, is accepted as the most effective way to ensure the sustainability of existing historic buildings (Ball, 1999, Kohler, 1999, Douglas, 2002). In this context, attention should be paid to the preservation of the architectural, social, cultural and historical values of the building (Latham, 2000), and the building should be preserved holistically with the urban texture and all the artificial and natural elements it contains (Stubbs, 2004). Voordt and Wegen (2005) also

mention that the environmental factors of the historic building and its context play a very important role in the shaping of the new building design.

Madran (2006) stated that the designer should analyze the existing environment very well when designing in a certain environment that has been formed before him/her; and that today's technology and materials should be used with an attitude that always gives importance to environmental value and that imitation of the old should be avoided. Design in historical texture is not a one-dimensional phenomenon and comprehensive studies should be carried out on it (Büyükmıhçı, Kılıç, 2015). In this context, it is very important to read the messages conveyed by cultural assets correctly in both holistic solutions and single building scale examinations and to shape contemporary design according to this reading (Asatekin, 2004). A transformation within the scope of re-functionalization provides a great advantage economically as well as enabling a building that has lost its function or has remained idle to participate in social and cultural life (Bullen and Love, 2010). In some cases, the building even becomes a landmark of the city and constitutes an important transformation point (Mısırlısoy, 2017).

The problem of re-functioning and contemporary addition is a field of knowledge that has been discussed by many experts from the past to the present, with many changing definitions and many principles. This is part of the scope of protecting cultural assets that carry important references from history and transferring them to the future. The significance of historical environments and the necessity of their protection have been acknowledged in this context, particularly in the 20th century. International studies and meetings on this topic have been organized, and as a result, documents, principles, and decisions have been produced in a way that allows each culture to implement them directly or by interpreting them. Numerous conservation standards have been established for the design of new structures in historic settings in the legislative rules. The principles and criteria established on the subject of new building-contemporary addition in historical environments have been compiled in a certain order to support the subject of the study in the documents discussed in this section, which have significantly contributed to the development of contemporary conservation theory (Table 1).

Table 1. Timeline of the Statutes and Declarations covered in the study



The issue was first addressed in the Carta Del Restauro of 1931, and in articles seven and eight, it was pointed out that contemporary additions should be different from the original, should be designed in a precise and clear manner, and it was especially emphasized that they should not be misleading (Carta Del Restauro, 1931). In the 1964 Venice Regulations, it was emphasized that the monument should be considered together with its surroundings, that repair is a work requiring expertise and should be based on reliable documents. The most fundamental principle is that the addition should bear the characteristics of its time and not damage the original structure (Venice Charter, 1964). The relevant principles in the international texts such as the 1975 Amsterdam Declaration, 1976 Nairobi Declaration, 1987 Washington Charter, 1994 Nara Certificate of Authenticity, 2003 Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage, 2011 Valetta Principles for the Conservation and Management of Historic Towns and Urban Areas, and 2017 Principles for the Conservation of Wooden Architectural Heritage are given in tabular order (Table 2).

Table 2. Principles on Repurposing and Contemporary Annex in the Statutes and Declarations covered in the study

International Agreements, Declarations, Regulations on Protection	**The Athens Charter for the Restoration of Historic Monuments (1931)**	
	Article 2.	Proposed Restoration projects are to be subjected to knowledgeable criticism to prevent mistakes which will cause loss of character and historical values to the structures.
	Article 5.	Modern techniques and materials may be used in restoration work.
	Venice Charter (1964)	
	Article 6.	The conservation of a monument implies preserving a setting which is not out of scale. Wherever the traditional setting exists, it must be kept. No new construction, demolition or modification which would alter the relations of mass and colour must be allowed.
	Article 9.	The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp. The restoration in any case must be preceded and followed by an archaeological and historical study of the monument.
	Article 12.	Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.
	Article 13.	Additions cannot be allowed except in so far as they do not detract from the interesting parts of the building, its traditional setting, the balance of its composition and its relation with its surroundings.
	The Declaration of Amsterdam (1975)	
		Afford functions to buildings which, whilst corresponding to the needs of contemporary life, respect their character and ensure their survivaL
	The Declaration of Nairobi (1976)	
	Article 24.	Where safeguarding plans exist urban development or slum clearance programmes consisting of the demolition of buildings of no architectural or historic interest and which are structurally too unsound to be kept, the removal of extensions and additional storeys of no value, and sometimes even the demolition of recent buildings which break the unity of the area, may only be authorized in conformity with the plan.

