TÜRKİYE CUMHURİYETİ'NİN YÜZÜNCÜ YILI

New Era in Architecture

Editor
Murat DAL

BİDGE

BIDGE Publications

New Era in Architecture

Editor: Prof. Dr. Murat DAL

ISBN: 978-625-372-462-7

Page Layout: Gözde YÜCEL

1st Edition:

Publication Date: 25.12.2024

BIDGE Publications,

Certificate No: 71374

www.bidgeyayinlari.com.tr - bidgeyayinlari@gmail.com

Krc Bilişim Ticaret ve Organizasyon Ltd. Şti.

Güzeltepe Mahallesi Abidin Daver Sokak Sefer Apartmanı No: 7/9 Çankaya / Ankara

Content

CHAPTER I

Integration of Artificial Intelligence into Architecture: A New Era

Ayşegül KAÇAR[1]
Fatih SEMERCİ[2]

Introduction

Currently, new technological developments have brought the discipline of architecture in a radical way. Following digitalisation and automation, artificial intelligence (AI) is redefining the boundaries of architecture by offering a wide range of new possibilities from design processes to building management. AI not only enhances the creative potential of architects, but also has the potential to go beyond traditional methods to produce smarter, more efficient and sustainable solutions.

[1] PhD student, Necmettin Erbakan University, Institute of Science and Technology, Konya/Türkiye, Orcid: 0000-0002-8195-3633, aysegulkacar@gmail.com
[2] Assoc. Prof. Dr., Necmettin Erbakan University, Faculty of Fine Arts and Architecture, Department of Architecture, Konya/Türkiye, Orcid: 0000-0002-1017-5141, fsemerci@erbakan.edu.tr

Architecture has been a discipline influenced by technological innovations throughout history. From advances in building materials to computer-aided design (CAD), each innovation has led to radical changes in design and construction processes. The introduction of AI in architecture is the recent and perhaps the most transformative of these changes. Through complex data analysis, learning algorithms and predictive capabilities, AI offers a new paradigm both in the design process and throughout the life cycle of structures.

The aim of this chapter is to investigate the integration of artificial intelligence in the field of architecture, the innovations and potential advantages it brings to architectural processes. Firstly, a brief overview of the historical development of AI has been presented and then the developments in the discipline of architecture from digital tools to artificial intelligence have been mentioned. The transformation of the notion of "generative design" into the notion of "generative artificial intelligence (AI)" has been discussed.

Finally, the ethical issues of this technology and its possible effects on the architectural profession have been also discussed. The fact that AI is not only a tool but also a power transforming the practice of architecture is the main premise of this study.

History of Artificial Intelligence

The milestones of artificial intelligence were laid in the 1940s and became the turning point of important developments. In 1943, McCulloch and Pitts introduced the first mathematical formulation of the biological neuron, which is considered the first 'artificial neuron' (McCulloch & Pitts, 1943). This artificial neuron represents an early definition of the artificial network concept. Then, in 1948, a device called ‘Transistor’ was developed (Bardeen & Brattain, 1949) With this machine, control could be achieved by changing the strength of an electrical signal (Figure 1).

Figure 1. Transistor

Source: [1]

The first definition of artificial intelligence was made by McCarthy and his associates in 1955. According to them, artificial intelligence was defined as: ‘the use of the human brain as a model for machine logic’(McCarthy, Minsky, Rochester, & Shannon, 2006).

The field of artificial intelligence, which was developed with these theoretical discourses and applied prototypes, was further developed by designing a machine that learns through a prototype called ‘Perceptron’ developed in 1957. Perceptron was able to classify images by training and learning (Figure 2).

After the prototypes related to artificial intelligence, there are also developments in the field of Natural Language Processing

(NLP). A programme called ELIZA was developed as a computer-based chat programme (Weizenbaum, 1966).

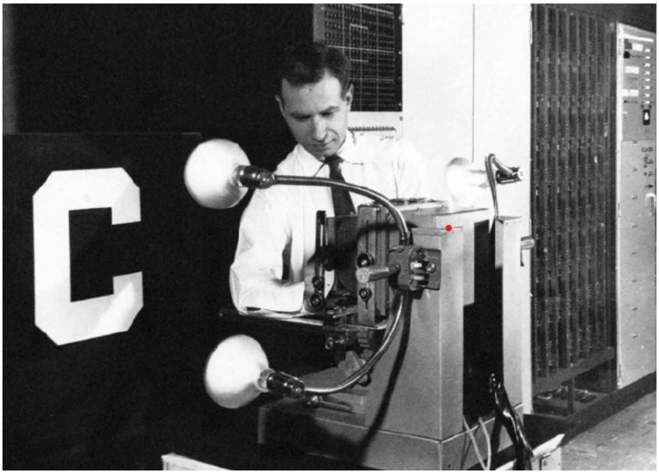

Figure 2. Perceptron

Source: [2]

In 1969, the limitations of artificial intelligence were critically examined and articulated in the seminal work *Perceptrons* (Minsky & Papert, 1969). The book critiques Rosenblatt's (1957) Perceptron, asserting its inadequacy and inability to solve complex problems.

The period of stagnation in artificial intelligence that followed these critical publications ended with the emergence of Expert Systems. Expert Systems are designed as software programs capable of reasoning based on a set of predefined rules.

Examples of Rule Based Expert Systems are MYCIN project, R1 programme, Cyc project. MYCIN project is an artificial intelligence model intended to identify bacteria to be used in the medical field. The R1 programme is a rule-based model for the user, intended to automate the ordering of computer components. The Cyc project aims to model data such as information and concepts about how the world works (Chaillou, 2021).

Following these models, artificial intelligence experienced a second period of stagnation, often referred to as the second AI winter, due to the limitations of expert systems, particularly their lack of a learning principle. However, the design of the computer "DeepBlue" in 1997 marked the end of this stagnation and reignited interest in AI research. DeepBlue, as an artificial intelligence system, achieved a historic milestone by defeating the World Chess Champion Garry Kasparov (Newborn, 2003). With this development, the concept of ‘deep learning’ was introduced to the public.

Deep learning has been further developed with AlexNET, a deep learning programme developed in 2012 (Krizhevsky et al., 2012).

In 2016, Go champion Lee Sedol was defeated by AlphaGo developed by DeepMind (Silver et al., 2016) .

The American Research Laboratory, OpenAI, published an artificial intelligence language model called GPT-3 in 2020 (Brown et al., 2020). Subsequently, DALL-E and GLIDE language models were published, and artificial intelligence became the centre of attention. ((Ramesh et al., 2020); (Nichol et al., 2021) .

Each of these models is trained on large datasets and contributes to language and visual content generation. Thanks to advanced artificial intelligence and deep learning techniques, complex and creative tasks can be accomplished.

In 2014, a new deep learning framework theorised by Ian Goodfellow developed GANs (Generative Adversarial Networks) that can be trained to produce image synthesis (Goodfellow et al., 2014).

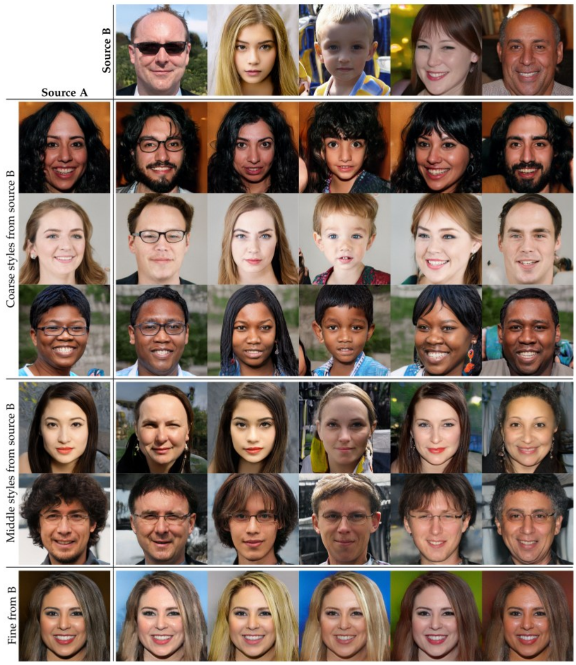

Figure 3. Human faces generated with StyleGAN

Source: (Karras, 2019).

In a study published in 2019, a StyleGAN model that can generate a large number of realistic human faces at high resolution has been designed using these GANs. (Karras, Laine, & Aila, 2019). In the image shown in Figure 3, it is aimed to generate non-existent human faces by overlapping features such as hair type, glasses type, skin colour from human faces in source A and source B (Figure 3).

AI and Architecture

Architecture's relationship with technology continues to mature with the development of artificial intelligence. Therefore, it is of great importance to understand how artificial intelligence will contribute to the technological development process of architecture. This chapter aims to reveal how both histories intersect while grounding the presence of AI in the field of architecture.

1.Computer Aided Design and Architecture

In the mid-1950s, design software produced by some engineering firms pioneered the use of computers in architectural design. Firstly, an American researcher named Patrick Hanratty introduced the first Computer Aided Design (CAD) prototype called ‘PRONTO’ in 1959. (Carlson, 2005).

In 1963, Ivan Sutherland developed the software programme ‘Sketchpad’, one of the first CAD programmes developed at MIT. (Sutherland, 1964). Sutherland's work has been used for the representation and manipulation of geometries on screen. Sutherland has designed software that not only allows precise 2D drawing of technical elements, but also offers an intuitive interface for designers. With pen handling and highly simplified controls, SketchPad has provided drafters with a level of comfort and flexibility (Chaillou, 2022). According to Gerber, Sketchpad is a parametric design engine in which relationships between geometric entities are preserved when points, lines and arcs are moved on the screen with a light pen (Gerber, 2007).

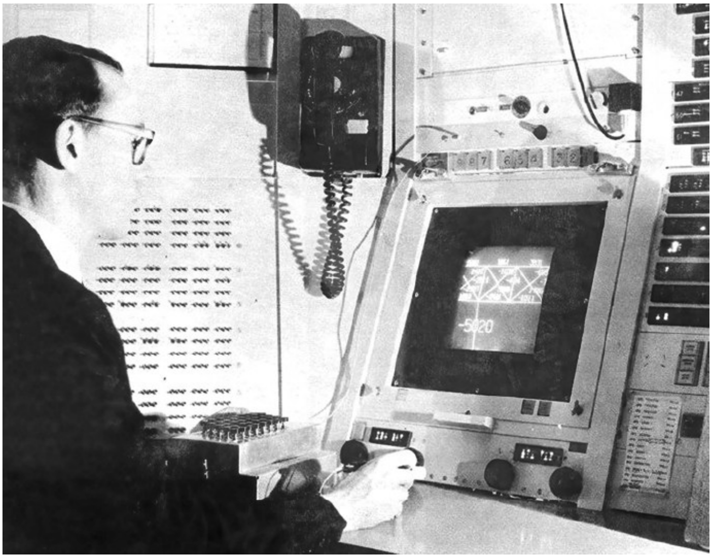

Figure 4. Ivan Sutherland & Sketchpad

Source: [3]

With Pierre Bezier's ‘UNISURF’ software, the transition from two-dimensional drawing to three-dimensional modelling in computer-aided design has been achieved. (Bézier, 1971). This programme, which was first used in the automotive sector, has been used in many fields including architecture.

Nicholas Negroponte, who investigated the effect of computer-aided design on architecture, enabled the implementation of computer-aided design in architecture with his ‘URBAN 5’ project (Negroponte, 1969) . In 1970, Negroponte published his book ‘The Architecture Machine’. The main purpose of this book was to investigate how computers could improve architectural design in the future decades (Negroponte, 1970) .

In 1989, computer-aided design and fabrication software, CATIA, was developed by Dassault Systemes to solve the extreme geometric complexity of some of architect Frank Gehry's projects (Çıngı, 2006). Using CATIA, Gehry resolved the geometric complexity of his designs and attempted to find new forms. In this way, Gehry set a precedent in the field of architecture with the Guggenheim Museum in Bilbao, which opened in 1997 (Figure 5).

Figure 5. Guggenheim Museum

Source:(From the author's archive, 2017)

With the development of software such as AutoCAD, architects have been able to control complex geometries and create collaboration between designers.

However, as architects adopted this software, some limitations emerged. These limitations, such as the repeatability of drawing tasks, lack of control over specific shapes and the difficulty of specifying complex design rules, have led the industry to look elsewhere for complementary technologies.

2.Generative Design and Architecture

Generative logic is not new in design and architecture. Mitchell mentions that the origins of generative systems can be traced back to philosophy, literature and music composition, and especially architectural generative systems to Leonardo da Vinci (Mitchell, 1977) (Figure 6).

Celestino Soddu (1994) defines generative design as ‘a morphogenetic process that uses structured algorithms for unique and unrepeatable results realised by an idea-code’ (Soddu, 1994).

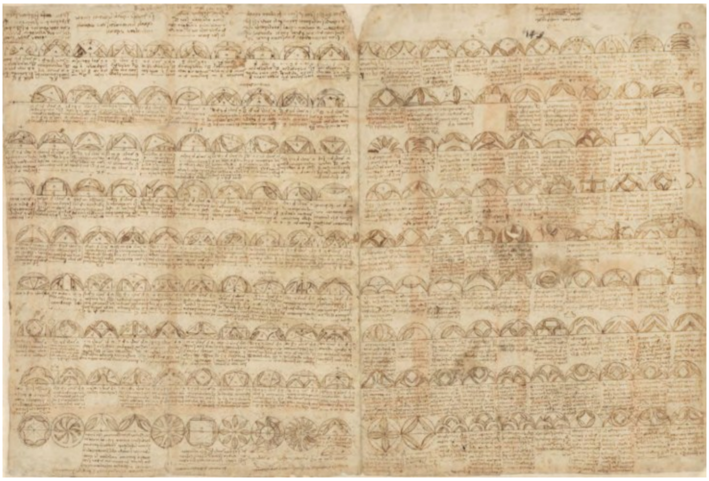

Figure 6. Geometric codes, variations drawn by Leonardo Da Vinci

Source: (Generative Art Journal, 2019)

Branko Kolarevic (2003) defines digital morphogenesis as follows:

“Predictable relationships between design and representations are abandoned in favour of computationally generated complexities. Design models that can realise continuous, continuous and dynamic transformations replace the static norms of

traditional processes. Complex curvilinear geometries are produced with the same ease as Euclidean geometries of planar shapes, while cylindrical, spherical or conical forms can also be produced. Design no longer 'generates' the plan; sections play only an analytical role. The grid, repetitions and symmetries lose their former legitimacy as infinite variability becomes as feasible as modularity and mass customisation offers alternatives to mass production." (Kolarevic, 2003).

Michael Hensel defines digital morphogenesis as 'a process of self-organisation based on the growth of living organisms, from which architects can learn' (Hensel, Menges, & Weinstock, 2006)

Generative systems assert not only the creation of form, but a creation that goes beyond modelling the 'logic' of design. This is the modelling of the basic functioning of the design rather than the physical modelling of a designed 'object' (Leach, 2009).

The first computational generative models focused on the synthesis of architectural layout and were based on optimisation and symbolic artificial intelligence techniques (Flemming & Woodbury, 1995; Mitchell, 1977)

Over time, generative models have become a technique with the incorporation of methods such as optimisation and genetic algorithms. Furthermore, rule-based and agent-based models such as fractals and L-systems, cellular automata and swarm algorithms, or simulation techniques such as physics simulation have further expanded this repertoire (Fischer & Herr, 2001; Kalay, 2004; Kolarevic, 2003; Oxman, 2006)

Machine learning is also incorporated into generative models to automatically infer generative from data or experience (Bidgoli & Veloso, 2019; Kalay, 2004)

Dino (2012) categorised generative systems into three categories (Dino, 2012): linguistic, biological and parametric design.

Veloso and Krishnamurti (2021) developed a taxonomy for generative models and categorised them in a table (Figure 7), (Veloso & Krishnamurti, 2021). The blocks in the first row are the three common expressions of a generative model: parametric, rule-based and agent-based. These blocks are very important as they define special formulations for models that result in different design spaces and forms of design navigation. The second row includes computational methods such as optimisation, composition and simulation for automatic design synthesis. These blocks support the execution phase where designers can explore design alternatives by interacting with the design, its inputs and outputs. Finally, the third row includes generative learning and behavioural learning blocks, which are computational strategies to automate the formulation of the model using data or experience.

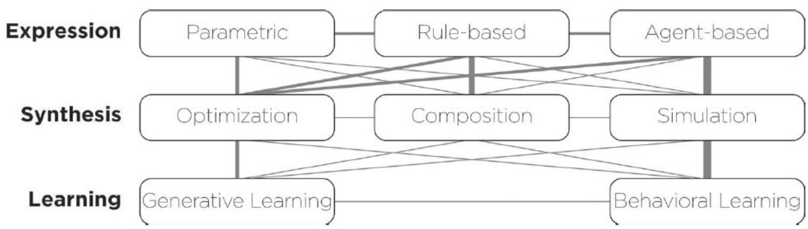

Figure 7. Taxonomy of Generative Models

Source: (Veloso & Krishnamurti, 2021).

3.Parametric Design and Architecture

Parametric design is a process based on algorithmic thinking that enables the expression of parameters and rules that together define, codify and clarify the relationship between ‘design purpose’ and ‘design response’ (Jabi, 2013).

Luigi Moretti defined parametric architecture as the study of the ‘relationships between the dimensions’ of a design based on parameters. Moretti's project, Stadium N, was an early demonstration of the potential of parametric modelling, in which he formulated a precise procedure by defining nineteen parameters as a set of mathematical equations that are directly responsible for the final shape of the structure. Each variation of this set of parameters reveals a new shape for the stadium (Moretti,1971),

In 1988, Samuel Geisberg introduced the software ‘Pro/ENGINEER’, which provides full access to geometric software.

In his manifesto entitled ‘Parametricism, A New Global Style for Architecture and Urban Design’ (2009), Schumacher laid out the basic principles of the architectural style he called ‘Parametricism’ (Schumacher, 2009).

Working with Schumacher, Zaha Hadid's work, such as the Kartal Pendik masterplan (Figure 8), was often the result of rules coded directly into the programme, providing an unprecedented level of control over building geometry. Throughout her work, many architectural decisions have been formulated as parametric procedures, whereby key variables drive the resulting design. The apparent fluidity and organic nature of Hadid's work is partly due to this coding methodology.

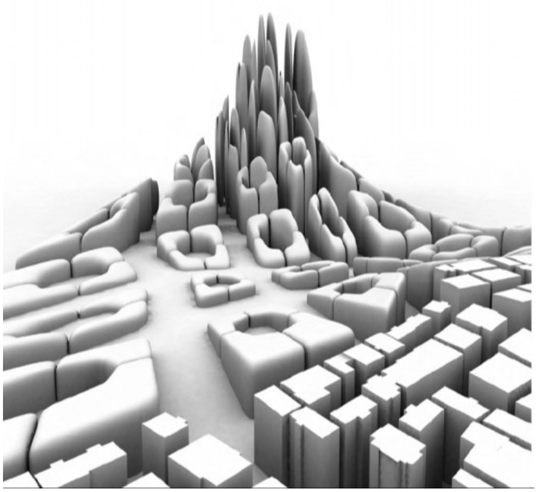

Figure 8. Zaha Hadid's Pendik Master Plan

Source: [3]

Software applications such as 'Generative Components' developed by Bentley Systems, 'Dynamo' developed by Autodesk and 'Grasshopper' developed by McNeel and Associates, enable the rapid exploration of complex ideas that often exceed the limits of traditional techniques such as hand drawing, physical model making and CAD. By using Grasshopper, the design process can effectively reach a whole new level of systematisation: design can now be planned more programmatically, as designers devote part of their design time to the formulation of the fundamental rules of Architecture, their repeatability and applicability at scale (Figure 9).