	Article 28.	Particular care should be devoted to regulations for and control over new buildings so as to ensure that their architecture adapts harmoniously to the spatial organization and setting of the groups of historic buildings. To this end, an analysis of the urban context should precede any new construction not only so as to define the general character of the group of buildings but also to analyse its dominant features, e.g. the harmony of heights, colours, materials and forms, constants in the way the facades and roofs are built, the relationship between the volume of buildings and the spatial volume, as well as their average proportions and their position. Particular attention should be given to the size of the lots since there is a danger that any reorganization of the lots may cause a change of mass which could be deleterious to the harmony of the whole.
	The Washington Charter (1987)	
	Article 8.	New functions and activities should be compatible with the character of the historic town or urban area.
	Article 10.	When it is necessary to construct new buildings or adapt existing ones, the existing spatial layout should be respected, especially in terms of scale and lot size.
	The Nara Document on Authenticity (1994)	
	Article 9.	Conservation of cultural heritage in all its forms and historical periods is rooted in the values attributed to the heritage. Our ability to understand these values depends, in part, on the degree to which information sources about these values may be understood as credible or truthful. Knowledge and understanding of these sources of information, in relation to original and subsequent characteristics of the cultural heritage, and their meaning, is a requisite basis for assessing all aspects of authenticity.
	Charter on the Built Vernacular Heritage (1999)	
	Article 2. Prıncıples of conservatıon)	Contemporary work on vernacular buildings, groups and settlements should respect their cultural values and their traditional character.
	Article 5. (Guidelines in practice)	Adaptation and reuse of vernacular structures should be carried out in a manner which will respect the integrity of the structure, its character and form while being compatible with acceptable standards of living. Where there is no break in the continuous utilization of vernacular forms, a code of ethics within the community can serve as a tool of intervention.
	The Burra Charter (1999)	
	Article 15.2	Changes which reduce cultural significance should be reversible and be reversed when circumstances permit.

	Article 15.4	The contributions of all aspects of cultural significance of a place should be respected. If a place includes fabric, uses, associations or meanings of different periods, or different aspects of cultural significance, emphasizing or interpreting one period or aspect at the expense of another can only be justified when what is left out, removed or diminished is of slight cultural significance and that which is emphasised or interpreted is of much greater cultural significance.
	Article 21.1	Adaptation is acceptable only where the adaptation has minimal impact on the cultural significance of the place.
	Article 21.2	Adaptation should involve minimal change to significant fabric, achieved only after considering alternatives
	Article 22.1	New work such as additions to the place may be acceptable where it does not distort or obscure the cultural significance of the place or detract from its interpretation and appreciation.
	Article 22.2	New work should be readily identifiable as such.
	Article 23.	Continuing, modifying or reinstating a significant use may be appropriate andpreferred forms of conservation.
	Principles For The Analysis, Conservatıon And Structural Restoration Of Archıtectural Herıtage (2003)	
	Article 3.9	Where possible, any measures adopted should be "reversible" so that they can be removed and replaced with more suitable measures when new knowledge is acquired. Where they are not completely reversible, interventions should not limit further interventions.
	Article 3.10	The characteristics of materials used in restoration work (in particular new materials) and their compatibility with existing materials should be fully established. This must include long-term impacts, so that undesirable side-effects are avoided.
	The Valletta Principles for the Safeguarding and Management of Historic Cities, Towns and Urban Areas (2011)	
	Article 4.b	The introduction of new activities must not compromise the survival of traditional activities or anything that supports the daily life of the local inhabitants. This could help to preserve the historical cultural diversity and plurality, some of the most valuable elements in this context.
	Article 4.c	When it is necessary to construct new buildings or to adapt existing ones, contemporary architecture must be coherent with the existing spatial layout in historic towns as in the rest of the urban environment. Contemporary architecture should find its expression while respecting the scale of the site, and have a clear rapport with existing architecture and the development patterns of its context.

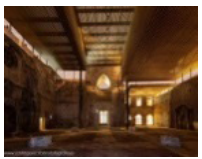
	Principles for the Conservation of Wooden Built Heritage (2017)	
	Article 11.	Interventions should preferably: a be the minimum necessary to ensure the physical and structural stability and the long-term survival of the structure or site as well as its cultural significance; b follow traditional practices; c be reversible, if technically possible; d not prejudice or impede future conservation work should this become necessary; e not hinder the possibility of later access to evidence exposed and incorporated in the construction; f take environmental conditions into account.

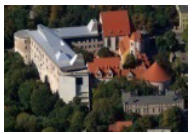
3. Evaluation of The Identified Examples in The Context of Conservation Principles

In order to make an objective evaluation in the context of conservation principles, eight buildings that were built in different geographies, cultures, climates, functions and times but were converted to the same function were selected. In the sample examinations within the scope of the research, eight buildings that were originally built to meet different functions and used as museums within the scope of re-functionalization were identified. While the selected examples were re-functionalized as museums, contemporary additions were designed with different design approaches, and a table was created to identify the selected examples in terms of exhibiting different approaches in different countries, and in this context, the name of the building, its photograph, location, information about the architect or architectural office that designed the transformation and contemporary addition design were included. In the table, the function of the original building and the period/year of construction are indicated, and the dates of the transformations it underwent within the scope of reuse are also noted (Table 3).

As a study methodology, the changes that the selected examples have undergone in the historical process and the approaches in contemporary annex design are presented. The contemporary designs were evaluated based on the rules and mottoes established according to the aforementioned statutes and declarations and are shown in a table at the end of the chapter (Table 4).

Table 3. Statutes and Declarations covered in the study Timeline

	Sample Buildings	Name	Location	Architect	Construction Year	Trans. Year	Orig. Function	
1		**Jan Cremer Museum**	Enschede Netherlands	Rem Koolhaas SeARCH team	1907	2011	**Cotton Storage**	**MUSEUM**
2		**Monastery Of San Juan Cover**	Burgos, Spain	(BSA) José Manuel Barrio	11th c	2015	**Monastery**	
3		**Orsay Museum**	Paris, France	Victor Laloux ACT architecture group	1900	1986	**Station**	
4		**St. Mary's Medieval Mile Museum**	Kilkenny, Ireland	McCullough Mulvin Architects	13th c	2017	**Church**	

	Sample Buildings	Name	Location	Architect	Construction Year	Trans. Year	Orig. Function	
5		**James Simon Gallery**	Berlin, Germany	David Chipperfield Architects	19th c	2001-2016	**Museum**	
6		**Zeitz Mocaa**	Cape Town, South Africa	Heatherwick Studio	1921	2011-2017	**Grain Silo**	
7		**Zibo**	China	Archstudıo	1943	2015	**Factory**	
8		**Moritzbu G Museum**	Halle/ Germany	Fuensanta Nieto Enrique	15th c	2008	**Castle**	

3.1. Jan Cremer Museum

The Jan Cremer Museum was built in 1907 for the storage of cotton bales at the intersection of main arteries right next to the train tracks in Enschede, the Netherlands (Figure 1). In 1973, after the bankruptcy of the textile mill, it fell into disrepair and was damaged by a fireworks explosion in 2000 (URL 1). It is one of the few industrial buildings that survived the explosion and has gained monument status as it is the only building that carries the memory of the region (URL 2). In 2010, Rem Koolhaas and SeARCH architects collaborated to revitalize and repurpose the building (URL 3).

Figure 1. Old and Post-Transformation Photograph of the Building (URL 4, 5, 3)

The existing floor height of 1.95 m was not sufficient for the new public function of the building and natural lighting. In this context, the architects built a new ground floor 1.5 m deeper into the ground to provide the necessary floor height for the entrance and new function (URL 2). The first floor was used as a storage room and the floor height was left untouched. The building was cut in half horizontally in the middle of the second floor and raised by 3 m, and the space in between was filled with a glass partition. At the same time, the circulation units connecting the different volumes of the building were solved with the new glass partition (URL 3). The facade design of the new addition was inspired by the cover design of Jan Cremer's best-selling book in the Netherlands, and concrete

facade elements in the same color as the bricks of the original building were used. The relief of the book cover was printed on all the slabs and mounted side by side to form the facade of the new building (URL 3, URL 5).