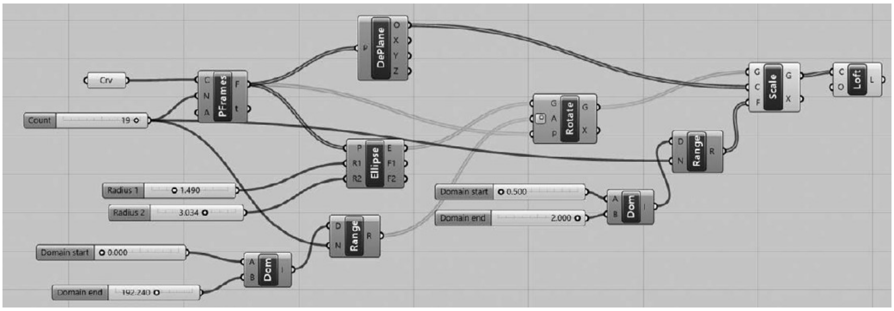

Figure 9. Visual code defined in Rhino's algorithmic editor Grasshopper3D

4.Generative AI and Architecture

Nicholas Negroponte was the first to introduce the concept of ‘machine assistant’. The aim of URBAN 5 was to help architects to draw floor plans. However, through URBAN 5, the complementarity between the designer and an intelligent agent has been provided (Negroponte, 1970).In 1976, Cedric Price invented the machine called ‘GENERATOR’. With this project, Price explored the concept of a self-adapting building. The project could also play a role in the design process (Yiannoudes, 2022) .Consequently, the works of Negroponte and Price have shaped the topic of artificial intelligence in architecture.

The addition of generative design features to Revit or the proliferation of Machine Learning libraries for Grasshopper have provided many opportunities for practitioners to interact with AI. In addition, a new generation of design tools has recently emerged. These mostly browser-based tools offer cheap and simple access to AI-based design tools. Spacemaker, Archistar, Delve, XKool, CoveTool are just a few examples of this new web application ecosystem (Chaillou, 2022).

4.1. Machine Learning

Chaillou (2022) divides artificial intelligence into roughly five classes: machine learning, expert systems, robotics, robotics, computer vision, natural language processing. (Chaillou, 2022) . According to him, a machine learning model can produce a phenomenon by iteratively being exposed to large amounts of data in the learning or training process. This process can then be used to predict or imitate. In the learning phase, an AI model is driven by a feedback loop. Training ends when the user believes that the machine has learnt the match between a variable and a target value well enough.

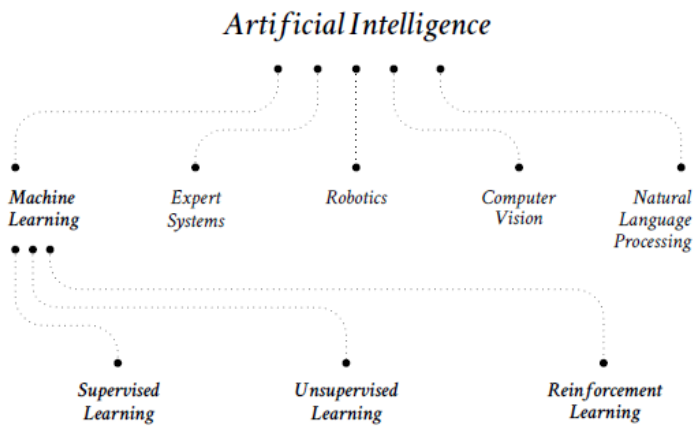

Figure 10. Classification of artificial intelligence

Source: (Chaillou, 2022).

Another feature of machine learning is the user's control over the computation. Whereas in parametric modelling the user is responsible for formulating the computational steps and associated parameters, in machine learning the use of the model starts with the user, but the tuning and sometimes even the definition of the parameters takes place within the model. With ‘hyperparameters’ (high-level tuning tool) the user is guided in the general direction of the model.

Machine learning is a field rich in many recent breakthroughs and initiatives. These applications span different sectors, from speech recognition to image synthesis and robotics.

Machine learning is generally divided into three sub-categories depending on the training strategies involved:

o Supervised learning

o Unsupervised learning

o Enhanced learning

Supervised learning explores the application of machine learning to the matching of known input-output data pairs. In a sense, it is a model of imitating a mapping using labelled data.

Unsupervised learning attempts to model patterns found between observed data without having a specific output value. In other words, the data presented to the algorithm is not labelled; it is up to the model to discover trends occurring within this stream of raw information.

Reinforcement learning simulates a series of steps where, instead of consuming pre-existing pairs of data, it collects rewards; here it readjusts its behaviour to further improve its score.

4.2. Artificial Neural Networks-ANN

The foundation of Artificial Neural Networks was laid by McCulloch-Pitts (first artificial neuron - 1943), and Rosenblatt et al (perceptron - 1957). Artificial networks aim to mimic the information processing of the human brain. The structure of these networks can change as users change the number of neurons, layers, training parameters and other settings. They can perform tasks such as filtering, activating, normalising and pooling information.

During the training of an ANN, as data flows through the network, the weights of the neurons are gradually adjusted using a feedback loop mechanism. Learning proceeds in a simple iterative back-and-forth fashion: first, computation flows from input to output in a process called ‘feed-forward’. Then, when this computation reaches the end of the network to produce a prediction, the accuracy of the result is evaluated and a corrective feedback loop, also called ‘back propagation’, is triggered. This time information flows through the network in the opposite direction while assigning a correction to specific neurons. In ANNs, feed-forward and back-propagation are repeated multiple times to gradually tune the network and improve its overall accuracy. This simple mechanism has been used in countless research projects today, from basic research to larger deep learning.

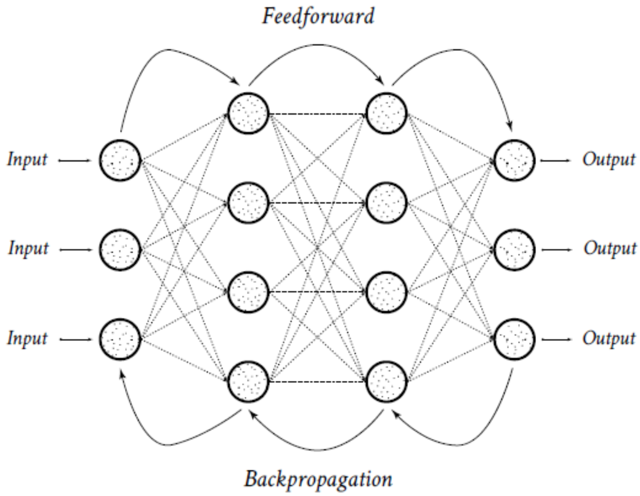

Figure 11. ANN training

Source: (Challiaou, 2022).

Examples of artificial neural networks are CNN, GNN, GAN:

- CNN-Convolutional Neural Networks
  This structure is designed for the processing of visual images. This structure operates with a parameter concept called ‘convolution’. Convolutions form the basis of applications such as image recognition technologies. ImageNET (Deng vd,2009.) a research project built on this technology.
- GNN-Graph Neural Networks
  This structure is a neural network that allows the processing of graph data. Molecules, architectural programmes can be represented using graphs. It was developed to better investigate topological information.
- GAN-Generative Adversarial Networks

GANs were theorised by Ian Goodfellow in 2014 and used to synthesise images (Goodfellow et al, 2014). GAN uses two competing models in its training model, a ‘generator’ and a ‘discriminator’. For instance, given an image database, the discriminator works to improve the ability to recognise data, while the producer works to create synthetic images. At the same time, the discriminator is used to provide feedback to the producer about the quality of the output images. It is built on feedback between two agents rather than the self-correcting loop of a single model (Figure 12).

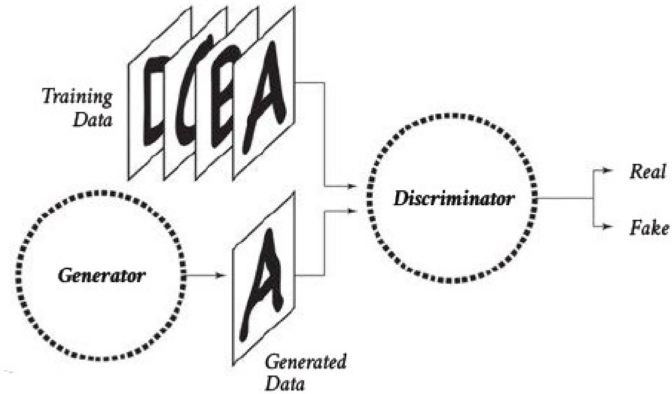

Figure 12. Training the GAN model

Source: (Challiaou, 2022).

Conclusion: Potential Impacts of Artificial Intelligence on the Architecture Profession

The integration of artificial intelligence (AI) into the field of architecture represents not only a technical and aesthetic transformation but also raises profound ethical challenges. The implications of AI’s use in architectural processes are being debated across a wide spectrum, ranging from the nature of the creative process to the future of the profession.

On the one hand, AI accelerates design processes, enabling the resolution of more complex problems and the creation of more innovative projects. However, this raises questions about the role of architects in the creative decision-making process. The replacement of creative processes with algorithmic decisions could lead to homogenization in design and a reduction in aesthetic diversity. Moreover, the relegation of architects to roles such as “overseers” or “system managers” could profoundly impact the identity and practice of the profession.

From the perspective of the future of architecture, the widespread adoption of AI has the potential to expand the boundaries of the profession while simultaneously altering workforce dynamics. Processes requiring less technical expertise might hinder young professionals from entering the field and could challenge the perceived value of experienced architects. Conversely, collaboration with AI might enable architects to assume more strategic and creative roles.

In conclusion, the impacts of AI on architecture extend beyond mere technological innovation, redefining the ethical foundations and societal responsibilities of the profession. While architects must embrace the opportunities presented by AI, they must also carefully assess its limitations and risks. It is evident that AI will continue to shape architectural practice, but the direction and depth of this transformation will depend on how architects lead this process with both ethical and creative approaches.

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CHAPTER II

Historical Interplay of Ottoman and Western Influences; An Analysis of Interior Design in Izmit Kasr-ı Humayun

Ebru ERDOGAN[1]
Gulsah UNER[2]
Tulay GUMUSER[3]

INTRODUCTION

Furniture producing, which began thousands of years ago, is evidenced by numerous artifacts still found in museums in some countries today. Initially, humans crafted various furniture items from wood and stone to sit comfortably. Over time, with the increase in needs and the advancement of production tools and machinery, a variety of designs were developed. It is not entirely possible to

[1] Prof. Dr., Selcuk University, Faculty of Arch. and Design, Department of Architecture, Konya/Turkey, ORCID: 0000-0001-7415-6567, e-mail: erdogan@selcuk.edu.tr
[2] Res. Assist., Kocaeli University, Faculty of Arch. and Design, Department of Architecture, Kocaeli/Turkey, ORCID: 0000-0001-8039-3024,
e-mail: gulsah.uner@kocaeli.edu.tr
[3] Assoc. Prof. Dr., Selcuk University, Faculty of Arch. and Design, Department of Handcraft, Konya/Turkey, ORCID: 0000-0002-6264-2629,
e-mail: tulaygumuser@gmail.com

separate the art of furniture from architecture. The art of furniture is considered an accessory of architecture, a tool of interior furnishing. Therefore, architectural styles of the time have had a significant influence on the development of furniture throughout the ages. In every era, artisans reflected their unique concepts of aesthetics, skill, and thought into furniture (Kurtoğlu, 1986). Besides furniture, the discipline of architecture has historically encompassed and interacted with many fields of science and art, including painting, music, sculpture, cinema, fashion design, and textiles.

Throughout human history, people have used spaces to shelter and meet their needs. These spaces should provide the necessary level of comfort according to the user's needs. Physical factors such as color, light, and temperature within a space should be arranged according to the individual's requirements. Just as structural elements like walls, columns, doors, and windows play an essential role in creating a space, furniture also plays a highly effective role (Açıcı and Konakoğlu, 2018). The concept of space has thus become a common element across all disciplines. The aesthetic value that furniture adds to spaces can be achieved through the materials it is made from, the production techniques used, its colour, texture, and finish. In this regard, it is important to note that furniture primarily consists of two main components: the frame and the upholstery. The frame is the structural system that supports the furniture, while the upholstery encompasses all surface treatments with various materials that the user can touch. Initially, humans processed surfaces with natural products such as felt, leather, and fur, later creating various spaces using different fabrics. From this perspective, textiles have not only been functional but have also become a ubiquitous material in daily life, ranking among the important elements of interiors like furnishings. In this context, it can be argued that the most crucial elements that convey and enable the experience of emotion in an interior space are furnishings and textile elements. Many architects, aware of the organic connection between space and textiles, have incorporated furniture and textile products related to the space into their design processes (Jackson, 2002). Larsen meticulously examined the design relationships between space and textiles, emphasizing in his book "Fabrics for Interiors" that textiles are the primary materials for interior arrangements. He stated:

"Today, what differentiates interiors is not so much the design of the interior architecture as the objects within that space. These objects provide materiality and sensitivity to the personality of the spaces. Fabrics, one of these objects, are the main guiding element in space design and perform this role excellently. Fabrics are versatile in application, readily available, and economical, making them the most practical supporters of interiors with their astonishing variety and adaptability" (Larsen & Weeks, 1975).

This study examines the design characteristics of the furnishings, accessories, and upholstery textiles exhibited in the Atatürk Room, Mother-of-Pearl Room, and Bedroom of the Kasr-ı Humayun, which currently serves as a museum. The analysis focuses on how these elements connect to the historical context of their period. A critical aspect of this research is the exploration of how the interiors of an architectural structure built in the late Ottoman era, shaped by interactions with Western influences, synthesized these cultural and stylistic elements. This examination will be conducted from a contemporary perspective, shedding light on the integration of these influences within the broader historical and architectural framework. The relationship between textiles and furnishings in historical residences serves as a testament to the lived experiences within those spaces, while also acting as vital elements that convey the cultural identity of their era to the present day. The originality and authenticity of the furnishings, accessories, and textiles in such historical dwellings are significant for research in this field, offering valuable insights into the cultural and historical context of the period.

TEXTILES IN THE INTERIORS OF 19TH CENTURY OTTOMAN BUILDINGS

In the 16th century, the Ottoman Empire reached its zenith not only in economic and political terms but also in the field of textiles. During this period, textiles known as "Palace Fabrics," handwoven with gold and silver threads as symbols of status, held significant importance. However, from the 17th century onward, the quality of these textiles began to decline. As economic conditions deteriorated, the use of precious metals such as gold and silver in weaving was prohibited, leading to further restrictions in textile production (Martal, 1992). While 17th-century textiles largely retained the stylistic elements of the 16th century, subtle differences in detail emerged. By the 19th century, prior to the invention of the Jacquard loom, the quality of yarn and the intricate use of patterns in handwoven fabrics enhanced their value (Yaşar and Boynak, 1999). During this period, the Ottoman Empire, while striving to preserve its traditional textile practices, also came under increasing European influence, resulting in the production of fabrics on Jacquard looms, which were incorporated into their designs. The need to sustain textile production with European support brought about significant changes in both the palaces and the lifestyle of the Ottoman elite. As the sultans moved away from Topkapi Palace, the groups of textile artisans (nakkaş) residing there also dispersed (Tepe, 2019). Despite challenges such as falling prices, evolving technologies, shifting fashions, and fierce competition from foreign manufacturers, Ottoman textile production remained vibrant in the first half of the 19th century (Quataert, 1999).

One of the most striking aspects of Ottoman palace fabrics is the repetitive arrangement of motifs in their composition schemes. Motifs such as tulips, carnations, peonies, hatayi, rumi, rosebuds, the tree of life, and medallions were prominently featured in these textiles. By the 19th century, these motifs were arranged in freer compositions. The leaves and branches, commonly seen in Ottoman textile compositions, were rendered in a more curvilinear fashion, while Western influence introduced floral bouquets with slender branches and leaves, often arranged with vases in geometric patterns (Kavcı Özdemir, 2006). Designs featuring floral patterns included segmented leaves on branches, Rococo-style C and S curves, spirals, vases influenced by Neoclassicism, as well as depictions of boats and human figures. Large and small staggered medallion patterns, which were common in both Eastern and Western textiles, were also evident in these fabrics (Yaşar and Boynak, 1999). In terms of colour, red—a national color of the Turks—was prominently featured in these textiles, followed by blue, green, gold, white, beige, and black (Öz, 1946; Aslanapa, 2016). Throughout this period, the production of palace fabrics continued to employ classical Ottoman motifs and composition elements, while simultaneously incorporating Baroque and Rococo styles that reflected the transformative influence of Europe. Initially, consumption in

Ottoman society was focused on meeting basic needs, but with the changing social structure, textiles, like other luxury goods, became symbols of status among the Ottoman elite.

ARCHITECTURAL AND STRUCTURAL FEATURES OF KASR-I HUMAYUN

Kasr-ı Humayun, also known as Abdülaziz Hunting Lodge, is located in the Kemal Pasha neighbourhood of İzmit, the central district of Kocaeli. Situated on an elevated hill, the palace overlooks the Sea of Marmara. Registered as a historical monument in 1987, the building is believed to have been constructed during the reign of Sultan Abdülaziz (Kaya and Çağıl, 2018). Notably, Kasr-ı Humayun is the only palace constructed outside of Istanbul. Until 1967, the building served as the Provincial and Agricultural Chamber, after which it functioned as the İzmit Museum. It underwent restoration in 1992, and following the damage sustained during the 1999 earthquake, a comprehensive restoration project commenced in 2004 and was completed in 2005. Today, the building serves as a palace-museum (Kesikbaş and Erdoğan, 2020; Kaya, 2009).

The İzmit Kasr-ı Humayun is a prime example of Westernization-period architecture in İzmit. Designed in the Neoclassical style by the renowned architect Garabet Amira Balyan, it exemplifies his significant architectural contributions, which include the Dolmabahçe and Çırağan Palaces, the Salı Bazaar Coastal Palace, Ortaköy Mosque, Harbiye, and the Tomb of Sultan Mahmud II (Fıratlı, 1971). Although it is traditionally described as a two-story structure with load-bearing brick walls on a foundation (Kâhya, 2012), the building also includes a small basement (Kesikbaş and Erdoğan, 2020). Constructed with a rectangular plan, the building adheres to the traditional Turkish house layout, featuring a central hall. It is accessed via three entrances, with the main entrance located on the southern façade facing the sea (Figure 1). The other entrances are situated on the eastern and western façades. The main entrance is approached by staircases of five steps positioned on both the eastern and western sides. Unlike the doors on the eastern and western façades, which are covered by balconies, the main entrance is not sheltered by any cantilevered structure. Instead, the entrance door and the southern wall of the Reception Hall on the upper floor are designed to project outward, emphasizing their prominence (Gölcük, 2021).

Figure 1: İzmit Kasr-ı Humayun (Uner, 2024).

The ground floor of the building consists of an entrance hall used as an exhibition area (Table 1-a) and symmetrical rooms on either side (Atatürk Room and Protocol Room) (Table 1-b, 1-c). In the entrance, there are wet areas, an office currently used as a security room, and a service staircase leading upstairs. Behind the central hall, one reaches a landing through the stairs flanked by Corinthian columns. From these landings, the stairs then continue in two directions. The central Reception Hall on the upper floor, (Table 1-d) is flanked by rooms designated for different purposes: the eastern room serves as a lounge (Mother-of-Pearl Room) (Table 1-e), and the western room is planned as a bedroom (Table 1-f). The bedroom is connected by a door to a marble-clad bathroom (Kesikbaş and Erdoğan, 2020; Gölcük, 2021).

Table 1: Kasr-ı Humayun (Uner, 2024).

a: Entrance Hall

b: Ataturk Room

c: Protocol Room

d: Reception Hall

e: Pearly Room

f: Bedroom

This study examines the design features of the furnishings displayed in the Atatürk Room, the Mother-of-Pearl Room, and the Bedroom of Kasr-ı Humayun, which currently functions as a museum. It focuses on the period-styles of the upholstery textiles and their historical connections. From a contemporary perspective, the study explores how the interiors of this architectural structure, built because of the late Ottoman Empire's interactions with the West, form a synthesis influenced by these interactions.

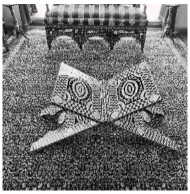
MATERIALS AND METHODS

This study adopts a qualitative research methodology. Qualitative research is a form of knowledge production designed to understand human potential, unravel its complexities, and explore the intricacies of social structures and systems created by human endeavour. Research conducted using qualitative methods aims to develop a deep and nuanced understanding of the phenomena or events under investigation (Morgan, 1996). Common data collection techniques in qualitative research include observation, interviews, document analysis, and discourse analysis (Hatch, 2002). The first phase of this study involved a comprehensive literature review about furnishings and textiles. In the second phase, with permission granted by the relevant authorities, the İzmit Kasr-ı Humayun Kosku Museum was visited, and photographs of the furnishings and textiles displayed in the museum were taken. Additionally, original photographs of the furnishings and textiles that were replaced during previous restorations were sourced from the museum's archives. Given that the Lodge was constructed in the 19th century, an analysis of historical sources related to the furnishings and textiles of that period was conducted, followed by an in-depth evaluation of the design characteristics of the furniture currently on display in the museum.