It is understood that the new addition was built with today's technology as stipulated in the regulations, and it is seen that it is in harmony with the original building in terms of color. The new addition was built with an approach that respects the historic structure in terms of scale and proportion, and the additions are clearly legible (Figure 2).

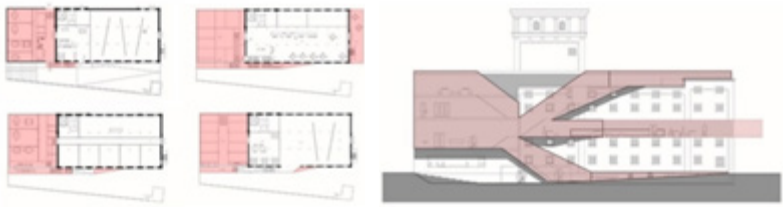


Figure 2. Plan and façade representation of the newly added building [1]

3.2. Monastery of San Juan

Outside of the old city walls, the Monastery of San Juan in Burgos, Spain, was constructed in the eleventh century (Figure 3). The building suffered considerable fire damage in the 15th, 16th, and 18th centuries as a result of wars in those eras, but the outside walls and some gothic features have endured to the present day (URL 6). The building was given a superstructure in order to conserve the remains and provide a location for cultural events, and it now serves as the Marceliano Santamaría Museum (URL 7). In 2017, the building received given the Europa Nostra Award (URL 8).

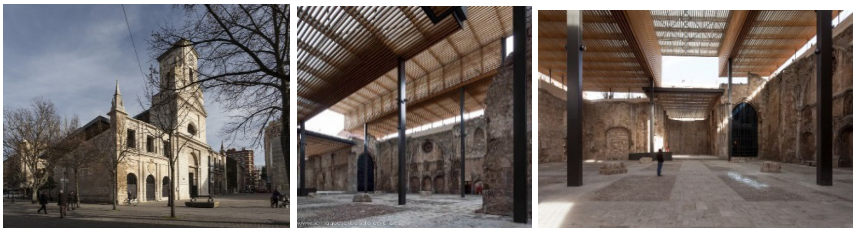


Figure 3. The upper cover built for the Monastery of San Juan (URL 6)

1 Created by editing the drawings taken from https://www.search.nl/#!content/cremer-museum and prepared within the scope of MIM 509 Buildirg Desing in Historical Cites course.

The modern superstructure was created with the intention of preserving the building's original components while also modernizing it and enabling it to operate as a museum. Prior to the design of the modern addition, a historical and archaeological assessment of the structure was completed. Its structural integrity was then examined, and the building was constructed in accordance with the findings, which were assessed by specialists from various fields (URL 7).

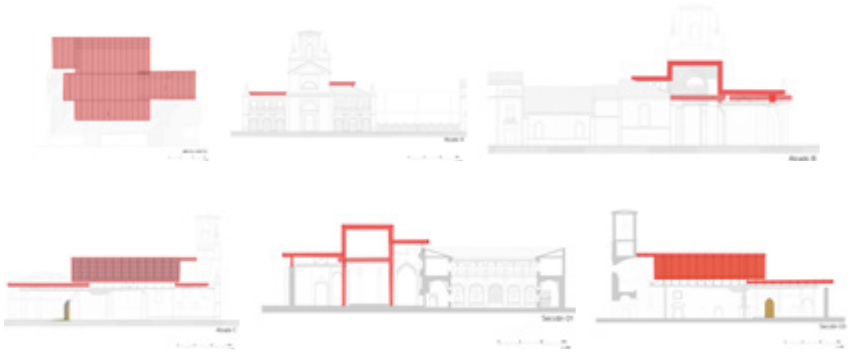


Figure 4. Plan, section and façade representation of the contemporary superstructure [2]

In the design of the roof, folded planes were designed with reference to the original three-nave plan typology of the building. In order to protect the ancient ruins, the contemporary roof cover extending beyond the boundaries of the walls was solved in a recyclable way and with minimum contact points on the building without damaging the perception of architectural remains (Figure 4). Wood, glass and steel were used in the design of the new addition, and the spirituality of the building was emphasized with the lighting design in the material combination.

3.3. Orsay Museum

The Orsay Museum, formerly known as the Gare d'Orsay, was designed by architect Victor Laloux as a train station and opened in 1900 for the opening of the Paris Universal Exposition (Kupfer Schneider, 1998) (Figure 5). Opposite the Tuileries Gardens, on the left bank of the River Seine, the complex, which included a train station and a hotel, was the main station of the south-western French rail network (URL 9). Used for 39 years as a train station, the building was later used as a prisoner collection area, ballot depot, film set, postal center,

2 Created by editing on the drawings taken from https://www.archdaily.com/783820/cubierta-monasterio-de-san-juan-bsa and prepared within the scope of MIM 509 Building Desing in Historical Cites course.

parking lot, and the hotel part was closed in 1973 (Mathieu, 1987, URL 9). In 1978, the station was recognized as a cultural heritage site, which put an end to the idea of demolishing the station and building a giant hotel (Gartner, 2007).

Figure 5. Old and new version of the Orsay museum (URL 9, 10)

The building was transformed into a museum as a result of the competition held in 1979, keeping as much of its original state as possible. It was reopened as a museum in 1986. (Devrim, 2019). ACT Architecture (Renaud Bardon, Pierre Colboc, and Jean-Paul Philippon) won the 1979 competition, preserving the key architectural features that define the building's distinctiveness, such as glass-covered ceilings, expansive halls with high floors, and imposing clocks (Devrim, 2019). The interior of the building was created by architect Gaetana Aulenti after a second competition was organized in 1980 (Yılmaz, 2014). The former station building's interior was planned by Aulenti as a series of spacious galleries with natural light coming in from the ceilings of terraces rising on either side of the main corridor (Yılmaz, 2014).

Figure 6**. Illustration of the sections added within the scope of the** functioning as a museum [3]

3 Created by editing on the drawings taken from https://www.archilovers.com/projects/19681/allestimento-interno-museo-d-orsay.html#images and prepared within the scope of MIM 506 Refunctioning Problems Of Historical Buildings course.

The gallery layout is organized on three main levels surrounding the atrium under the building's iconic glass dome, with exhibition spaces, galleries and other facilities spread across these three levels (URL 11). The architect (Balçık, Karaoğlu, Ayaz, 2022), who used stone for the walls and floors of the new additions, was criticized for the design's massive and labyrinthine rooms (Yılmaz, 2014). Although the building was criticized, it is positive in terms of reflecting the characteristics of its era and making the historical building a symbol building (Figure 6).

3.4. St. Mary's Church

William Marshal, Earl of Pembroke and Lord of Leinster, constructed St. Mary's Church in Kilkenny, Ireland, in the early 13th century (Drisceoil, Harris, Doyle, 2015). (Figure 7). The church held its final service in 1951 and was shut down six years later after being considerably restored in 1739 in accordance with its original 13th-century structure (Bradley, 2000). The building had been abandoned for several years when it was closed, and in the 1960s it was transformed into a parish hall (Integrated Conservation Group, 2005). Officials from Kilkenny City Council decided to buy the structure in 2010 and transform it into a museum (Yapı, 2019).

Figure 7. St. Mary's Church, old and new (Integrated Conservation Group, 2005, URL 12)

In the restoration works, the extensive service requirements of the new function were placed below ground while preserving the existing medieval fabric (URL 13), and the original medieval plan and spaces were reconstructed by reconstructing the passage and choir section to the north (Yapı, 2019). Until the 20th century, the museum had many important carved limestone burial sites, and with the existing stone structure and redesigned spaces, the museum has become an archaeological experiment (URL 12). True to the original medieval plan, the surviving base of the existing stone walls is separated from the old structure by a corrugated material made of lead, referencing the gray skies and stones of Ireland (Yapi, 2019). Glass partitions were made on the floor to display archaeological remains, and chains were made for the rain gutters that hang down, based on the knowledge of past cultures (Mulvin, 2020). It is seen that almost most of the standards in the statutes and declarations examined in the design of the building have been taken into consideration (Figure 8).