ANALYSIS OF FURNISHINGS AND TEXTILES IN KASR-I HUMAYUN

Throughout history, furniture has evolved in response to the social and cultural contexts of human life, often reflecting the status and societal position of individuals. Designed with regional influences and available materials, furniture styles and forms have varied significantly. The furnishings of each era are shaped by the religious beliefs, socio-cultural structures, and technological advancements of the time. Even in ancient civilizations, furniture held great significance, with numerous surviving examples from millennia ago attesting to its early development. Initially, people crafted furniture from stone and wood, primarily for seating purposes. As human needs expanded and tools advanced, furniture evolved in terms of materials, size, functionality, and ornamentation. The passage of time has played a critical role in shaping architectural styles, and designers from each period have infused their works with their distinctive aesthetics, craftsmanship, and conceptual approaches (Uner and Erdogan, 2021). In this context, the present study examines and analyses the current condition of selected furnishings, accessories and textiles in Kasr-ı Humayun (Table 2).

Table 2: Furnishings, Accessories and Textiles in Kasr-ı Humayun (Uner, 2024).

			
1 Atatürk Room	*2 Atatürk Room*	*3 Pearly Room*	*4 The Reception Hall*
			
5 Landing	*6 Pearly Room*	*7 Atatürk Room*	*8 Bedroom*
			
9 The Reception Hall	*10 Landing*	*11 Pearly Room*	*12 Pearly Room*

The furnishings present in the Kasr today are not actually the original. It has been observed that the items inside the building were brought from various cities, palaces, or museums. When the decision was made to reuse the Kasr as a museum, numerous artifacts were sent to the Kasr from Topkapi Palace, Konya Museum, Tokat

Museum, Museum of Turkish and Islamic Arts, and the General Directorate of Antiquities and Museums (Ankara). Thus, the furnishing of the Kasr and the exhibition of the artifacts placed in the display cases have been prepared (Gölcük, 2021). The room designated as Atatürk's Room contains furnishings numbered 1, 2, and 7 as listed in Table 1. The leather-covered lounge chair (number 2) from the Savarona Ship has not undergone any repairs, and its textile fabric is original. The furnishings numbered 1 and 7 are in the style of Louis XVI. The chair backs are either solid or shaped like hearts or cups. A symmetrical crown is present on the solid backrest, and the carvings are not deep (Kurtoğlu, 1986).

The fabric on chair number 1 features small floral and curvilinear leaf motifs arranged within medallions that repeat side by side in a half-drop pattern on a shiny gold background. The designs use a bright yellow colour, with pink and blue flowers being particularly notable. The furnishings numbered 3 and 6, which have been repaired, are in the Mother-of-Pearl Room (Table 3). These chairs have throne-like backs and rest on four wooden legs. The backs feature geometric cartouches with mother-of-pearl inlays and vegetal decorations. Additionally, some cartouches have lattices formed by interlocking wooden pieces. The same decorations are found on the skirts of the chairs and the thrones. The upholstery fabric on the seating portion has gold geometric motifs repeated in vertical cream-colored stripes on a red background. The surroundings consist of stripes with black horizontal dashed lines on red, silver, cream, and yellow. The fabric is secured with a red cord, as seen on chair number 4.

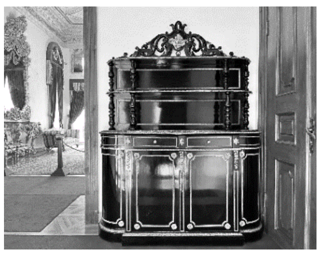
Table 3: The Changing Conditions of Some Furnishings and Textiles in Kasr-ı Humayun; Before Restoration (Golcuk, 2021) and Current State (Uner, 2024).

Before Restoration / Current State


3 The Mother-of-Pearl Room


4 The Reception Hall





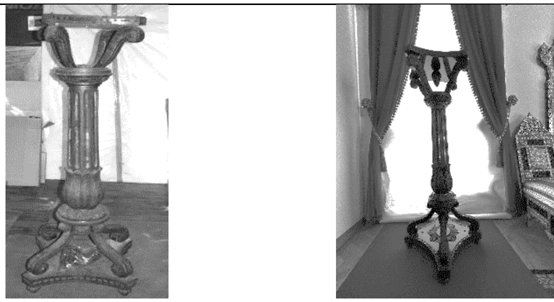
5 Landing

6 The Mother-of-Pearl Room

8 Bedroom

9 The Reception Hall

10 Landing



11 Pearly Room

12 Pearly Room

The central lectern is decorated with mother-of-pearl inlay. The restored decorative furnishings (number 11 and 12) reflect the art of Baroque furniture. In Baroque furniture design, carved ornaments are characterized by their deep and prominent structure. Another notable feature is the use of moldings and pilasters, along with cabriole, claw-and-ball, and twisted legs (Kundakçı, 2017). Additionally, six armchairless chairs (number 4) and a candelabrum (number 9), positioned in various locations within the Reception Hall, have also undergone restoration (Table 3). These chairs, matching the sofas, rest on legs that widen from the bottom to the top. The backs and seats are covered with the same type and pattern of fabric. The fabric design on the back and seat of the chairs features a 1/4 symmetrical composition; a floral motif on a cream-colored background at the top and bottom of the central vertical axis is surrounded by a C-shaped leaf. The middle part of the pattern consists of curvilinear leaves. The central motif is repeated with thin-thick vertical stripes around it. The fabric is secured with a red cord. The motifs use pink, brown tones, green, and gold colours. The lower part of the candelabrum is broad, with concave edges. It rests on a square base, with clawed feet at each of the four corners. The surrounding area is adorned with raised floral motifs. The lower section of the column features an extended floral relief, while the upper section is decorated with circular leaves. The candelabrum itself is eight-armed, with the arms formed by the curling of long leaves. Additionally, there is a finial in the centre. The overall structure is made of gilt bronze and is of French craftsmanship. Gölcük (2021) notes that the candelabrum was brought from the Topkapı Palace Museum and has undergone restoration.

Next to the door leading from the landing to the divan room is a restored console (numbered 5 in Table 3). The console, brought from the Topkapi Palace Museum, is ebony-veneered, black, and polished. The rectangular lower part has an oval curve on the sides. The top has a shelf arrangement, and a triangular crest made of rumis. The console has four doors and four drawers, and it is adorned with gold-gilded, vegetal decorations and metal strips with six-pointed stars. Additionally, the restored pedestal candlestick (number 10), also located in the landing, is a product of the "Era of the Four Greats." During this period, design and production underwent simplification, with a reduction in decorative elements. As a result, techniques featuring floral and curvilinear branch motifs were avoided (Kundakçı, 2017). The desk (numbered 8 in Table 3) located west of the Reception Hall in the Bedroom has also been restored. It is ebony-veneered, black, and polished with numerous drawers. The legs are curved outwards. Gold-gilded metal reliefs are nailed to the corners of the drawers and doors, and on the legs.

DISCUSSION

Monuments within a city serve as tangible evidence of our cultural heritage (Madran, 2000). Therefore, historical buildings are of great importance to cities, as they provide insight into the social, cultural, economic, and architectural structures of the periods in which they were constructed. Additionally, historical monuments serve as spaces where cities, and even global societies, display their cultural identities (Mehr, 2019). However, over time, many architectural monuments have been destroyed or are on the verge of destruction due to various reasons such as earthquakes, fires, wars, and other calamities (İslamoğlu, 2018). A contemporary conservation method that is effective in preserving historical buildings that have lost or are losing their original function is to assign them new functions. This is a widely used practice to ensure the transmission of architectural knowledge to future generations (Kaymakçı, 2022). Many of these buildings, having lost their original function, have been repurposed to meet contemporary needs (Koçan, 2011). For example, Bursa's Aynalı Hamam has been transformed into a marketplace, and Lala Şahin Pasha Madrasa has been repurposed as a library, illustrating numerous instances of adaptive reuse.

Thus, the change in function allows for the adaptive reuse of historical buildings that no longer fulfil their original purposes due to various environmental, economic, social, and cultural changes. This intervention facilitates the preservation and ongoing utilization of these structures, which can be seen as a form of revitalization (Aydın and Şahin, 2018). Moreover, by being reutilized, these buildings not only acquire a sustainable function but also avoid becoming mere remnants of the past (Saraç and Tanrısever, 2018). As a result, historical buildings that have diverged from their original function can be adapted for new uses (Ahunbay, 2018). However, it has been observed that there is a tendency to convert historical buildings into museums. This trend is thought to be driven by the high level of public interest and visitation that museum-converted buildings attract (Kaymakçı, 2022). Nevertheless, it is crucial that the identity of these reutilized buildings is preserved and that a meaningful connection is established between the building's new function and its historical significance, ensuring its transmission to future generations.

One of the buildings adapted as a museum within the scope of this study is the İzmit Kasr-ı Humayun. Previous studies on the building have largely remained within the architectural domain. However, it is essential to examine the building from an interior design perspective, particularly focusing on its furniture, accessories and textiles. Historical buildings are significant as they serve as key symbols and cultural memory sites for the cities in which they are located. While the transformation of the palace into a museum has led to an identity conflict due to the introduction of furniture from different locations, this adaptation has also allowed the building to survive to the present day and become a popular tourist destination, which is a positive outcome.

CONCLUSION AND SUGGESTIONS

The furnishings and textiles are essential elements that reflect the cultural identity of the period and play a prominent role in interior design. Beyond their functionality, furnishings and textiles enrich each other through aesthetic and artistic aspects, continuing to evolve with modernism into two indispensable concepts in design. They exhibit a close relationship under the umbrella of design, offering clues that aid in understanding historical processes through museums. Within the scope of this study, the interior furnishings and textiles of Kasr-ı Humayun (Abdülaziz Hunting Lodge), which exhibit an eclectic character influenced by Baroque, Rococo, Neoclassical, and Empire styles during the Ottoman period, have been examined. The materials, patterns, and applications of design objects are distinct characteristics that differentiate societies and encapsulate the essence of the technical, craft, and artistic concepts of the period in which they were created. For the authenticity of this information, it is expected that the exhibited objects are original. However, it has been observed that while many museums have successfully preserved furnishings through restoration efforts, the original textiles have not been maintained, and their replicas often fail to accurately reflect the originals.

As a conclusion, it has been determined that some of the furnishings displayed in the Izmit Kasr-ı Humayun Museum were not originally used in Kasr-ı Humayun. Instead, these items were brought from other palaces for exhibition purposes after the building was converted into a museum. The styles prevalent in 19th-century painting, sculpture, and architecture are also evident in the furnishings. The displayed furnishings in the Izmit Kasr-ı Humayun

Museum include both Western styles and those with traditional construction techniques. In terms of style, it is possible to observe an eclectic style that includes Rococo, Neoclassical, and Empire styles, as well as motifs specific to the empire, such as the crescent and star. The significance attributed to textile products and their usage purposes vary according to societal conditions and cultural structures, leading to differences in their historical development. This study also demonstrates the crucial role that furnishings and textiles used in the interiors of historical buildings play in reflecting the spirit, history, and national identity of the space. Although the furnishings examined in the museum are not entirely original, they have been restored and maintained. As shown in Table 2, the wooden parts of the furnishings have been painted and polished. The use of original wooden frames in the furnishings provides important information about the period's furniture, while the fact that the upholstery fabrics are not original and have been replaced—despite their similarity to 19th-century styles—indicates significant differences and mismatches in patterns with the furniture. These textiles, which do not reflect historical authenticity, highlight the importance of proper archiving to provide accurate information about a museum's past. Today, the Kasr-ı Humayun Palace Museum, affiliated with the Kocaeli Archaeology and Ethnography Museum, is a cultural value worth seeing for its architecture, exhibited artifacts, wall paintings, and furnishings. It is essential to preserve and pass on this cultural heritage to future generations.

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CHAPTER III

Evaluation of Konya Karatay Madrasah Restoration

Filiz Karakuş[1]
Esra Koyuncu[2]

Introduction

Konya, which has been the capital of the Anatolian Seljuk State since its establishment, is an important city where the Seljuk art and style is revealed, and the cultural heritage of this state is protected. In this city, there are many building types such as palaces, mansions, mosques, masjids, madrasas, tombs, fountains, baths and caravanserais belonging to the Anatolian Seljuks. Among these structures, the Karatay Madrasa, which was built in 1251 and has reached the present day, has always preserved its importance because it both mostly reflects the Seljuk art and has original

[1] Assoc. Prof., Ankara Yıldırım Beyazıt University, Faculty of Architecture and Fine Arts, Department of Architecture, Ankara/Türkiye, Orcid: 0000-0002-7562-3435, ferdemir06@gmail.com
[2] MSc, Ankara Yıldırım Beyazıt University, Institute of Natural and Applied Sciences, Department of Architecture, Ankara/Türkiye, Orcid: 0009-0007-2159-8776, esrakoyuncu96@gmail.com

features. This building, which has survived to the present day, has been damaged in some parts and has undergone various repairs. Within the scope of this study, information will be given on the history and architecture of the building, and then the restoration it has undergone will be mentioned.

General Characteristics of the Structure

Location and History:

The building is located on Alaeddin Boulevard in Konya, the capital of the Anatolian Seljuk state. Karatay Madrasah was built during the reign of İzzettin Keykavus II by Emir Celaleddin Karatay in 1251. Its architect is unknown. The madrasah, which was also used during the Ottoman Period, was abandoned in the end of the 19th century.

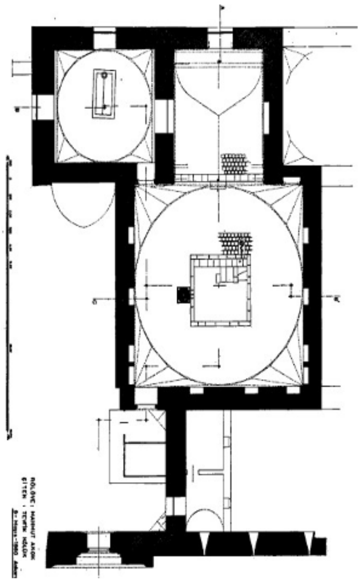
The building is located on the north of Alaeddin Hill, opposite the Selcuk University Rectorate Building and on Ankara Street. It is very close to the mosque and mansion built on Alaeddin hill. The madrasah, which is used as the Museum of Tile Works today, is frequently visited by local and foreign visitors due to its very important and central location (Yılmaz & Ulusoy, 2017).

Architectural Characteristics:

Karatay Madrasa is different from classical type Seljuk works with its plan, architectural formation, material and decoration features. Some of the features that make it different are:

- The skewness in the wall on the east façade
- Facade layout formed by the use of colored marble on the crown door
- Technical differences of the tile decorations in the interior (Yaldız, 2003)

The building has a simple plan scheme (figüre 1-2). It has a single storey, a closed courtyard, a single iwan and a dome. The domed madrasahs built during the Seljuk period in Anatolia are not as common as the madrasahs with courtyards. It is one of the rarest and most beautiful examples of the domed madrasah type. The decoration in the building is concentrated on the interior and the crown door (Yetkin, 1965). It is one of the most beautiful works of its period with its architecture and especially the tile coverings in the interior. Only the crown gate and three parts of the building have survived to the present day. These parts were repaired in 1954. The building, which was abandoned at the end of the 19th century, started to be used as a museum (Kuran, 1969).



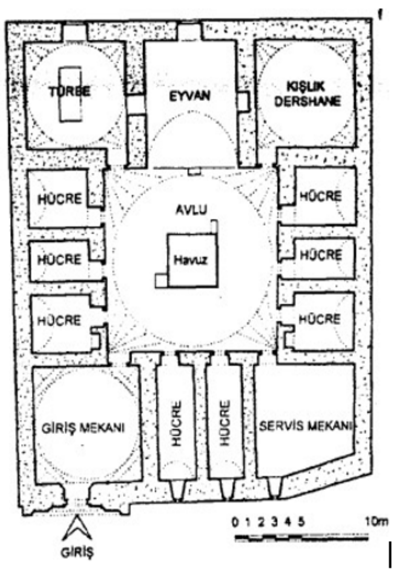


Figure 1: 1960- Survey plan (Akok, 1970)

Figure 2: Restitution plan (Yaldız, 2003; Sözen 1972)

Facade Characteristics:

The madrasa is generally 32.50 meters x 26.50 meters in size. The entrance to the building is from the east side. The portal on the entrance facade is not in the middle of the building but in the south corner (Kuran, 1969) (Figure 3). When viewed from the exterior, it is seen that the dome of the inner courtyard is the highest (Akok, 1970).

The Seljuk crown door tradition is not seen in the crown door composition. The effects of pre-Islamic regional architecture are mostly seen (Yaldız, 2003; Kuban, 2002). Examples of these differences are the door opening is not arched but with flat stone beams, and the muqarnas ending with five rows instead of a single string (Yaldız, 2003).

Two kinds of stone materials were used in the crown door (Figure 3). The depth of the entrance niche is small. There are decorated columns and capitals on the right and left of the niche. The pediment and the top of the niche are pointed arches, and the arch weave is made of two colors of stone. There are seven rows of muqarnas in the entrance niche. The upper part of this muqarnas continued straight without tapering. There are horizontal lintels and moldings on the entrance door. A carefully crafted frame surrounds these details of the inner door (Akok, 1970). There is an inscription written in Seljuk sülüs on the upper part of the crown door. It is decorated with white and gray marble between the door arch and the epitaph, and there are 3 rosettes (kabara) on it (Figure 4-5). The crown door is one of the parts of the building that has preserved its original shape well. The crown gate, measuring 7.50 meters x 8.25 meters, made of white and gray marble, resembles the gate of the Alaeddin mosque (Yetkin, 1965).

Figure 3: The entrance façade and crown gate of the madrasah (archive of the authors)

Figure 4: Crown gate detail of the madrasa (archive of the authors)

Figure 5: Crown gate details of the madrasa (archive of the authors)

From the entrance area behind the crown door, a passage is provided to the inner courtyard covered with a dome. In the middle of the inner courtyard measuring 12.10 meters X 12.00 meters, there is a square pool with a side of 3.70 meters. The inner courtyard is covered with a dome with a diameter of l2 meters and the interior of the dome is decorated with brick and tile mosaics. There is an opening in the middle of the dome. Although this part is closed today, it was open. Air and light were provided to the middle part of the building from here. It also keeps the courtyard cool on summer days. Rainwater was collected in the pool that was right under this opening. From the square plan to the dome, it is passed with triangular pendentives. There are student cells in the south and north of the inner courtyard. In addition, there is an iwan (Figure 6) in the middle of the courtyard to the west. It is 6.35 meters wide and 7.90 meters deep. Covered with a pointed barrel vault, this iwan is two steps higher than the floor level of the inner courtyard. There are large rooms with domes on the right (north) and left (south) of the iwan. In this room to the south, there is the tomb of Celaleddin Karatay and the sarcophagus inside belongs to him. The dome of the room is made of brick and is knitted with herringbone technique (Figure 7) (Kuran, 1969).

Figure 6: Madrasa main iwan (URL 1)

Figure 7: Madrasa dome detail (URL 1)

Decorative characteristics:

The best example of how significant decoration is in a madrasah is the Karatay Madrasa. The tiles, which contain various motifs and colors, enliven all the spaces of the madrasa and distract the building from its heavy appearance. It has a balanced ornament without exaggeration (Yaldız, 2003). The decorations in the building are divided into three as stone-marble, brick and tile decoration. Carving, relief, inlay and openwork techniques were used on the entrance facade where marble was used. Brick is generally used as a knit and not preferred for decoration. Tile decoration was used extensively in the building. For this reason, Karatay madrasah is one of the buildings in which tile material is used the most (Erdemir, 2015).

The decoration in the building is prominent with marble-stone at the crown door and mosaic tiles in the inner courtyard and iwan. The Ayetü'l-Kürsi and Baccarat Sura written in kufic, extending in stripes on the dome drum and walls, are among the most beautiful examples of inlay and cut tile work (Yetkin, 1965). The inner courtyard was actually covered with tiles from the corner junction of the triangular pendentives to the floor. Today, the tiles at the bottom have been destroyed, only the parts above the door arches remain. The walls and vault of the iwan were actually completely covered with tiles. Today, there are no tiles left on the walls, and the tiles on the upper part of the vault have also been poured. Besmele and Ayet'ül-kursi were written on the iwan arch with an exquisite thuluth made of mosaic tiles (Kuran, 1969). In the tile decorations in the Karatay madrasah, mostly the cut tiles technique was used. The tiles are black, eggplant purple and turquoise. Superior compositions are created with this technique. White (cream) color of plastered surfaces was also used. In particular, plaster whiteness was mostly used to highlight the writing strips (Akok, 1970).