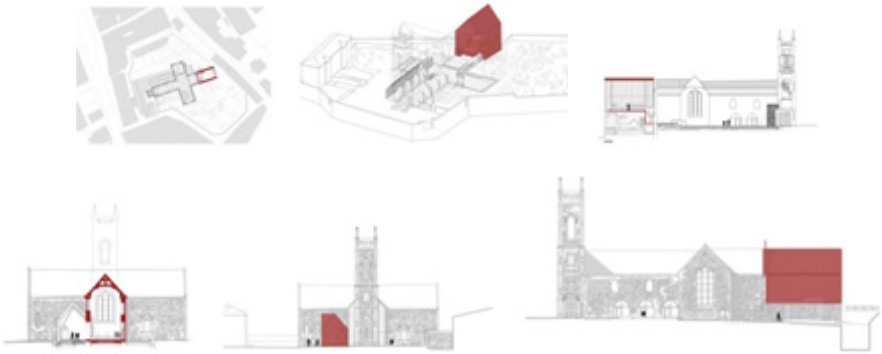


Figure 8. Illustration of the sections added within the scope of the functioning as a museum [4]

3.5. James Simon Gallery

The James Simon Gallery was designed as the entrance building on Museum Island on the Spree River in Berlin (URL 14) (Figure 9). In 1810, Prussian King Friedrich Wilhelm III's desire to create a public art collection led to the construction of the Altes Museum in 1830, followed by galleries and museums known as the Neues Museum, Nationalgalerie, Bode Museum, Pregamon Museum, and the area was transformed into Museum Island. The buildings were damaged in World War II and repaired until 1986, and in 1999

4 Created by editing on the drawings taken from https://www.archdaily.com/875457/medieval-mile-museum-kilkenny-ireland-mccullough-mulvin-architects of MIM 509 Buildirg Desing in Historical Cites course.

Museum Island was listed as a UNESCO World Heritage Site (URL 14). Designed in 2001 by David Chipperfield as the entrance to Museum Island, the building was opened in 2016 (URL 15).

The building is very important in terms of its location next to many cultural heritage elements built in different dates and providing a connection. This factor was taken into consideration in the design of the gallery and the potentials of the existing area and the urban relations between the existing buildings were important data during the design phase.

Figure 9. Photographs of the customs warehouse complex on the site of the James Simon Gallery (URL 14, URL 15, URL 16).

The building contains the foyer, auditorium and exhibition spaces that museums need, while at the same time providing access to the museums from different levels. It also creates a physical connection with the Archaeological Promenade, which connects the four archaeological museums along the Kupfergraben canal (Figure 10).

Figure 10. Representation of the relationship between James Simon Gallery and other buildings [5]

5 Created by editing on the drawings taken from https://www.beta-architecture.com/james-simon-galerie-museum-david-chipperfield/ and prepared within the scope of MİM S37 Design in Historical Texture course.

The architectural language of the James Simon Galerie is based on existing architectural elements, with the new colonnade being a modern interpretation of Stüler's colonnade, which now ends at the Neues Museum and forms a small colonnaded courtyard (URL 17). In this context, a contemporary building has been designed that reflects classical architecture in the development of details, interpreting it without imitating it.

3.6. Zeitz Mocaa Museum of Contemporary Art

The Zeitz Museum of African Contemporary Art, located in Cape Town, the capital of South Africa, was formed by the conversion of a grain silo built in 1921 (URL 19) (Figure 11). Disused since 1990, the silo was redesigned as a museum by Heatherwick Studio and opened in 2017 as a monument of symbolic importance in Cape Town's industrial and economic history (Sainani, 2022, URL 20).

Figure 11. Zeitz Mocaa Silo and Contemporary Art Center (URL 21)

The existing grain silo structure consists of two different sections. The first part consists of 42 interconnected round concrete cylinders 33 m high and 5.5 m in diameter for grain storage. The second part is the elevator tower, a 57 m high structure with a steel frame and concrete infill walls, which was once used

to hoist grain up to the silo bins (Constable, 2017). In the redevelopment design, it was decided to keep most of the building and not to demolish such a large amount of concrete.