Research on the original state of the building

Konya Karatay Madrasa is a well-known structure in the literature. As a result of on-site investigations and measurements, it was understood that the space behind the crown door was covered with a dome. It is identified from the existing triangular pendentive remains that the room to the north of the iwan was also domed, as in the tomb. In addition, it is evident from the remaining traces that the transition system of the entrance area to the dome is different from that of the other rooms. The dome of the entrance area is a ribbed dome. Another consideration is the side cells. None of the cells on either side of the madrasah have walls today. It is possible to see only the vault beginnings. There are traces of four doors on these walls. These four doors initially suggest that there are four cells on each side. However, the fact that the two doors in the east are 20 cm apart refutes this claim. It is estimated that one of these openings was made as a cabinet niche. The domed room to the north of the iwan is thought to be a winter classroom. It is estimated that the place in the northeast corner was either two cells inside one another, a library or a soup kitchen (Figure 7-8-9-10) (Kuran, 1969).

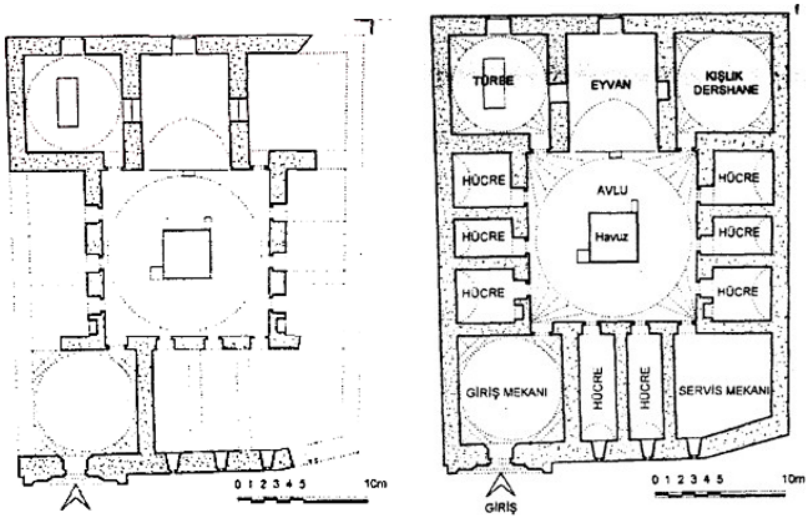


Figure 7. The plan of the madrasa before it was repaired in 1923 on the Left (Yaldız, 2003; Kuran,1969) / Restitution plan on the right (Yaldız, 2003; Sözen 1972)

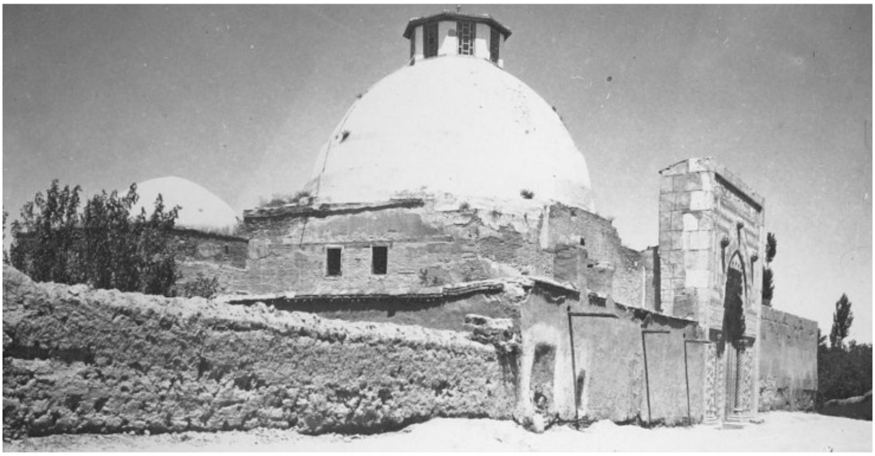


Figure 8. Karatay Madrasa-1914 (URL 2)

Figure 9. Karatay Madrasa on the left -1890 / Karatay Madrasa Crown Gate on the right (URL 2)

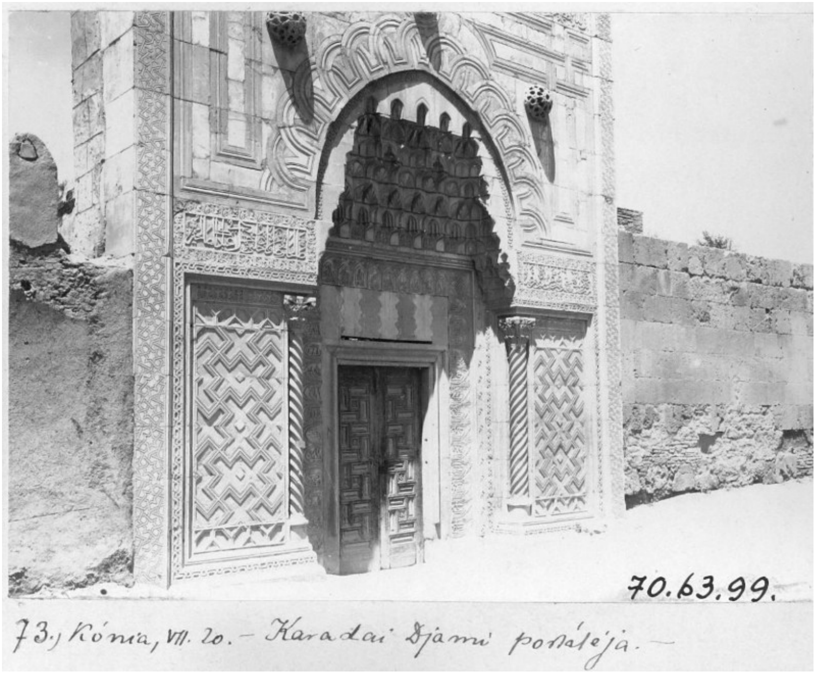


Figure10. Karatay Medresesi Taç Kapısı-1914 (URL 2)

Restoration of the building until today

The madrasah had rich foundations as of the time it was built, so it was frequently repaired in the past years. In the last centuries, with the disintegration of foundations, the source of income has decreased, and it has fallen into ruin. Many student cells were destroyed, and most of the tiles were shed due to moisture. It was closed with the Law of Unification of Education in 1924 and was not used for a while. In 1936, the building was repaired again. It was opened to use as the *Museum of Tile Works* in 1955 to exhibit the tiles found in the Beyşehir Kubad Abad excavations and from the surrounding provinces (Yaldız, 2003). While Önder talked about the old conditions of the building in his two books published in 1952 and 1972, he stated that the student cells began to collapse in the middle of the 19th century (Yılmaz & Ulusoy, 2017). That's why student cells were built in their place. In 1935-36, no student cells remained around the madrasah.. In 1936, the dome, iwan and tomb were repaired. Student cells made of mud brick were demolished in 1938. It was repaired in 1952, 1953, 1957. During these repairs, the old student cells in the north and south of the madrasah were rebuilt. The madrasa has been opened to visitors as the Museum of Tile Works since 1955, and it continues to function as the same (museum) today. The water channel, which was excavated in the main iwan of the madrasah in 2006 by the Museum Directorate, was exhibited. In 2008, the tiles in the courtyard were restored by the Ministry of Culture and Tourism. In 2010, under the presidency of Konya Museum Directorate, to eliminate the static problems and plan integrity of the building; salvage excavation was carried out in the destroyed northeast corner. In line with the data revealed because of archaeological excavations, the restoration works carried out between 2018-2020 and the student cells in the east of the madrasah were completed.

With the 1950 and earlier repairs, the exterior has been considerably modified. The domes are completely lead coated. A metal framed glass cover was added to the dome opening. The north and south cells with traces of foundations were restored (Akok, 1970). The skylight was renewed because of the restoration work carried out in 1990/91 (Yaldız, 2003).

The crown gate has remained virtually unchanged since it was built. The windows in the building were repaired and some changes were made in their forms. In addition, new window openings were opened because of the demolition of the space behind the crown door (Yılmaz & Ulusoy, 2017). The tile coverings of the Karatay Madrasa have been destroyed either intentionally or by the effect of time. This destruction can be seen in the upper parts, inside the dome and at the bottom of the walls. Once upon a time, this destruction was carried out deliberately to transfer our artifacts to foreign markets (Akok, 1970). After the madrasah was given the function of a museum, no interventions were made that would harm the original character of the building. The entrance to the museum is made from the place behind the crown door. An administrative advisory unit has been added to the entrance iwan. The student cell next to this place has been converted into an administrative unit and archive (Figure 11-12) (Yaldız, 2003).

Figure 11. Entrance iwan and administrative unit (archive of the authors)

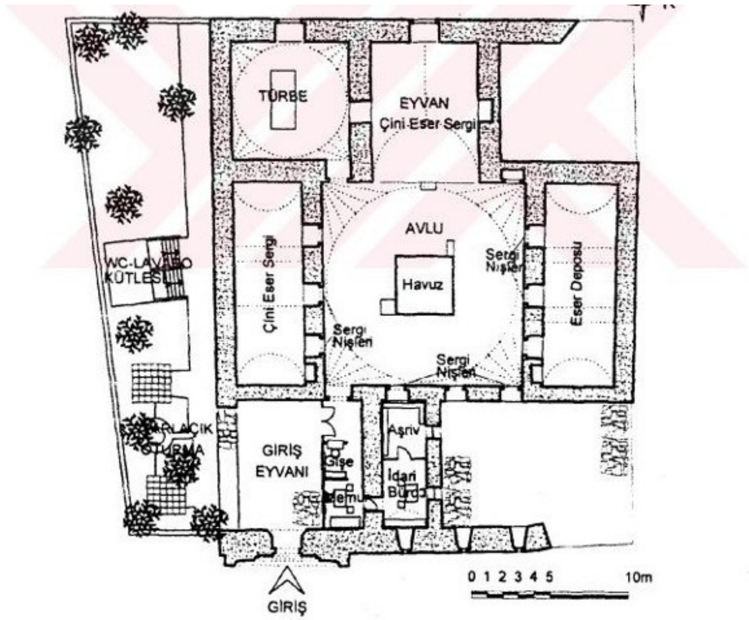


Figure 12. Karatay Medresesi Mevcut Planı-2003 (Yaldız, 2003)

The inner courtyard covered with a dome has turned into a place where tile works are exhibited. The student cells, which were destroyed until recently, were reconstructed based on their basic traces (Figure 13). The walls between the student cells in the north and south were removed and turned into a single large exhibition space. In the parts of these cells facing the courtyard, the doorways have been turned into exhibition niches. WC-sink is arranged in the garden. On the walls built of rubble stone, there were occasional deteriorations and spills in the joints. For this, the emptied parts were filled with rubble stone and the joints were filled with lime mortar (Yaldız, 2003).

Figure 13. Student cells turned into exhibition spaces (archive of the authors)

2005-2007 Restoration works:

Maintenance and repairs were carried out both outside and inside the building. In the external repairs, first, the walls of the building were cleaned, and the necessary insulation was made. Later, the facade walls and the top cover were overhauled. The lead coatings of the central dome and the upper cover of the main iwan were renewed, and the necessary insulation was made (Figure 14-15). In the meantime, large cracks were detected in the walls. Precautions were taken especially for these crevices formed on the walls of the main iwan (Erdemir, 2015).

The domed room in the northwest corner, which was destroyed, was repaired. In the first phase, the walls of this section were rebuilt with cut stone in accordance with the old foundation remains. The brickwork dome decoration of this room, whose top cover is a dome, was knitted in the fishbone pattern as in the original (Figure 16) (Erdemir, 2015).

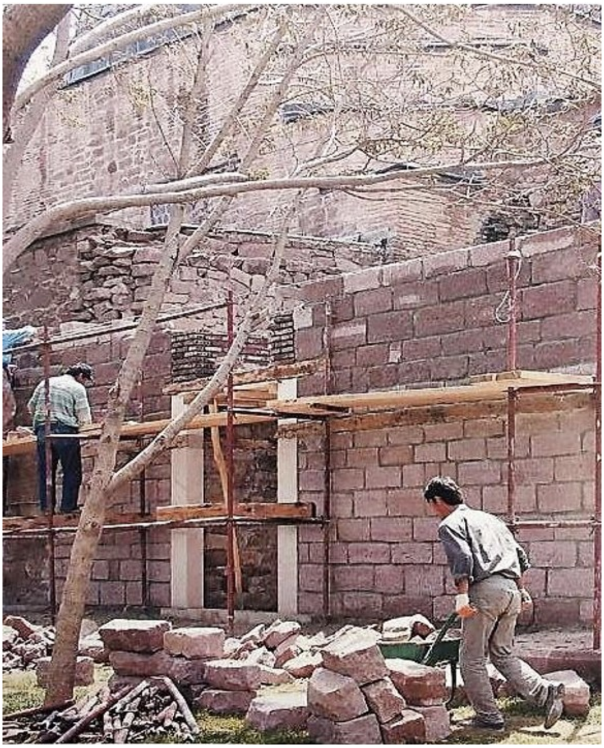


Figure 14. Repair of the ruined room in the northwest (Erdemir, 2015)

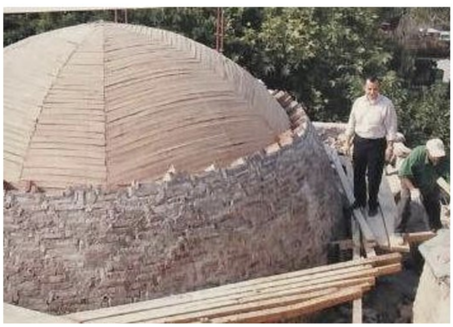


Figure 15. Dome skeleton of the ruined room in the northwest on the left / Dome structure of the destroyed room in the northwest on the right (Erdemir, 2015)

Figure 16. Completed dome on the left / Inside view of the dome in the middle / Drawing of the dome on the right (Erdemir, 2015)

A wide channel was found at the bottom during the draining of the soil in the ground to consolidate the foundation. There are water pipes here. These pipes come from outside the madrasah and reach the pool in the courtyard. In the cleaning and drilling works carried out in the main iwan, the soil of the iwan was removed, and the original brick floor was reached under it (Figure 17). Wooden beam rows were found here. It is understood that cylindrical beams of the same size and thickness form a row side by side, both carrying the upper load and creating leveling and drainage (Erdemir, 2015).

Figure 17. Restoration work in the main iwan on the left / Finds in the main iwan on the right (Erdemir, 2015)

Some interventions related to the madrasa were also carried out on the inner walls of the courtyard, the dome and transition elements. The rich wall tiles of the madrasa began to fall rapidly. The spilled parts, albeit haphazardly, have survived to the present day by being glued to the walls. The tiles, which were randomly patched on the wall during the repairs, were removed and stored in the warehouse. Their places were filled with plaster and leveled, and they were colored with paint close to reality. The same method was applied in the restoration works carried out on the dome and transition elements of the madrasah. After the cavities of the spilled and destroyed areas were filled with plaster and leveled, their surfaces were painted as before. These repairs have greatly reduced the problems of the work, increased its resistance and provided the opportunity to perform its task better (Figure 18,-19) (Erdemir, 2015).

Figure 18. Cracks in the iwan wall (Erdemir, 2015)

Figure 19. The works on the main iwan on the left / The cracks in the wall on the right (Erdemir, 2015)

2018-2020 Restoration works by Konya Directorate of Surveying and Monuments

Information about the restoration made in this period was obtained from the reports of the Konya Directorate of Surveying and Monuments. In 2010, under the presidency of Konya Museum Directorate, to eliminate the static problems and plan integrity of the building; salvage excavation was carried out in the destroyed northeast corner (Figure 20). In line with the data revealed because of archaeological excavations, the restoration works carried out between 2018-2020 and the student cells in the east of the madrasah were completed.

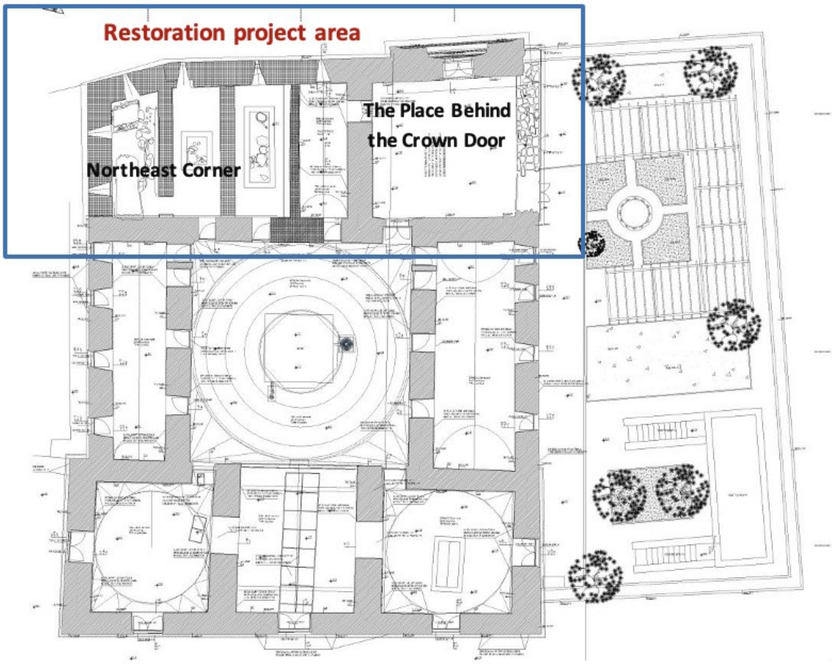


Figure 20. General plan of Karatay Madrasa

The data obtained because of the excavations in 2010 has been the basis for the latest restoration applications. The basic approach to the protection of cultural assets is to ensure their continuous maintenance. Ahunbay (2004) identifies consolidation, integration, renovation, reconstruction, cleaning, and transportation as the primary techniques for monument restoration, often applied in combination (Ahunbay, 2004). The preservation and use of the Karatay Madrasa have been ensured through interventions such as consolidation, cleaning, renovation, and completion.

The interior of the room in the northeast corner is not finished. It is still under construction. The main walls and the newly built glass dome can be seen from the outside of the place.

• Deformation and melting are observed in the tandoori remains belonging to different periods on the ground. Although the remains have not survived as a whole, they provide information about the original function and form of the period. These remains will be displayed with laminated glass flooring.

• Drains in the building mortar, joints and wall residue on the north façade were repaired. The joints have been renewed. After grouting the remains with lime mortar, the main walls were built.

• Two closed rectangular doors on the west wall will open.

• The top cover of this section is made of steel profile carrier, covered with glass material deemed appropriate, and made in the form of a sail vault (Figüre 21) (Based on the wall traces, it was concluded that this place should be covered in the form of a sail vault).

• During the production of the steel top cover, care was taken not to damage the original parts of the structure. The connections of the steel system with the wall were made considering the walls to be rebuilt. The connections on the existing walls are provided with epoxy anchors between the joints.

Figure 21. Exterior view of the newly built glass dome of northeast corner (archive of the authors)

Restoration applications behind the entrance door are as follows:

- The tile mosaic floor of the section behind the entrance door has moved away from its original level because of the interventions. The floor was covered with brick material, bringing the quota recommended in the restoration project (Figure 22).

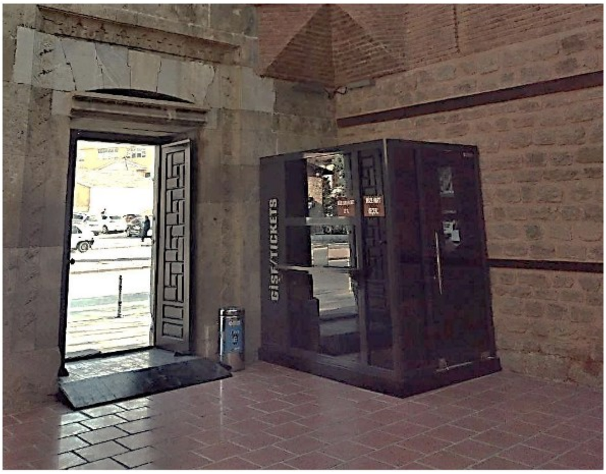


Figure 22. Covered with brick material infloor (archive of the authors)

• The joint discharges on the walls were renewed with lime mortar. It is reinforced by injection where needed. The rubble knitting on the west wall was rotted where necessary and the deviations in the wall were removed.

• The bricks that rotted and lost their properties in the transition areas to the dome were rotted and renewed. The joints were renewed with lime mortar and reinforced by injection with lime mortar in the parts deemed necessary during the application.

• The main wall of the south façade has not survived. The wall, which was built up to a certain level symbolically during the previous applications, was resurrected.

• The tile cover on the Turkish triangles has been removed.

• The cement plaster of the existing room, located between the back of the crown door and the northeast corner, will be scraped and renewed with lime mortar.

• In order to prevent the greenhouse effect of the top cover to be made in this section and to provide ventilation, the dome was elevated in the upper part to provide air circulation.

• The top cover of this section is made of steel profile carrier, covered with glass material deemed appropriate (Figure 23-24).

• During the production of the steel top cover, care was taken not to damage the original parts of the structure. The connections of the steel system with the wall were made considering the walls to be rebuilt. The connections on the existing walls are provided with epoxy anchors between the joints.

Figure 23. The top cover of this section is made of steel profile carrier, covered with glass material deemed appropriate (archive of the authors)

Figure 24. Exterior view of the newly built rib-vaulted glass dome archive of the authors)

Evaluation and Conclusion

The Konya Karatay Madrasa was closed in 1924 due to the Unification of Education (Tevhid-i Tedrisat) Law, resulting in the loss of its original function. In 1955, the building was re-functionalised and began serving as the Tile Works Museum, continuing this function in subsequent years under the principle of adaptive reuse. Changes in the comfort standards of modern life have led to historical buildings becoming obsolete over time. While some of these structures may retain their original uses, they are often subjected to wear and degradation due to social, technological, and environmental factors, potentially rendering them inactive (Douglas, 2006). Preservation of these structures can be achieved by modernizing their original functions or adapting them for suitable new uses. Adaptive reuse has emerged as one of the widely accepted conservation approaches today (Bullen and Love, 2011).

One of the most significant issues in the field of preservation is the transmission of historical structures, which are part of the past and hold an important place in urban identity, to future generations. In our country, which bears the traces of many civilizations, the preservation of cultural and architectural heritage is of great importance. Sharing the architectural features and preservation process of the Karatay Madrasa, one of the prominent structures of the Anatolian Seljuk period, is considered important in this regard.

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URL 1: *https://okuryazarim.com/konya-karatay-medresesi/*

URL 2: http://www.eskiturkiye.net/tag/konya

CHAPTER IV

The Effect of Anthropogenic Factors on The Development of Deterioration in Cultural Heritages

Mehmet Can BALCI[1]
İsmail İNCE[2]
Mehmet Ergün HATIR[3]

1. Introduction

Atmospheric effects threaten the cultural and aesthetic significance of monuments by causing deterioration of building stones. Of these effects, water is among the most important factors controlling deterioration processes. Water is also the most active agent in the deterioration processes in building stones (Fener & Ince, 2015). Water intrudes into historic buildings in two different ways:

[1] Asst. Prof., Batman University, Faculty of Engineering and Architecture, Department of Civil Engineering, Batman/Turkey, Orcid: 0000-0003-3737-2556, mehmetcan.balci@batman.edu.tr

[2] Assoc. Prof., Konya Technical University, Faculty of Engineering and Natural Sciences, Department of Geological Engineering, Konya/Turkey, Orcid: 0000-0002-6692-7584, iince@ktun.edu.tr

[3] Assoc. Prof., Necmettin Erbakan University, Faculty of Fine Arts and Architecture and Environmental Design, Konya/Turkey, Orcid: 0000-0003-0460-0583, mehatir@erbakan.edu.tr

capillary uplift and infiltration of rainwater (Korkanç et al. 2019). In capillarity, groundwater rises in the opposite direction of gravity in the voids inside the building stones. Rainwater seepage triggers freeze-thaw and wetting-drying cycles in building stones, while salt crystallization is involved in atmospheric processes through capillary uplift (Hatır et al. 2022). These atmospheric processes can cause deterioration of the building stones, resulting in permanent damage to the monuments. The monumental structures, which were planned to survive for a long time and be passed down from one generation to the next, were built by taking measures to protect themselves from the effects of water. For this purpose, drainage lines were planned to prevent soil water from entering the monuments, and roof forms and gargoyles were designed according to the climate for infiltration water on the monuments.

Besides water, another influential factor on deterioration processes is anthropological effects. Anthropogenic effects may play an important role in accelerating this process. Human impacts, such as vandalism, cadastral works and inappropriate restoration activities, can increase the rate of existing deterioration, but can also lead to the appearance of new types of deterioration. As a result of anthropogenic activities in the historical process, the measures taken to protect the monument against deterioration may also become dysfunctional. This undesirable situation accelerates the deterioration processes and poses a serious threat to monuments.

One of the important monuments where the aforementioned threats are observed is the Taş Mosque in Konya. Taş Mosque is one of the unique Seljuk period monuments in the city of Konya. This mosque is a monument built in 1215 entirely using cut stone. In this present study, the deterioration of the Taş Mosque, one of the unique Seljuk artifacts, due to human influences was examined.

2. Description oF Taş Mosque

Konya, the ancient seat of the Anatolian Seljuk State, became the capital city in 1097 when Iznik was ceded to Byzantium and reached its most vibrant period with Izzeddin Keykavus I and Alaaddin Keykubat I (Önge, 1988; Baykara, 2002; Erdemir & Yavuzyılmaz, 2010; Arslan, 2021). During the late 11th century Seljuk conquest, the city, which was only within the walls surrounding Alaaddin Hill, expanded with the construction of the second outer walls, especially during the reign of Alaaddin Keykubat I. As a result, the city witnessed great architectural breakthroughs reflected in the development of the city. Undoubtedly, the most important building types of this architectural development were the masjids built in the neighborhoods (Arslan, 2021).

Taş Cami is also known as Akçe Gizlenmez Cami. Inscriptions indicate that the structure was built in 1215, during the reign of the Seljuk Sultan Izzeddin Keykavus, by Hacı Ferruh Bin Abdullah for the architect Ramazan Bin Güneş. Because the interior, exterior, walls, and dome of the structure were entirely constructed with uniformly cut stones from Küçük Muhsine, it is popularly known as the Stone (Taş) Mosque. Gödene Stone, together with Sille Stone and Keçimuhsine Stone, has been used as a building material in Konya for centuries. Taş Mosque has a rectangular session area extending in the east-west direction. It consists of a cubic masjid section with a square plan and a single dome and a congregation section.The entrance doors and the stone mihrab in the rectangular building are adorned with engravings, each symbolizing a unique meaning. The geometric borders on the mihrab represent stars, the universe, the cosmos, and the concept of eternity. Although it is a small structure, it has stone carvings and geometric relief ornaments that are rare even in Seljuk mosques (Figure 1).

Figure 1: General view of Taş Mosque

3. Material and Method

In-situ observations and laboratory studies were carried out to investigate the origin of the damages observed at the Taş Mosque. For this purpose, samples were collected from the ancient quarry of the rock from which the monument was built and samples were prepared in the laboratory according to the methods recommended in TS EN-1936 (2010). After the sample preparation stage, porosity and dry density values (TS EN-1936, 2010), P-wave velocity (ASTM E494, 2010) and capillary water absorption (TS EN-1925, 2000) values were determined according to the relevant standards.

In order to determine the petrographic and textural properties of the rock from which the monument was built, a thin section was prepared according to TS EN 12407 (2019) standard. The definitions specified in ICOMOS-ICS (2008) were taken into consideration in the observational examinations made in-situ.

4. Laboratory and Observational Results

4.1 Petrographic and indexes-strength properties of the samples

Macro examination of the building stone shows plagioclase, hornblende and quartz phenocrysts and rock fragments floating in a light-dark gray paste (Figure 2.a). Microscopically, the pyroclastic rock contains 40% volcanic glass, 20% plagioclase, 13% hornblende, 8% quartz, 9% rock fragments, 9% biotite and 1% opaque minerals (Figure 2.b). The rock shows porphyritic texture and is named crystalline tuff according to Schmid (1981) classification.

The porosity (n), dry density (ρ_d) and P-wave velocity (Vp) values of the building stones used in the monument are 24.35%, 1.90 g/cm^3 and 2.57 km/h, respectively. According to NBG (1985) porosity classification, the building stone is classified as very high porosity rock. The capillary water absorption (C) value of the samples, which plays a major role in the transport of water in the building stone, is 99.33 g/m^{2}s$^{0.5}$. According to Snethlage's (2005) capillary water absorption classification, the sample is classified as highly absorbent rock.

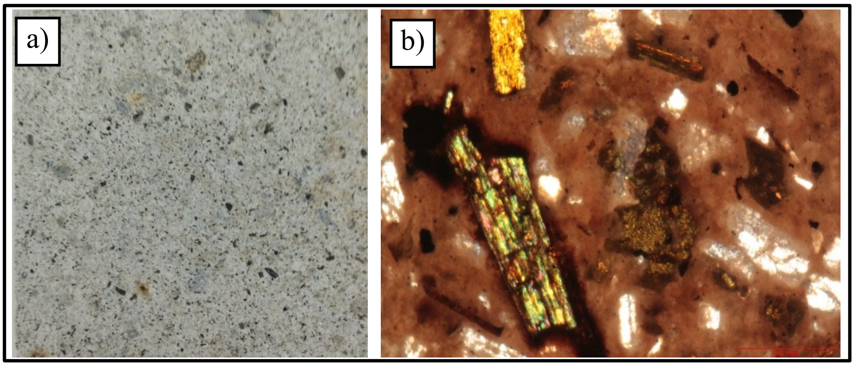

Figure 2: Building stone; a) macroscopic appearance, b) thin section view

4.2 Deterioration types observed in the monument

In addition to their aesthetic appearance, building stones have been frequently used in monuments throughout history due to their higher strength properties compared to other traditional building materials. However, rocks with high porosity and capillarity are sensitive materials to atmospheric processes. Anthropogenic impacts can directly affect the acceleration of these processes. In this study, the deterioration processes at Taş Cami, where atmospheric deterioration processes accelerated due to cadastral activities around the monument. This monument, built of pyroclastic rocks with high capillary water absorption, has been below the road elevation over time due to landscaping. This caused rainwater to accumulate around the monument and increased the level of capillary rise (Figure 3).

Figure 3: Entrance facade of the Taş Mosque

During rainy periods, water-soluble salts are transported into the rock pores by capillary uplift, and with the increase in temperature, efflorescences type of deterioration was formed (Figure 4).

Figure 4: Efflorescences type deterioration development

In addition, while wetting-drying cycles due to atmospheric processes are active in the capillary zone during the summer periods, freeze-thaw related deterioration developments are evident during the winter periods. Due to these processes, flaking, which is the beginning of the deterioration processes in the capillary region, as well as contour scaling type deterioration were detected (Figure 5).

Figure 5: Flaking, contour scaling and moss growth observed in the capillary zone

Some of the stones in this part of the building show differential erosion type deterioration due to matrix loss (Figure 6). In addition, moss-type biological colonization was detected in some stones in parts of the building with high humidity (Figure 5).

Figure 6: Differential erosion observed in the capillary zone

Another problem in the monument is the moisture detected in the percolation zones caused by rainwater. Due to the loss of function of the monument's gargoyles, the percolation zones in the mosque show a wide spread. In addition, in the zones where the gargoyles were located, seepages and capillary zones combined to form a large moist area (Figure 7). In these zones, contour scaling deterioration developments were detected at depths of 1-5 cm due to atmospheric processes (Figure 8).

Figure 7: The moist area showing a wide spread in the monument

Figure 8: Contour scaling type deterioration around the gargoyle

In addition to atmospheric deterioration processes, soil settlement and vibrations caused by vehicle traffic in front of the monument also triggered deterioration. Due to soil settlement, the mosque shifted from its vertical axis and cracks formed due to vibrations. (Figures 3 and 9).

Figure 9: An image of cracks developing in the monument

Another problem in the monument is the wrong restoration applications (Figure 10). After the applied interventions, the aesthetic appearance of the mosque has deteriorated.

Figure 10: Improper restoration work on the Taş mosque

5. Conclusion

Anthropogenic effects can be one of the greatest threats to the sustainable conservation of monuments. Human impacts can cause instantaneous damage to structures, but they can also accelerate atmospheric processes over time. In this study, Taş Camii, where deterioration accelerated due to atmospheric processes after cadastral activities, was examined and the findings are given below.

• Over time, the capillary level of the Taş Mosque, which was below the road level, rose and caused the development of flaking, contour flaking, differential erosion, efflorescence and moss-type deterioration over a wide area.

• As the gargoyles collapsed over time, the seepage zone widened and deeper contour scaling formations emerged.

• The wrong restoration applications in the capillary region not only reduced the aesthetic value of the mosque but also caused the capillary level to increase.

• Based on the results of this study, it is thought that evaluating the effects of environmental planning on monuments will make a significant contribution to the transfer of historical monuments to future generations.

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CHAPTER V

Architectural Design Process and Virtual Reality

Halil SEVİM[1]
Havva ALKAN BALA[2]

1.Inroduction

From the past to the present, the changing and evolving structure of life has affected human beings and thus many areas with which they interact. The role of technology in this change cannot be underestimated. Therefore, every step taken, every task performed and every product developed in the field of technology has a key role in meeting directly with the user. This development leads to a gradual blurring of the boundaries between the real and the virtual in a conceptual sense. As a result of this disappearance of conceptual boundaries, the interaction between the real and the virtual increases

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[1] Assist. Prof. Dr., KTO Karatay University, Faculty of Fine Arts and Design, Department of Architecture, Konya/Türkiye, Orcid: 0000-0002-0211-3397, halilsevim@gmail.com

[2] Prof. Dr., Çukurova University, Faculty of Architecture, Department of Architecture, Adana/Türkiye, Orcid: 0000-0002-0027-7531, halkanbala@gmail.com

This study is based on Halil SEVİM's doctorate thesis entitled "A METHOD SUGGESTION OF EXPERIENCING VIRTUAL REALITY IN ARCHITECT CUSTOMER RELATIONS".

and this interaction effects architecture. The context of architecture and design is in direct interaction with human beings. Every human being is a life designer who can assume the role of a user. However, interaction between the designer and the user is required in the process that progresses from the definition of the design problem to the production of a solution. Problems that may occur during this interaction damage the process and create negative effects. In order to avoid communication-related problems, innovative searches in communication methods come to the fore. In this context, communication with virtual reality as a tool in the architectural design process has been investigated.

2.Architectural Design Process

Although the word design can be explained conceptually in different ways, in architectural terms, it can be defined as the generation of an idea for a purpose or the creation of a new situation by developing an existing idea. The act of designing can be defined as finding the right part for physical integrity, a result-oriented problem-solving activity, a decision-making mechanism to minimize errors in situations of uncertainty, simulating and experimenting with the action to be performed until a satisfactory result is obtained before performing the action, and the production of satisfactory results by achieving the best balance of economy and effectiveness (Jones, 1992).

Markus explains the design process as a process in which the stages of analysis, synthesis, evaluation, decision and communication are related to each other in a continuum by making a vertical grading from the general/abstract to the specific/concrete (Markus et al., 1972). In Markus' model, the decision reached as a result of the analysis, synthesis and evaluation stages is formed as a reorganization and restructuring of the decision reached before it in the process followed from the beginning to the end. In this way, the process continues and the final decision is reached and communication is ensured (Markus et al., 1972). In addition to the process definitions made by Markus, the studies of Boekholt, Archer, Akın and Hamel were also examined. These studies have similar definitions. The following three basic steps are commonly identified in the design process;

- Analysis

- Synthesis

- Evaluation (Jones, 1963; Zeisel, 1984; Vries, 1994; Lawson, 2006).

In the architectural design processes examined, the communication phase is defined as a concrete step in some processes, while it is not defined in others. However, in all of these processes, there is a communication phase, even if it is not defined.

In the Architectural Design Process, analysis is a process associated with investigating and decomposing the design problem into its components. In addition, analysis involves collecting and examining existing information, identifying goals and needs, and determining the connections between the components of the design problem (Vries, 1994). In this context, the analysis phase is actually a research and data collection process for the design problem rather than a design solution. The data collected as a result of the research can be grouped to be used in the next stages. As a result of collecting the data together in groups, the classification process can be realized and thus rational use of these data will be possible. The analysis phase begins concretely when the design problem is communicated to the designer or the architect in the architectural design process. However, the analysis phase can be considered as a situation that starts from the moment the user first encounters the architect in the architectural design process. This situation will allow the architect to observe the characteristics of the user before the design problem to be solved for the user and to make an idea about the demands that the user will express or not express clearly. Similarly, the same idea applies to the location of the design problem, the characteristics of the location, the materials to be used, the construction technique and technology.

Synthesis in the architectural design process deals with the experiments made to solve problems and is an effort to create a holistic design by combining these experiments (Vries, 1994). The production trials carried out by the designer based on the researches and data collected in the analysis phase are realized in the synthesis phase. At this point, the usage, importance and priority groupings made in the analysis phase serve as a reference and guide the designer. In addition, the designer makes use of his/her own experiences and knowledge.

The evaluation phase in the architectural design process is the part where the proposed solution or solutions are examined for their ability to meet the needs (Vries, 1994). It cannot be ignored that the information obtained by the architect from the very beginning of the process affects the preferences during the selection in the evaluation phase, where the solution proposals produced in the synthesis phase are tested according to the criteria determined and the selection process is carried out according to the fulfillment of the requested needs. The evaluation phase, which can also be considered as the selection phase, ends with the decision on the suitability of the design. Before this decision-making process, the architect examines the design and investigates whether it meets the needs. However, this research is realized through expressions in forms determined by the architect. The design proposal, which can only be expressed by the architect with limited size and scale in traditional methods, is never possible to be perceived in one-to-one scale and actual dimensions as if it was built under these conditions. For this reason, the acceptance of the solution proposal is added to the process as the architect's subjective thought.

Although communication in the architectural design process appears as the last stage of the process in the narrative, it is actually a stage that covers the entire process. Communication covers all the dialog between the architect and the user in the analysis, synthesis and evaluation processes. The communication phase is examined under the titles of communication as function and behavior, communication as process, communication interface and communication problems.

Within the scope of the study, the communication phase is investigated by narrowing the scope of the design product, which has reached a certain maturity, in the form of a process in which a common platform is created between those who demand this product (user/experiencer) and those who demand this product (designer/architect), thus providing information flow and interaction. In the communication process, the architect presents solution-oriented selection proposals to the user from the first stages of the architectural design process to the evaluation stage by using various methods of expression. The user expresses positive or negative opinions in line with the traces left by this presentation. In addition, potential users convey their demands and changes of opinion to the architect in this process. When the definition of communication is extended to the field of architecture, it is said that "Architecture is primarily concerned with communication" (Gabriel and Maher, 2002). The premise of this definition is that the theories adopted by architects are the result of the communication expressed between the architect and the user, as well as within the built environment (Shabak et al., 2012; Shabak et al., 2014). The most important characteristic of a communication is that it is a social relationship in which the assumptions and expectations of the communicating parties can be stated and even explained. Also, in the design process, it should be considered that problems can be solved by using different forms of communication instead of increasing the amount of communication (Smulders et al., 2008).

Over time, many communication models have been developed, from written and drawn documents to computer-assisted communication such as telephone, fax, email and video conferencing. In the field of architecture, communication between architect and user is based on a relationship that uses everything from verbal communication to communication with the help of computer-generated technical architectural drawings. In the architectural design process, digital technology has been used in the production of two-dimensional drawings, three-dimensional representations, animations and simulations. Architectural presentations and the act of moving through them is a valuable method of communication (Kitchens and Shiratuddin, 2007). Digital technology not only facilitates communication between the user and the architect, but also enhances the architectural design process (Gabriel and Maher, 2002). Effective communication relies on the correct use of media (Ean, 2011). As in the field of architecture, the development of information technologies has also affected the communication environment (D'ambra et al., 1998).