The museum, which consists of 9 floors in total, was created by hollowing out the interior of the Grain Silo, and the galleries and atrium area in the center of the museum were designed in the space created in the middle of 42 round concrete cylinders (URL 19, (URL 22). On the roof floor of the building, there is a sculpture garden, restaurant, reading rooms and storage areas. The part that was originally an elevator tower is now a hotel. On the facade of the museum, it is aimed to revitalize the concrete facade with geometric convex glasses. The most striking negative aspect of the design is that it is very far from the principle of reversibility defined in the principles. Furthermore, the new addition needs to be appropriate in terms of mass, scale, rhythm and proportion, and the interior design of the building is controversial in this regard (Figure 12).

Figure 12. Illustration of the sections added within the scope of the functioning as a museum [6] (URL 23)

3.7. ZIBO - The Great Wall Museum of Fine Arts

Pharmaceutical production began at the demolished industrial building beyond the city center in 1943 and continued until 1980 (URL 24). (Figure 13). The factory building was relocated outside of the city as urbanization accelerated, and it remained vacant until 2014 (URL 25). After some time, artists started to frequent the building because of its large openings and distinctive texture, therefore it was decided to turn it into a museum of modern art (URL 24). Increasing human contact with the environment, bringing the factory to life, and stressing the relationship between indoor and outside spaces are all part of Archstudio's 2015 design concept, which was the basis for this project (URL 24).

6 Created by editing on the drawings taken from https://www.architecturalrecord.com/articles/13122-zeitz-mocaa-by-heatherwick-studio and prepared within the scope of MİM S37 Design in Historical Texture course.

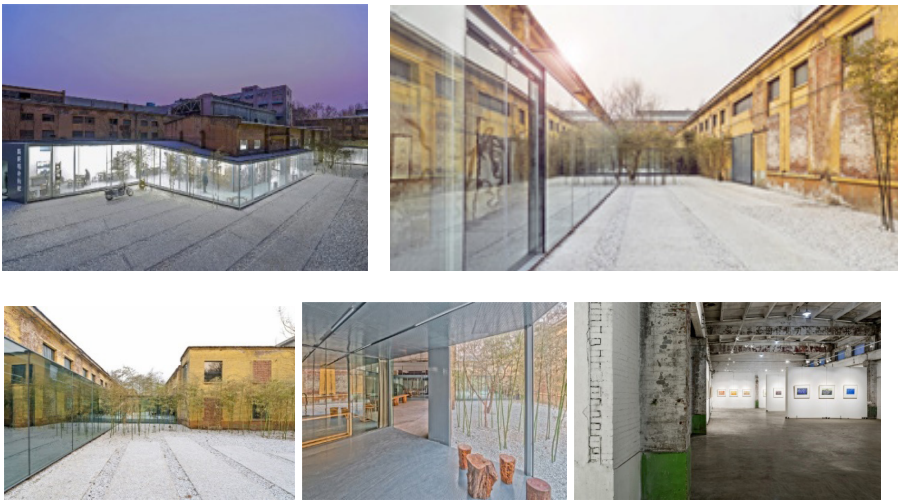


Figure 13. The Great Wall Museum of Fine Arts (URL 26)

In the area where the three factory buildings are located, a circulation area was created with a glass corridor around the old factory building, providing interaction between the interior and exterior of the building (URL 24). This transparent corridor encircles the bookstore, tea room, art studio and discussion room, making it a multifunctional space. In addition, the gray steel panels covered with this glass create horizontal lines in harmony with the factory structure (Figure 14).

Figure 14. Illustration of the sections added within the scope of the functioning as a museum [7] (URL 24)

The design aims to preserve the characteristic structure of the building's original function, allowing the visitor to witness the combination of past and present as they walk through the transparent corridor (URL 27). The references taken from the original building in the design of the contemporary annex made it compatible with the historic building in terms of form. The fact that the annex,

7 Created by editing on the drawings taken from https://www.arkitera.com/proje/the-great-wall-guzel-sanatlar-muzesi/ and prepared within the scope of MİM S37 Design in Historical Texture course.

which has the characteristics of its era in terms of material and structure, is designed to be recyclable, to increase its quality by attracting attention to the building and to be respectful in terms of scale/space, is an indication that it meets many criteria.

3.8. Moritzburg Museum

Moritzburg Castle in Halle, Germany, an important example of Gothic military architecture, was built in the 15th century (URL 28) (Figure 15). Used in the 16th century as an archbishop's residence, the structure was severely damaged by the collapse of the north and west wings during the Thirty Years' War and remained in ruins for about 250 years (URL 29). In the 18th century it was used as a garrison, in the 19th century it was intended to be turned into a university, but it remained idle until the 1900s, in 1904 it hosted the art museum of the City of Halle, in 2004 the administration decided to expand the museum and in 2008 it continued to function as a museum with contemporary additions (URL 30).

Figure 15. Photographs of the old and new Moritzburg Castle (URL 29, URL 31, URL 32)

In 2008, the change of function was realized by Nieto Sobejano Arquitectos and the design idea was to create a new roof that would allow natural light to enter the building, which was designed as a large folded platform with a rising and refracting structure to create new exhibition spaces (URL 30). The

design emphasizes the preservation of the castle's centuries-old ruins and original texture, which is achieved by minimizing the impact on the existing building and designing a lightweight structure as an upper cover (URL 30). The roof covered with rigid aluminum panels creates a dialogue between the angular geometry of the roof and the irregular volumes of the sloping roofs of the castle. Another complementary element in the design is the circulation elements built as two separate towers. With the design, the semi of the ancient ruin was released, and a transparent and permeable effect was created by using modern materials such as glass and steel in contrast to the massive appearance of the building (Figure 16).

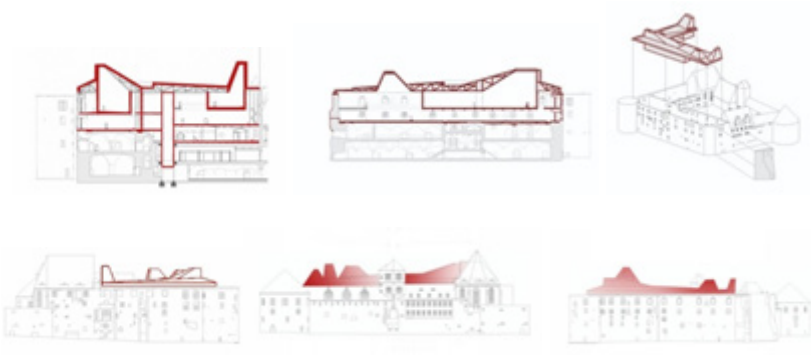


Figure 16. Representation of the sections added within the scope of the functioning as a museum [8] (URL 33)

8 Created by editing on the drawings taken from https://antonialoweinteriors.com/moritzburg-museum-extension-by-nieto-sobejano-arquitectos-fmp-precedent

Table 4. Evaluation of the examples considered in the study in the context of declarations and by-laws

4. Conclusion

With the appropriate mix of several characteristics, it is possible to design a historical building or texture. It is anticipated that new buildings being built in historically significant areas, which range in size from a single structure to entire cities, will be considerate of the past and conserve its original values while incorporating modern allusions. In this regard, the upcoming contemporary extension presents a unique design challenge. One of the most crucial steps is to analyze the existing texture thoroughly and ascertain its original and authentic values. It is not appropriate for modern or historic structures to have additions that imitate the original design.

The ideas in the legislation should be thoroughly digested and investigated in the design of contemporary buildings or additions in the historic environment since construction in historic environments is a set of multidimensional systems. The laws' guiding principles must to be modified to take into account each

nation's distinctively different historical settings. All laws and research agree that historic environments and buildings shouldn't be dominated by more modern additions, that they shouldn't take center stage, and that the main building itself shouldn't be demoted to the status of a historic structure's addition.

As stated in all international texts, analyzing the urban or structural context in which the buildings are located, contributing to historical and cultural sustainability, improving the quality of the existing texture, approaching harmoniously and respectfully in terms of material, scale, proportion, and form, and establishing integrity with the contemporary building through the use of architectural elements to be taken as references starting from the smallest element on the facade of the original building to the mass scale, and being recyclable are the criteria that should be taken into consideration in the context of design in the historical texture.

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