The most common complaints from users of architectural services are related to misunderstandings and dissatisfaction (RIBA, 2015). Although the user is crucial in the design process, they often do not understand the design processes and are not aware of what information they need to convey to the design team (Tzortzopoulos et al., 2006; Siva and London, 2011). Users who find themselves engaged in architectural design processes are often unfamiliar with them or are exposed to the stress and confusion caused by these unfamiliar processes. As the user learns more about the process, they become more comfortable and the attitudes of the architect and the user harmonize. The level of education of the user is a key component of a successful user-architect relationship (Siva and London, 2011). In addition to education, mutual understanding is another important component of a successful user-architect relationship (Long and Wilson, 2002; Stater, 2002; Tusa, 2002). Many successful construction projects have been realized only after time-consuming discussions and subsequent compromises (Chen, 2008). Architect-user meetings are a way to facilitate communication at every stage of the design process and to quickly find solutions to problems that may arise (Emmitt and Gorse, 2006; Otter and Emmitt, 2008). The basis of a successful production process is the generation, interpretation, distribution, coordination, management and storage of design information (Gray and Hughes, 2001; Emmitt and Gorse, 2009). The transformation of data into information is the process of communicating it to the user, who is the receiver in the process, with the help of a media (Moum, 2008). The problem often arises from the fact that users cannot imagine how the design will turn out after the construction phase (Lertlakkhanakul et al., 2008). The inability of users to read or misread drawings is also an important factor affecting the understanding of the design (Barrett and Stanley, 1999). Communication problems between users and architects can be classified as technical and social. Solving communication problems based on social issues requires a socially oriented approach. In order to solve social-based communication problems, it is necessary to develop a method that allows users to take part in every stage of the design process (Sarvarazadeh et al., 2013). Coughlan and Macredie also proposed a supportive design tool and technique where users can be involved in the design in an interactive communication activity (Coughlan & Macredie, 2002). As a solution to communication-related problems in the architectural design process, the following solutions have been proposed to establish more effective communication between designers and users (Shen, 2011):

- Letting the user(s) know that their opinion is valued,

- Managing design revisions based on requests,

- Using a clear and understandable visualization technique suitable for the design.

In the architectural design process, the presentation method and representation method used to transfer the structure designed by the architect to the user gain importance in terms of the accuracy of the transfer. At this point, in the perception of the designed space, the communication problem between the architect and the architectural design can be eliminated by using a clear visualization technique suitable for the design and the possibility of free movement in the space provided by virtual reality technology.

3.Virtual Reality

The definition of virtuality in virtual reality can be traced back to the efforts of the first people to tell later generations by re-enacting that moment with the signs they created on the cave walls. This is the basis of the definition of virtual. Virtual and real are not two opposite terms. They can be considered as two complementary terms. In this case, the term virtual can be defined as not having a physical existence at that moment. However, this does not mean that the physical existence of that moment took place in a time period in the past, nor does it mean that it has never happened or will never happen. The experience of this virtual moment in real time can be expressed as virtual reality. In this case, the virtual moment comes alive in real time and interacts with the user. This interaction and experiencing the moment in real time is the basis of the concept of virtual reality. The concept of virtual reality has been defined similarly at different times. According to the definition made by Sherman and Craig, the concept of virtual reality is the systems that constitute the virtual world in which the individual is physically surrounded and which includes interaction (Sherman & Craig, 2003). According to Burdea and Coiffet's simulation, virtual reality is a simulation created with the help of computers and graphics, which has an appearance close to the physical environment but is not fixed or static and interacts with the user (Burdea & Coiffet, 2003).

If the definition of reality is considered as perceiving what physically exists, the definition of virtual reality can be defined as perceiving what does not physically exist. The virtual existence of the physically non-existent means that it is created in the mind with the help of certain stimuli. These stimuli can be icons painted on cave walls or moving and interactive visuals with realistic graphics shown with the help of head-mounted virtual reality devices. The content of the virtual reality experience must include a virtual world, enveloping the user, feedback and interaction with the help of sensors. The virtual world can be created in the mind of the person with the help of stimuli. However, the existence of virtual reality systems is not mandatory for a virtual world (Sherman & Craig, 2003). For example, with the help of words containing spatial descriptions in a book, the detailed visualization of that place in the reader's mind as in the physical environment is an example of the formation of a virtual world. Immersion, which is necessary for the virtual reality experience, is a method that is created by appealing to the user's senses and affects perception. With the sense of immersion, the user experiences virtual reality by isolating himself from the physical environment and feeling that he is in the moment. This sense of immersion, which isolates the user from the physical environment, consists of two sub-sections: mental immersion and physical immersion (Sherman & Craig, 2003). Mental immersion means being enveloped by the stimuli that appeal to perception, even if not completely physically enveloped, in terms of thought and thus experiencing the virtual reality experience. Physical envelopment, on the other hand, means that our perception organs are partially or completely surrounded by virtual reality equipment.

During the experience of the virtual reality environment by the user, there are sensors on the system. With the help of these sensors, the user's movements are tracked and processed as interaction input in the virtual reality system. The user can make changes to the parameters they want to control with the help of auxiliary hardware or predefined signs. These changes are evaluated within the virtual reality system and current changes are presented to the user. Thus, feedback and interaction are provided in accordance with the user's movements. When virtual reality is analyzed without considering the hardware infrastructure, it can be seen as animations that have been going on since prehistoric times. Social changes have brought along developments in narrative techniques and forms of expression, and the changes that have occurred through these developments have affected societies again. In this interaction process, technology and therefore computer systems have developed rapidly with new inventions and have started to play a more active role in life. Hardware developments in virtual reality are in parallel with technological developments. In

1916, the first head-mounted display device was invented by Albert B. Pratt (Figure 1) (U.S. Patent 1.183.492).

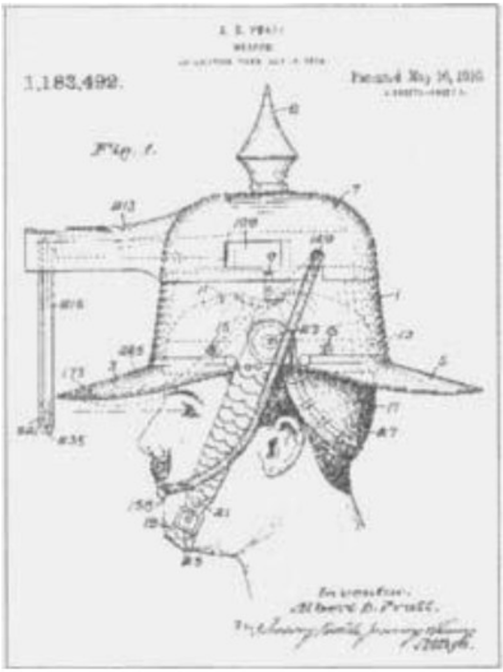

Figure 1. The first head-mounted display device

(Sherman and Craig, 2003)

Sensorama was invented by Morton Heiling in 1956, inspired by Cinerama, a system for showing moving pictures with the help of a large screen. Morton Heiling registered Sensorama as a simulator in 1962 (U.S. Patent 3,050,870). Sensorama is an imaging system for displaying different types of images in different formats. Sensorama was the first virtual reality hardware capable of displaying three-dimensional (3D) video. The video images shown in Sensorama were obtained with the help of two 35mm fixed focal length cameras side by side. In addition to video display, Sensorama also provided the user with motion, color, stereo sound, smell, wind effect and vibration data. The wind effect was realized with the help of small fans placed around the user's head, while the vibration effect was realized by means of motors placed on the seat. Thanks to these feedback features, Sensorama was designed in such a way that the user could feel the wind with the help of the fans, the potholes on the road with the help of the vibrating seat, and even the smell of the food sold there when passing by a shop, (Burdea and Coiffet, 2003).

From the early 2000s until today, the development graph of virtual reality has increased geometrically. Virtual reality is constantly evolving in parallel with technology. The main supporting factor in the development of virtual reality is the rapid development of computer technologies. Nowadays, hardware with fast processing power and capacity (CPU) is insufficient and specially developed graphics processing systems (GPU) are used for more detailed and faster display of graphics. As supporting hardware, tracking systems can also be provided precisely with the help of infrared cameras and various sensors. However, virtual reality systems have become economically accessible to the user. Thanks to the wide accessibility potential of virtual reality systems, which have spread to many different platforms, users can be constantly connected with users. As a result of the continuous development of computer systems and virtual reality hardware and software, it is now widely used in many areas such as health, education and entertainment.

The definition of virtual reality consists of a combination of 3 basic elements. These basic elements of virtual reality are immersion, interaction and imagination. In order to provide human-computer interaction, specially designed user interfaces are needed that transmit the user's commands as input to the computer and present the feedback from the simulation program on the computer to the user (Figure 2). With the developed hardware and software, these user interfaces in the virtual reality system are designed to interact with various senses. 3D position trackers that measure body position, clothes that detect body movements, data gloves that detect hand gestures, stereo headsets, large presentation viewers and virtual sounds generated by computers are the hardware that make up these interfaces (Burdea and Coiffet, 2003).

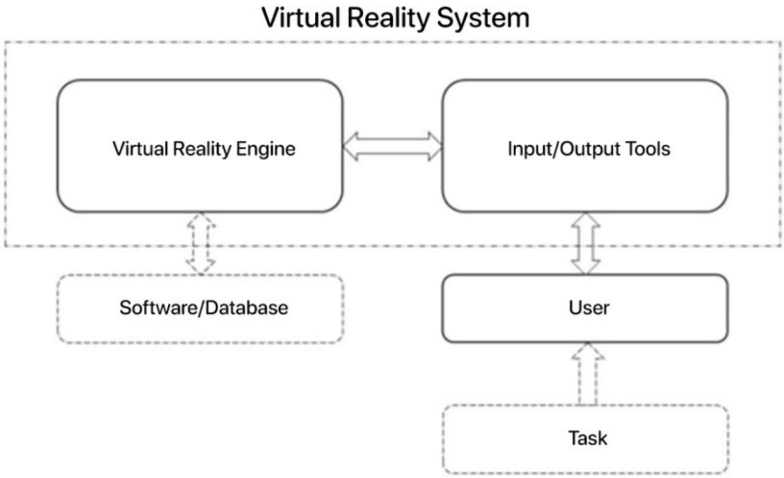

Figure 2. Components of virtual reality

(Burdea and Coiffet, 2003)

In addition to Burdea and Coiffet's description of the virtual reality system, Sherman and Craig present the design experience in the interaction of the user interface, virtual environment and life experience by adding the virtual environment and the user's life up to that moment and explain the components of the virtual reality experience (Figure 3.). In virtual reality systems, there are various data input methods to observe the user's interaction with the virtual environment. Virtual reality systems vary in the way the computer follows the user and the way user inputs control the virtual environment. Both the user's movements and the user's commands are important for a truly immersive virtual reality effect to occur (Sherman & Craig, 2003).

Position tracking is the transmission of three-dimensional displacement data to the computer, which is realized by means of position sensors, and which is due to the movement or rotation of these sensors in their own position. Position sensors are mostly used in tracking head and hand movements. Position sensors are the most important tracking hardware in the virtual reality system. They ensure the continuity of the interaction by informing the system of the user's location within the virtual reality environment (Sherman & Craig, 2003). Various tracking systems are used during the creation of the connection between the hardware sensing the position tracking and the moving joint and transferring the information to the computer. These systems show structural differences according to cost, hardware variations and system requirements.

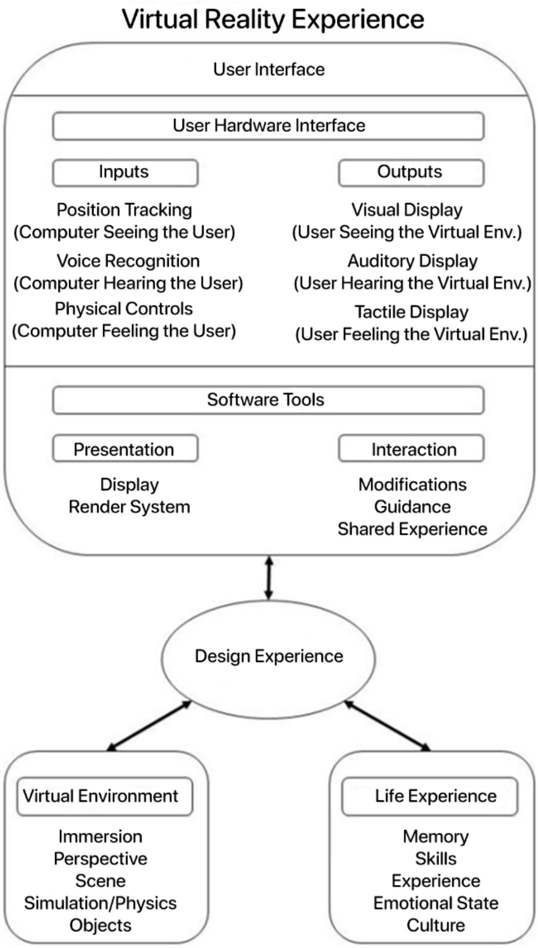

Figure 3. Virtual reality experience

(Sherman and Craig, 2003)

The limitations of tracking systems also vary according to these differences. The system requirements are shaped according to the need and determine which type of position tracking mechanism will be used. For example, in a system using optical sensors, there should be no obstacles between the joint motion sensor and the hardware to which this sensor transmits. Otherwise, there will be breaks in the system and the transmission of accurate data will be prevented. Therefore, if the data transmission is blocked by an object, it will not be possible to use this type of optical system. Depending on their structural differences, position tracking mechanisms are transformed into different systems such as electromagnetic, mechanical, optical, videometric, ultrasonic, inertial and neural.

In the physical environment, the human body is constantly exposed to sound waves. When these sound waves are perceptible by the ear, they are transmitted to the brain in the form of vibrations after passing through the bone system in the ear and perception takes place. Sound waves help to perceive a lot of information about the physical environment. Sound contains detailed information about environmental factors in the virtual environment as well as in the physical environment. In the virtual environment, sound is presented to the user in 3 forms: mono, stereo and 3D. In mono sound, the sound transmitted to both ears is the same. It provides the least information to the user. In stereo sound, the sound transmitted to both ears is differentiated. It contains more information about qualities than monaural sound. While 3D sound transmits differently to both ears like stereo sound, it is formed in a way to support the sense of envelopment by following the user's movements. Sound plays various roles in virtual reality systems. Complementary information provides more detailed information about the virtual environment. The echoes generated can provide information about spatial sizes and distances, as well as surface materials, weights and forces. Auxiliary feedback can provide information to the user in the form of indicating their choices or emphasizing approval during visual interaction. Alternative interaction method: the user can interact with his/her own voice in a virtual environment with the help of voice recognition algorithms and can make it happen by saying the actions he/she wants to implement (Gutierrez et al., 2008).

The voice command system can be analyzed as a data entry system in virtual reality. However, in this data entry system, predefined words and related functions should be determined. The user transmits the predefined words in the form of sound waves by acting as a transmitter with his/her own voice. The predefined words are received in the form of a sound wave by a microphone acting as a receiver suitable for data input in the system, and this sound wave is processed by the computer and the function to which it is connected is activated. Thus, interaction with the user who transmits the voice is ensured. Among the hardware tools that are called physical controls and enable the computer to interact with the user in virtual reality, the devices used to send the user's commands to the computer can be determined as keyboard, mouse, joystick and data glove. In addition to standard controls, the data glove used in virtual reality detects the angular and positional changes occurring in the user's joints with the help of various sensors on it and transmits them to the computer using wired or wireless transmission systems.

The data glove is a piece of hardware used to track hand movements and is used by the user to point and manipulate objects within the virtual reality scene (Figure 4) (Gutierrez et al., 2008). By continuously matching the physical position of the data glove with its position in the virtual reality, the user can move in the virtual environment as in the physical environment.

Monitor-based virtual reality systems have two major disadvantages. The user has to look in the direction of the monitor in order to experience virtual reality. Because of this, it is the system that creates the least sense of immersion among virtual reality systems. In the system, only a small part of the user's field of view is covered by the monitor and the user's communication with the virtual reality environment takes place within this small area. Since most of the user's field of view is covered by objects outside the virtual reality environment, external stimuli are excessive. This weakens the immersion effect of virtual reality (Sherman & Craig, 2003).

The working principles of the hardware in projection VR systems are similar to monitor-based systems. However, in these systems, the hardware is fixed due to its larger size. The displayed volume is much larger than the monitor. Thus, they can cover a large part of the user's field of view. Large display screens can be created by juxtaposition with monitor systems, but since there are no joints in projection display systems, a much more seamless and integrated image can be created (Sherman & Craig, 2003).

Figure 4. Virtual reality with projection

(Gutierrez et al., 2008)

In most projection systems, the projection mechanism is designed to be projected from behind the screen. This way the user's shadow does not interfere with the image formation and their shadow does not fall on the screens. In projection systems the tracking mechanism has to follow the user's position and head position in order to create a correct perspective image. If the curtains are joined at 90-degree angles, there is a reflection problem. Dark colored curtains can be preferred to prevent this, but in this case, the correct perception of the colors by the user is prevented. Due to the dimensional size of the curtains and the distances required between the projection devices and the curtains, projection systems require large areas (Sherman and Craig, 2003).

Head - Mounted Displays (HMD) usually consist of one or two small imagers with lenses and a viewfinder. The imaging equipment is miniaturized and structurally consists of a display system in CRT or LCD format. Many head-mounted imaging devices have a tracking mechanism. This allows the image to change in response to the user's head movements. In the case of head-mounted imaging equipment with two viewers, two different images can be presented to the two eyes. This is used to display stereoscopic images (Gutierrez et al., 2008).

Google Cardboard is the simplest and most economical of the head-mounted display devices that can be used for virtual reality today (Figure 5). It requires a smartphone and a virtual reality supported application to work independently.

Figure 5. Google Cardboard

(Google, 2018).

Google Cardboard offers the user the perspective and three-dimensional image obtained by splitting the screens of smartphones into two and presenting two different images at the same time. However, Google Cardboard cannot effectively give the user the feeling of being in a virtual environment because it can offer a perspective of less than 90 degrees and only utilizes the sensors on the smartphone.

Samsung Gear VR is the result of Samsung's collaboration with Oculus and works with smartphones (Figure 6). The Gear VR has a 96-degree optical viewing angle and built-in accelerometer, gyro sensor (gyroscope) and proximity sensors (Samsung, 2018). These built-in sensors on the hardware and the sensors on the smartphone work in an integrated manner and enable the user to experience the virtual reality environment effectively. The most important element of the Samsung Gear VR hardware that allows the user to experience the virtual reality environment more effectively than other hardware is that it allows the user to move completely and freely without any support point. In this way, the user can continue to experience the feeling of being in a virtual reality environment without being disturbed by any external element.

Figure 6. Samsung Gear VR

(Samsung, 2018).

There are touchpads and buttons on the hardware. Touchpads and buttons can be used to create inputs that will help the user's movements in the virtual environment. In addition, the touchpad and buttons can be programmed to trigger the necessary functions in line with the needs of the system to be created. Any hardware that can connect via Bluetooth technology can also be used as an external input device. The hardware used in the research was Samsung Gear VR. Samsung Galaxy Note 5 smartphone, which can work integrated with Samsung Gear VR, was used as a display device. The screen resolution of the Samsung Galaxy Note 5 smartphone is 2560 x 1440 pixels. The highest resolution available for virtual reality can be expressed as 1280 x 1440 pixels, as this would divide the screen into two equal parts in the application.

In the creation, editing and modification stages of digital expression methods, computers with the power to digitally process designs are needed. The high capacity of these computers in terms of processors, graphics cards and other hardware will allow more effective results to be achieved in shorter periods of time. Digital expressions are created with software that can work in harmony with these advanced computers and hardware. These software programs vary according to the forms of expression to be produced. Solid models are produced in three-dimensional modeling programs. Solid models are used in their pure form in the design phase and in the flow of information between people with professional experience. If it is desired to expand the volume of information flow and include users, information such as light, shadow, color and texture should be added to these solid models. Photorealistic images, on the other hand, are realized in the form of rendering these solid models with information such as light, shadow, color and texture by using rendering engines, which are additional software. In parallel with the developing technology, virtual reality hardware continues to develop. With these developments, it is possible for the hardware to display images in higher resolution and to measure user movements more accurately and quickly with the developing sensors. This speed and accuracy have the effect of increasing the sense of immersion the user experiencing in virtual reality. The level of sophistication of the hardware used is one of the important parameters in the quality of communication.

4. Expression of Architectural Design in Virtual Reality

In the architectural design process, various methods of expression have been used to ensure communication between the designer and the user and to convey solutions to problems. These expression methods are forms of expression of the thoughts produced in the mind. Through the expression of thoughts, data sharing and information transfer take place. Sharing data and transferring information in the architectural design process ensures the healthy progress of the process. For this reason, the communication phase in the architectural design process can be described as the concretization and transfer of expressions. In general, the study has a fiction developed based on the findings of the theoretical framework put forward and explained in the previous sections. In general, within the scope of the study, an approach that can be defined as 'a method that examines the experience of space with virtual reality in architect-user communication in the architectural design process' is exhibited. Presenting architectural designs using virtual reality technology is a method used today. However, it is considered a new approach due to the fact that the virtual reality technology has become wireless and portable thanks to the hardware used, and with the interaction code written in C# coding language and explained in detail in the section of preparing the virtual reality environment, the walkthrough can be done independently of the space with a free perspective in the design. In addition, the expression of the selected building in the digital environment from the idea stage to the construction stage in a way to affect the communication process was evaluated as a case study. The case study, in which digitization and virtual reality integration processes are investigated and examined in depth, constitutes the method of the research. Based on this case study, an approach that covers the design processes in general can be exhibited.

The problems encountered in the communication phase of the architectural design process identified by the literature research were identified and the study was carried out with the aim of finding solutions to these problems. The problem in the architectural design process usually stems from the fact that users cannot imagine how the design will unfold after the construction phase (Lertlakkhanakul et al., 2008). The inability of potential users to read or misread drawings is also an important factor affecting the understanding of the design (Barrett and Stanley, 1999). It has been stated that the level of education of the user is a key component of a successful user-architect relationship (Siva & London, 2011). While suggesting solutions to the communication problems between designers and users in the architectural design process, Shen states that a clear and understandable visualization technique suitable for the design should be used (Shen, 2011). In the architectural design process, the presentation method and representation method used to transfer the structure designed by the architect to the user gain importance in terms of the accuracy of the transfer. At this point, in the perception of the designed space, the communication problem between the architect and the architectural design can be eliminated by using a clear visualization technique suitable for the design and the possibility of free movement in the space provided by virtual reality technology (Figure 7).

The perception of the designed space by the user was investigated in two parts: dimensional perception and perception of the fulfillment of user needs. Dimensional perception is explained as the perception of the physical dimensions of the space by the user. Dimensional perception determines the size of the space and the positioning of the equipment that may vary depending on the use. The state of meeting user needs can be explained as the expression of the emotional expressions of the users when the activities to be carried out in the spaces are evaluated with spatial dimensions.

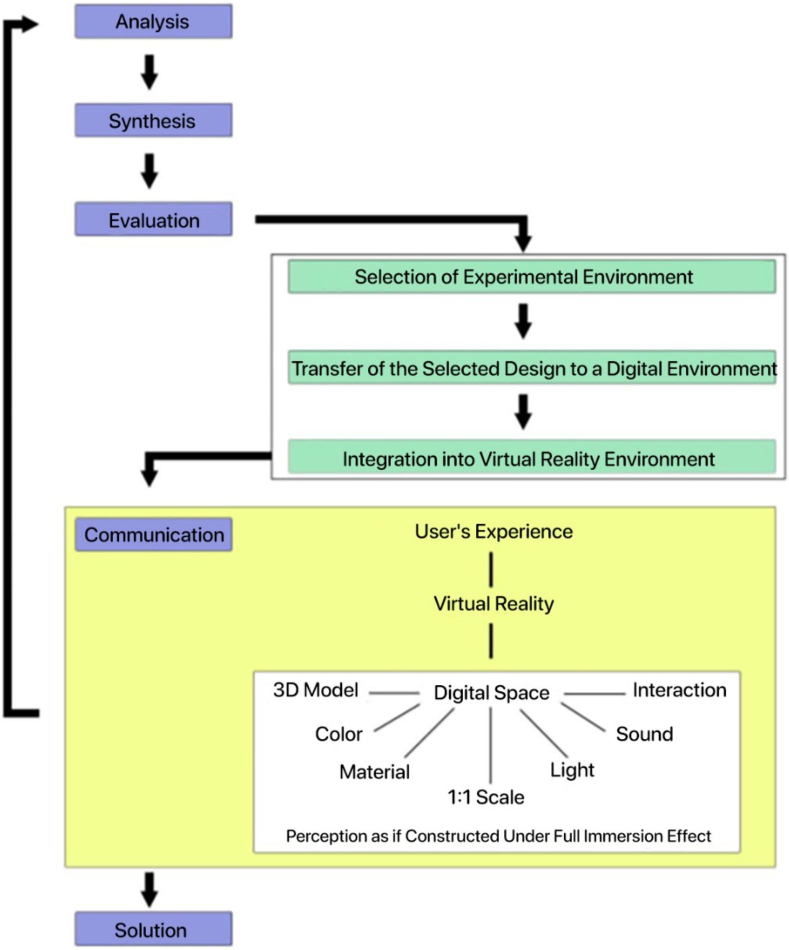

Figure 7. Diagram of the study

Based on all these researches, a solution was proposed to the problems in the communication phase of the architectural design process with the system produced using virtual reality technology. In the perception of the space, the communication problem between the users, the architect and the architectural design can be eliminated by using a clear visualization technique suitable for the design and the possibility of free movement in the space provided by virtual reality technology. The building project used in the field study is located in Konya province, Meram district, Armağan neighborhood, 18K IV plot, 26493 block, 1 parcel. The size of the parcel is 552,46 square meters. Hodja Ahmet Fakih Mosque and Mausoleum located in the north direction of the parcel is located between the main road and the building. To the north of Hocafakıh Street is the land of the Konya Sugar Factory.

Since the plan scheme of the 4 independent sections in the selected residential building is designed to be symmetrical, there is no functional diversity between the apartments. For this reason, the independent section numbered 2 on the ground floor was selected for the study. The studies after this stage were carried out on the selected independent unit numbered 2. A spatial life fiction was prepared in the context of the spaces in the apartment preferred for the study. Within this fiction, it is assumed that a nuclear family of 3 people will live in the apartment. A core family of 3 consists of a mother, father and a child. As a result of this assumption, life descriptions were realized in the spaces and the digital space was prepared in accordance with the architectural design.

During the creation of the virtual reality system, a solid model was produced in the SketchUp program using the existing project data. The solid model was transferred to the Unity game engine and turned into an interactive model with the auxiliary code prepared in the Visual Studio program. An Android application was created to be compatible with GearVR, the virtual reality hardware used. Thus, the digital space, which is the representation of the physical space ready to be experienced in the communication phase of the architectural design process, was revealed in the form of an application (Figure 8).

Figure 8. Virtual reality system setup

The technical drawings of the selected apartment were obtained from the design office in digital format in AutoCAD file format .dwg. In the AutoCAD program, editing processes were carried out in order to increase the plans, which are available as two-dimensional digital drawings, to the third dimension (Figure 9).

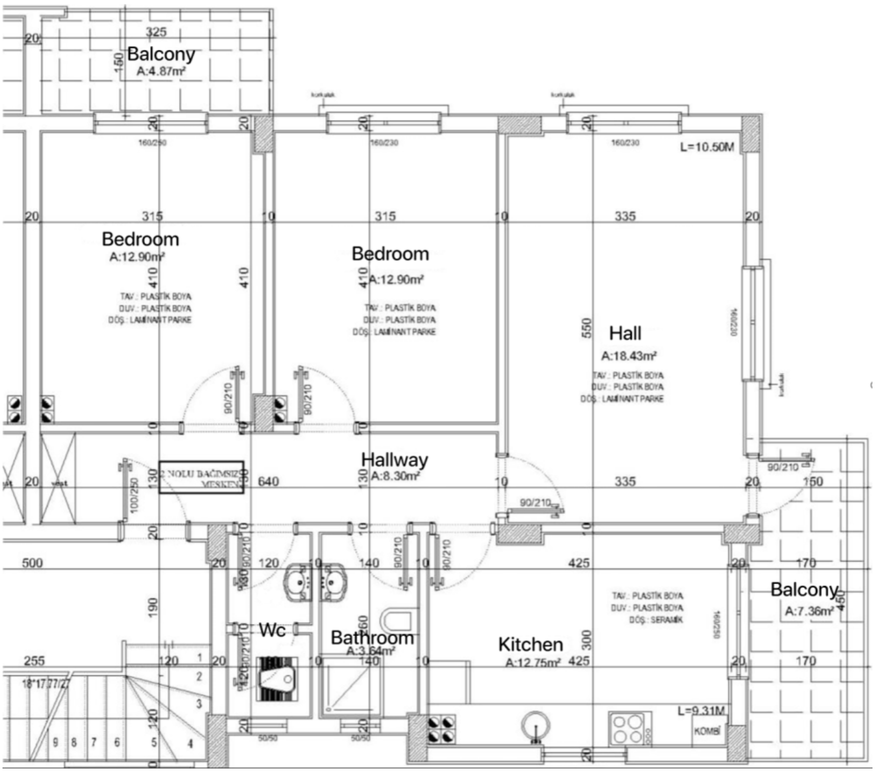

Figure 9. Plan

Editing operations are to combine the lines representing the walls in a layer, excluding texts, dimension lines, axes, hatches, furnishing elements that will not be used during modeling. Thus, in two-dimensional plan drawing, the parts that will be used and not used during modeling are separated from each other. This situation, which can be described as preparation for the three-dimensional modeling phase, saves time and effort. The edited two-dimensional plan drawings were transferred to the SketchUp program, a three-dimensional modeling program, to be upgraded to the third dimension. Within the SketchUp program, the walls were raised with the help of the Push/Pull command and became three dimensional. Then the floor and ceiling tiles of the apartment were prepared with the same method. The gaps required for the placement of joinery on the walls were opened in accordance with the plans (Figure 10).

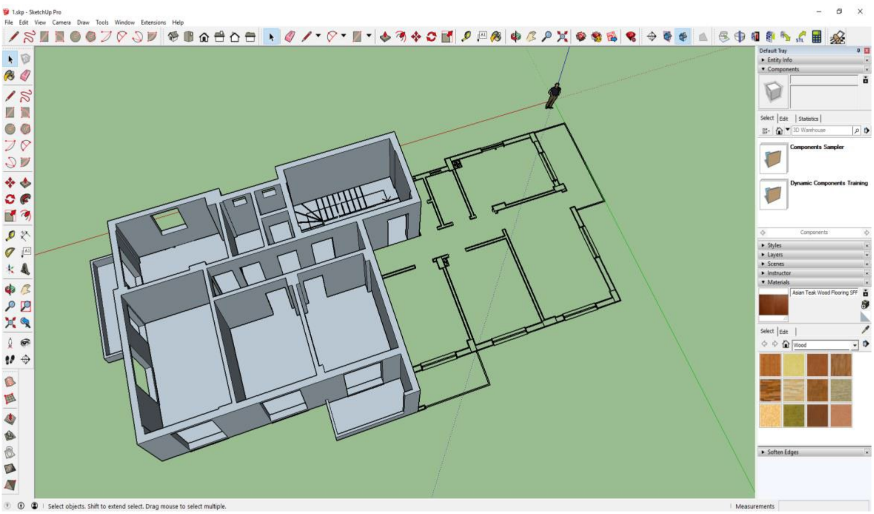

Figure 10. Preparation of walls in Sketchup program

After opening the necessary gaps for the joinery, the doors and windows preferred in the project were modeled. The prepared doors and windows were placed in the openings in the walls (Figure 11). During the modeling of doors and windows, glass material was coated on the glass surfaces to increase the interaction between the space and the external environment. With the placement of the joinery, the model is one step closer to realism.

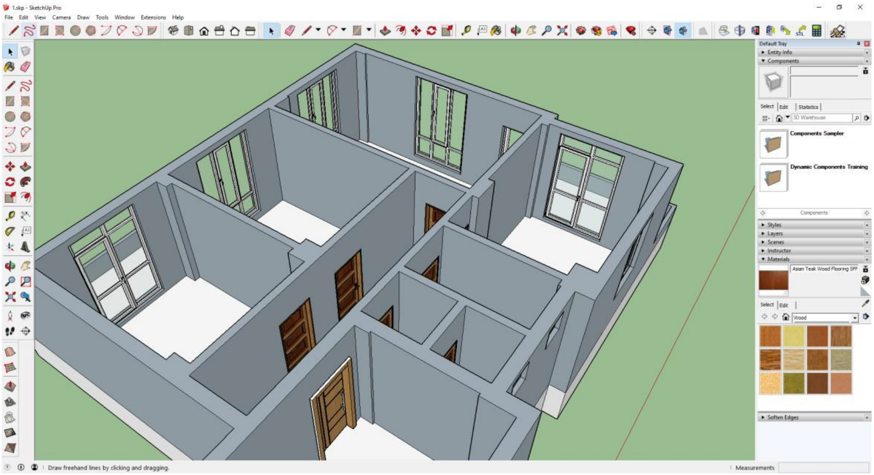

Figure 11. Modeling and placement of joinery

The model, whose walls and joinery were completed, was prepared with furniture and decoration elements selected according to the usage functions specified in the project (Figure 12). The furniture and decoration elements selected here were chosen to meet physical and psychological needs, taking into account the intended use of the spaces. At the same time, attention has been paid to furnishing the spaces in a way to have optimum transition areas in terms of use.

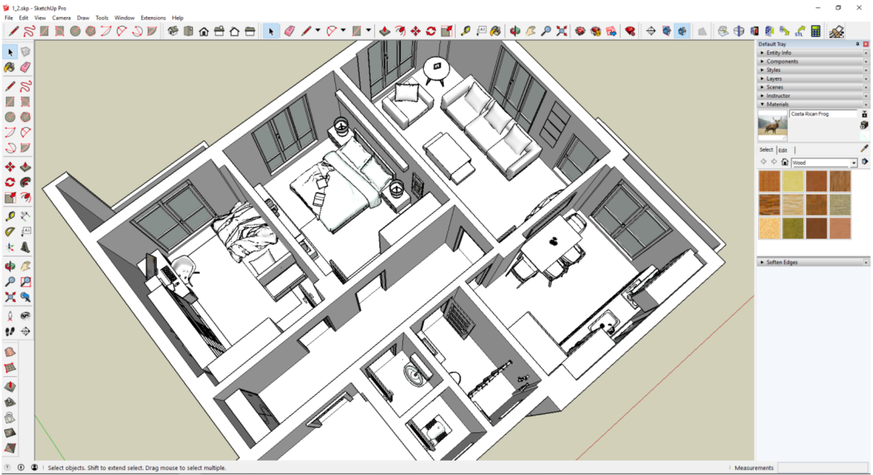

Figure 12. Placement of furnishings

After the placement of the furnishings, the integration of material and texture information, which are of high importance in perception, into the model was realized. The selected materials were coated on walls, flooring, furniture and all other furnishing elements (Figure 13).

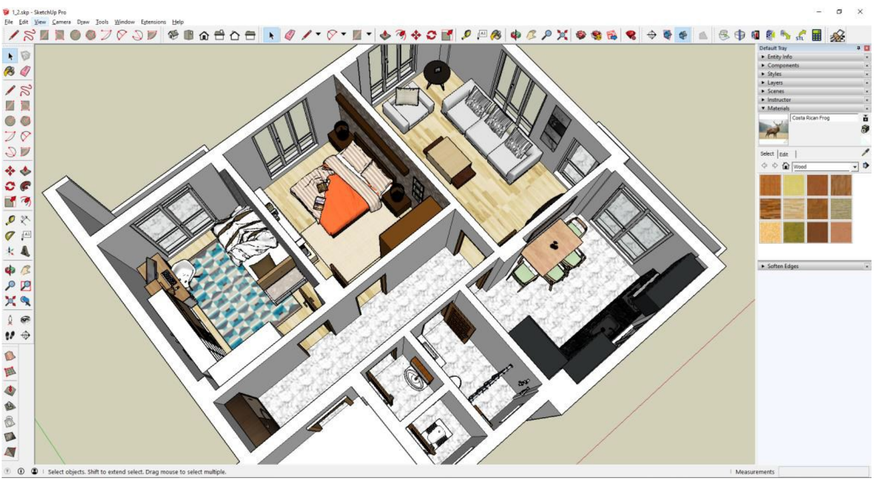

Figure 13. Coating of materials and textures

The modeling process was completed by coating the materials and textures. The models produced in the SketchUp program were imported into the Unity program to be edited as a virtual reality application (Figure 14). Although the Unity program is basically a game engine, it can export compatibility with the virtual reality platform. In this way, it was possible to use the interaction power of the game engine in the communication phase of the architectural design process. The model transferred to the Unity application has been customized in a way that allows the experiencer to perceive the space in motion by moving freely within it. For this purpose, cameras, which act as the eyes of the individual and are windows to the digital space, were placed first. Visual communication will be provided through these cameras.

According to 2014 data from the Turkish Statistical Institute, the average height of young girls is 162 cm, while the average height of young boys is 173.3 cm (TÜİK, 2018). In this case, the average height is 167.65 cm. The height of the digital character placed in the model was also determined as 167.65 cm (Figure 15).

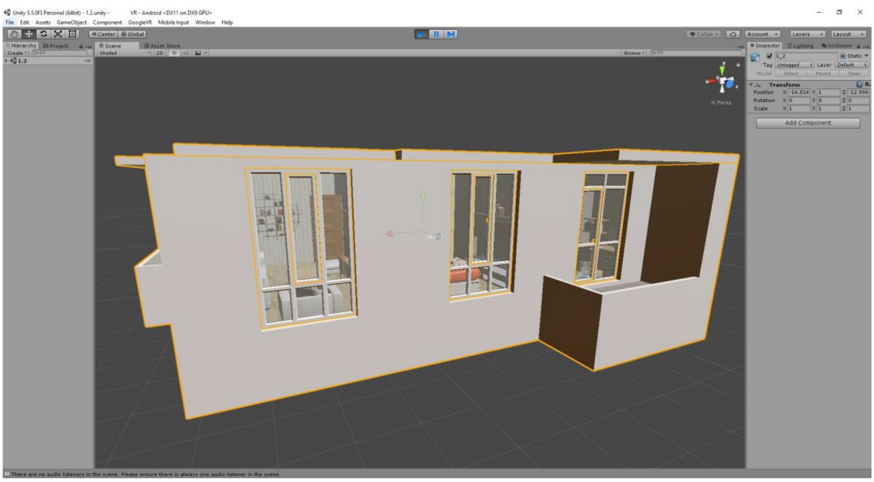

Figure 14. Model transferred to Unity application

Looking at the space from a different height is a factor that affects perception. With the arrangement made, the perceptual change that may result from the individual looking from a height different from his/her own eye level in the digital model is minimized.

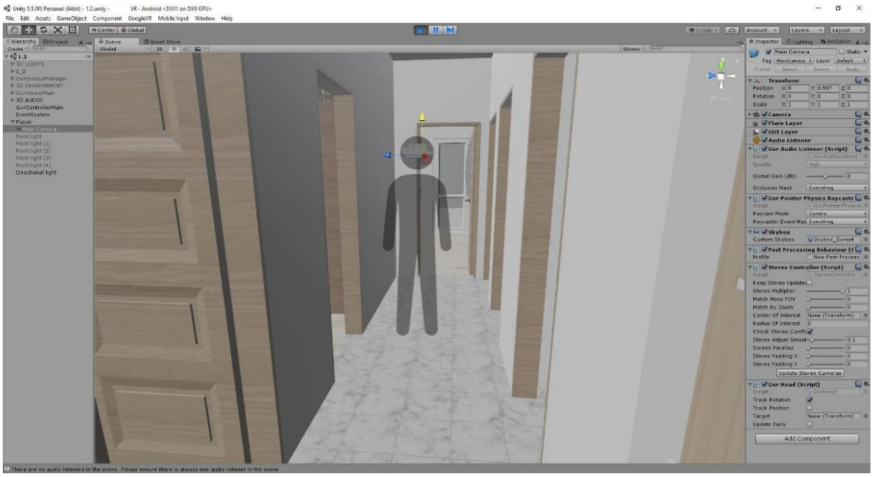

Figure 15. Primary person placement in Unity

After the placement of the digital character, optimization adjustments were made to ensure that there was no stuttering or lag due to the performance of the hardware used during the experience of the model (Figure 16). These optimization adjustments were made by reducing the size of the bitmap visual files that enable the appearance of the materials and texture overlays used and optimizing them with the hardware resolution to be used.

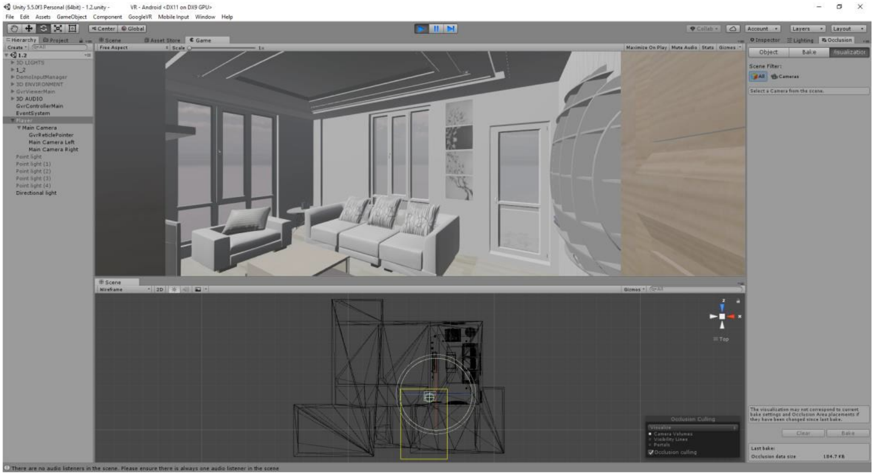

Figure 16. Optimization in Unity

The second optimization setting is called “Occlusion Culling”, where only the visible area is rendered. Here, only the objects that are in the frame of the camera and the overlays of those objects are rendered and all other objects behind the camera are hidden. Thus, all objects that do not need to be shown at that moment are hidden, unnecessary load for the processor is eliminated and performance is strengthened. This is done by synchronously refreshing with each movement of the camera. The user will not be aware of this as there will be no loss of visible area whatsoever. In this way, there is no perceptual loss and only performance improvement is realized.

After the optimization settings are completed, the model must be compatible with the virtual reality hardware to be used. GearVR virtual reality hardware, which is produced in cooperation with Oculus and Samsung, supports applications built on Oculus VR SDK (Software Development Kit) and Android SDK systems. In addition to these, in order for the developed application to have the interaction to meet user demands, necessary code writing operations in C# language were performed in the Microsoft Visual Studio program. The coding process in C# is explained below:

It is stated that there is a code to be executed in the Unity application and access to the sub-codes and materials in the system library. A defined section was prepared in order to control the properties of the character in the Unity application. Thanks to this section, the code has become able to control the properties of the character in the application. When the generated system is run, the section where the walking speed of the avatar is specified has been added. A section was written to specify the forward movement of the avatar when the generated system is run. The subcode for controlling the avatar is defined. The movements of the camera that will form the eye of the avatar or the section that will act as a window for the person who will experience the application to look at the digital environment have been defined. The part of the defined codes that will be activated when the code file is run for the first time has been prepared. The code was told to access the properties of the avatar in the Unity application and to find the relevant section. The section that allows the code to move the camera according to the perspective of the experiencer and change the image was added. Three options were created in the section that will be activated by iterating once in each movement during the time it is active by running the code file. These are the state of touching the touchpad on the hardware, the state where contact with the touchpad is interrupted and the progress state. In the case of touching the touch surface on the GearVR hardware, the section that provides progress movement in the digital space to be activated has been defined. A section has been prepared that enables the termination of the progress movement in the digital space to be activated in the event that the contact with the touchpad on the GearVR hardware is interrupted. As a result of the contact with the touchpad, the activation or deactivation of the progression command was defined. The camera's point of view is defined as the direction of progression. In this way, the experiencer can move in the direction they are looking at. It is ensured that the progress action is performed at the speed defined in the previous section.

When the touchpad on the side of the GearVR is touched by the user experiencing the virtual reality hardware, the C# code runs and the user starts to move in the direction they are looking at. When contact with the touchpad is lost, the hardware notifies the code and the code stops the movement. In this way, the user can navigate in the digital space in any direction and for as long as they wish, without any restrictions, as if they were walking around in the built structure. The virtual reality application, which became interactive at the end of the code writing process, was exported to run on the Android operating system (Figure 17). The export process was performed in .apk file format. Thus, the application can work in harmony with the smartphone attached to the GearVR hardware.

In order for the materials to create a distinct perceptual effect by reflecting the physical environment conditions, the scales of the objects and the materials covered on them were matched. Thus, distortions that may occur in the perceptual effect of textures were prevented.

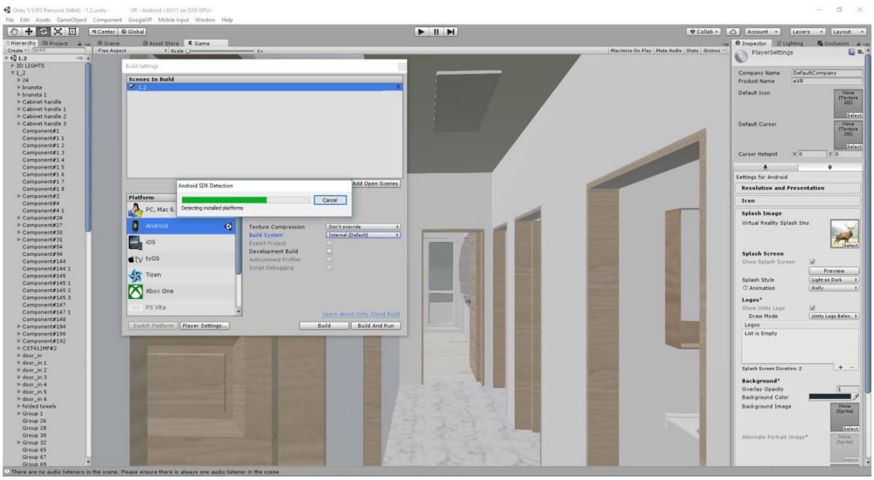

Figure 17. Exporting the virtual reality application

While experiencing the application with the virtual reality hardware, the user watches two images on a single screen in the same direction but looking at the same focal point with an angular difference small enough to create a three-dimensional perspective effect (Figure 18). These two different images transmitted to both eyes are superimposed in the brain and form a three-dimensional spatial perception. When the user turns his/her head or moves thanks to the virtual reality hardware, the image is updated in the direction he/she is looking. With the continuous updating of the image, the full immersion effect occurs. The full immersion effect causes the digital space to be perceived as if it were traveling in a physical environment. Thus, the user is abstracted from the current physical environment and enters the digital environment.

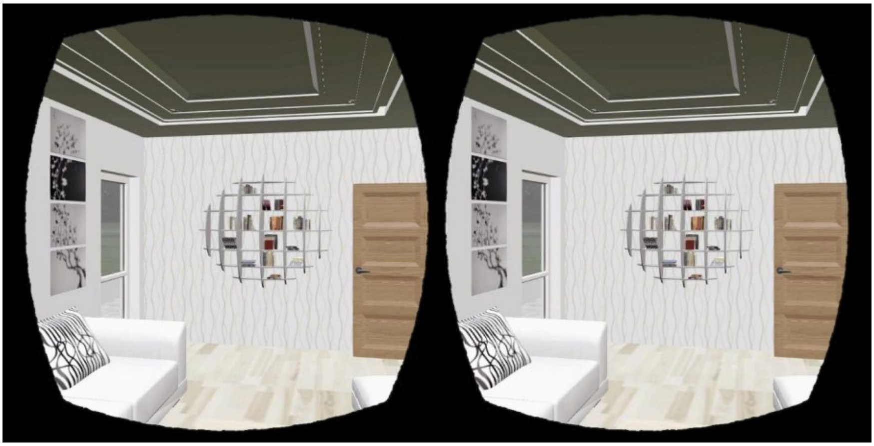

Figure 18. Virtual reality application

5. Conclusion

Within the scope of the study, the problems encountered in the communication phase of the architectural design process were identified from literature research. The situation of producing solutions to the identified problems by experiencing virtual reality using the system created was investigated. In this context, the communication problem between the architect and the architectural design can be eliminated by using a clear and clear visualization technique suitable for the design in the perception of the space and the possibility of free movement in the space provided by virtual reality technology. On the other hand, the digital space produced within the scope of this study has brought a new approach where the user has the option to perceive the space from different viewpoints and perspectives by moving freely, instead of being non-interactive, fixed and having a single point of view. The unique value of the study can be explained as the production of an interactive digital space by using the potential of virtual reality technology and the use of this method in the communication phase of the architectural design process, at the stage where the designer's information transfer with the user is the most intense, thus producing solutions to the problems encountered in the communication phase. Thus, while the design ideas are still in the formation stage and these ideas are reflected to the perception of the potential user before they are built, it allows all these ideas to be experienced by the potential user, the user, as if they were built and physically present. In this way, the current design process has been improved by evaluating the design idea before it is built, which can be experienced and evaluated after it is built. Thanks to the ability of the created system to perceive architectural ideas as if they were built during the design phase, it will be possible to directly involve the potential user, the user, in the design process by perceiving it and expressing their demands and thoughts while the design ideas are still in the formation phase. In this way, communication-related problems encountered in the user-architect relationship will be eliminated and situations that cannot be understood and transferred will be minimized. By involving the user in the design process, it will be possible to maximize the satisfaction with the final product. By ensuring that the user actively participates in the architectural design process and conveys their wishes and opinions during the process, it will be possible to prevent high cost, time and labor-intensive processes such as demolition, reconstruction or renovation in case of dissatisfaction after construction. With the use of the method in the context of housing, an interaction platform has been created where users can raise awareness, question before construction, express their demands, wishes and thoughts about the design concretely. In this way, data can be provided to the analysis phase, which is the first phase of the architectural design process. The architect returns to the analysis stage with the data obtained from the user in the communication stage and goes to the synthesis and evaluation stages by revising the design idea within the scope of demands, requests and thoughts. After the synthesis phase, the design idea is made to be experienced by contacting the user again. This process is continued on both the architect and user sides until a completely positive result is obtained after the communication phase. In the end, as a result of producing a design idea that fully overlaps with the user's demands, wishes and thoughts, the optimum design idea is produced as a result of a satisfied user, a successful architect for ensuring that the user is satisfied, and the satisfaction of the parties.

When the potential of virtual reality and the produced method is evaluated in future studies, it is thought that virtual reality can be used as a design, representation, expression and interaction tool not only in the communication phase of the architectural design process but also in all stages of the architectural design process. From this point of view, it is possible to take virtual reality technology out of the context of a tool that only realizes the presentation and turn it into a mechanism where production takes place. The production of digital space can be realized within digital space. Virtual reality can encompass the entire system both as the digital space itself and as a means of production. It is known that the potential of virtual reality has the capacity to allow this situation. Thanks to the interaction potential of virtual reality, it is possible to create a virtual environment where different designers can discuss design ideas and make joint design decisions, even if they are physically far away from each other in the same digital space. Thus, with the use of virtual reality technology, physical separation can be compensated by digital togetherness and borders can become invisible. With the invisibility of borders, the level of interaction can be increased. This situation can turn into an environment where designers can see each other through their avatars in the digital space as if they were physically side by side. Designers will be able to interact with each other and the design with the help of these avatars.

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CHAPTER VI

Cultural Herıtage Management In Infrastructure Investments

Rabia KAÇDİ[1]
Fatma Zehra ÇAKICI[2]

Introduction

Investment projects are the studies carried out by the states to ensure economic development and meet modern needs. In this context, infrastructure and superstructure projects are implemented to form the basis of economic activities and to meet the needs of growing cities (Gökırmak, 2019; Throsby, 2016). Human life, which has lasted for about 2 million years, has spread to different parts of the world for the last 40 thousand years and left traces. For this reason, archaeological remains are found in places where human life exists and are unearthed by excavations. Although there are traces of past civilizations in different regions of the world, Türkiye is also in a very rich and important position in terms of the history of

[1] Graduate Student., Atatürk University, Institute of Natural and Applied Sciences, Erzurum, Türkiye., Orcid: 0009-0005-0692-1067, rabiakacdii@gmail.com
[2] Prof. Dr., Atatürk University, Faculty of Architecture and Design, Department of Architecture, Erzurum, Türkiye, Orcid: 0000-0002-4117-2058, fzehra.cakici@atauni.edu.tr

civilization. In parallel with the developing technologies and advances on a global scale, Türkiye is in a period of rapid modernization and this situation causes an increase in needs such as housing, transportation and energy. In this context, major investment projects such as dams, roads and energy lines have been and continue to be carried out all over the country (Özdoğan, 2015). In countries that have experienced changes brought about by urban transformation and development processes with rich cultural layers that have hosted many civilizations such as Türkiye, there are situations where infrastructure projects negatively affect archaeological and cultural heritage areas (Tanrıvermiş and Aliefendioğlu, 2018). With the emergence of the negative effects of the completed projects on cultural assets around the world, conservation studies have been initiated (Özdoğan, 2006b). In this direction, reports have been prepared in order to carry out protection works before investment projects. The reports prepared cover the studies carried out to show the effects of the project on the environment, people, natural life and cultural heritage. Environmental Impact Assessment (EIA), Environmental and Social Impact Assessment (ESIA), Strategic Environmental Assessment (WFD) and Cultural Heritage Impact Assessment (CHIA) reports have started to be implemented in order to protect the environment, natural values and cultural heritage sites (Gürbüz, 2020; Çetin & Gülersoy, 2021).

As in all over the world, infrastructure projects in Türkiye have negative effects on archaeological and cultural heritage sites. Protection studies, which have started to be implemented worldwide, have also been put into operation in the country. Projects carried out for transportation, energy and water purposes have caused destruction and damage to historical places. It is known that many large and small-scale archaeological and cultural heritage values belonging to different periods from the process of making infrastructure investments to the present day have disappeared because the necessary analysis and conservation studies have not been carried out. An important step has been taken for the documentation and protection of cultural heritage assets with the EIA reports, which entered into force in 1993 in the country and enable the analysis of the environmental impact assessment of the projects to be carried out (Akdemir, 2019).

Due to the increasing needs in Türkiye and the fact that its geological structure is suitable for infrastructure projects, studies have been carried out all over the country to meet the needs such as natural gas, oil, water, electricity, road, etc. In order to ensure the sustainability of economic activities and the transfer of archaeological and cultural heritage areas to future generations by protecting them, infrastructure investment projects and conservation studies should be carried out simultaneously with a holistic approach (Özdoğan, 2015). In order to evaluate environmental impact assessment reports more concretely, cultural heritage values should not be independent of the EIA process and should be considered as an integral part of the necessary procedures (Bond et al., 2004; Sousa et al., 2020).

Infrastructure investments for transportation, energy, water, etc. have negative effects on cultural values. In this context, the impact areas of the projects that include cultural and archaeological areas in the study area on historical values, the protection methods given in line with the reporting studies carried out and to be carried out during the project design stages and afterwards, and the transfer of past civilizational lives to today's generations constitute the scope of this study.

Community Investments

In order for the states to survive, it is necessary to ensure the management of society, to manage the political relations of the states in national and international environments, to ensure public order and welfare, and to make incentives for economic growth and development (Del Bo & Florio, 2008). In this context, it is obligatory for the states to make various public investments in order to carry out activities. The concept of investment covers the actions taken by investing money in an income-generating business. The Turkish

Language Association (TDK) defines the concept of investment as *'new additions to the assets that increase the production and service power of the national economy'* (TDK, 2023).

Public investments, which are a type of investment, are one of the most important components of national income and are expenditures made for the state to perform public services. In this context, infrastructure works carried out under the name of public investments are known as expenditures that contribute to economic growth by supporting production activities. TDK defines the concept of infrastructure as *'all of the installations such as roads, sewers, water, electricity etc. required for a settlement or a building'* (TDK, 2024). These investments, which have a wide scope, constitute the basis of economic activities by creating the production infrastructure as well as meeting public needs with infrastructure projects made to serve in areas such as transportation, energy and water. Infrastructure projects constitute the first stage of social and economic development in order to meet the rapidly increasing needs of developing and growing cities in the world. Today, some of the residential areas where urban life continues are the continuation of the societies that lived in the past. Rapid urbanization, population growth, and the needs of modern life have led to the change of residential areas. Infrastructure works, which have become a necessity today, include construction works ranging from large-scale projects such as dams, subways, pipelines to small-scale projects such as the foundation pit of a building and parking lot works. Infrastructure expenditures, which develop according to changing conditions and opportunities, generally include the studies carried out within the scope of transportation, communication, energy and water projects (Akçay, 2006) (Figure 1).

Continuous changes are made to improve living conditions in the world. Transportation infrastructure works have been started to solve the increasing transportation problems in cities. Considering the infrastructure projects carried out as a result of the requirements in the field of transportation, it is seen that the studies were carried out in line with the needs such as population growth, motor vehicle use, passenger and freight transportation. In line with the requirements arising from urbanization, projects such as the expansion of existing roads, the construction of new roads, and the construction of the metro have been carried out (Beriatos and Gospodini, 2002). Infrastructure projects to meet increasing energy needs include projects for energy resources such as natural gas, oil, and electricity. Projects have also been carried out to meet the need for water between a rapid development process and advancing developments. Water is necessary not only for drinking water and sanitation, but also for agricultural irrigation, electricity generation, and ecosystem life. Water resources are insufficient in the face of increasing population and the desire to increase living standards. With the increase in population and human activities, it has become necessary to manage water resources correctly in order to meet industrial, agricultural and social needs. The increasing need for water has made it necessary to carry out infrastructure projects (Wijesundara & Dayawansa 2011).

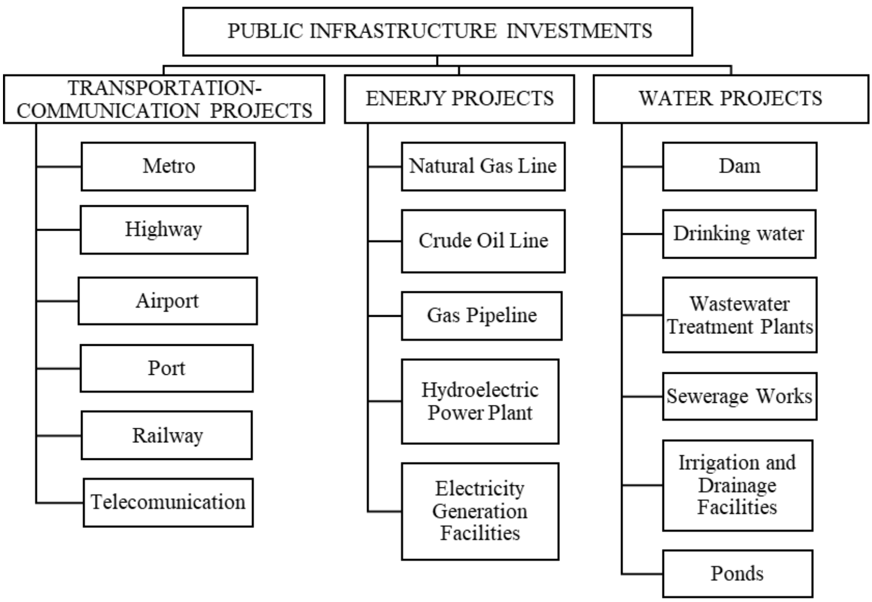

Figure 1: Public Infrastructure Investments

Cultural heritage assets affected by infrastructure projects (transportation, water, energy)

The issue of protection and documentation of cultural and archaeological assets during infrastructure projects was first evaluated by ICOMOS and World Archaeological Congresses and Council of Europe. The best examples of protection methods applied in infrastructure projects in different areas have been seen in Europe (Özdoğan, 2001). Conservation works that started during the planning phase are also continued during the construction phase. Considering the projects carried out in the field of transportation, it is seen that a great deal of effort has been made to protect and document archaeological and cultural values in metro construction projects in London, Los Angeles, Mexico, Thessaloniki, Vienna, and Rome campuses (Anagnostopoulos et al., 2017; Lambertucci, 2018; Miano, 2016). In studies such as the Polish Yamal-European gas pipeline project, the Oslo E-18 highway project, and the Val De Saône natural gas pipeline project, it is seen that all monitoring and inspection activities that would be required throughout the project were carried out in cooperation with state and non-governmental organizations (Akdemir, 2019).

It is known that several studies have been carried out for the protection of cultural heritage in Anatolia from the Ottoman Period and the Republican Period to the present day. The process of protection of cultural and archaeological heritage in Türkiye is generally carried out by the Ministry of Culture and Tourism and its affiliates. Today, the "Law No. 2863 on the Protection of Cultural and Natural Assets", which was adopted in 1983, is applied within the scope of the protection of cultural properties. The first rescue works carried out within the scope of infrastructure projects in the country are historical rescue works under the dam areas and started with the excavation of the Keban Dam site in 1968. Rescue works set an example for other excavations to be carried out. Before the dam started to hold water, the work was completed in 65% of the area. As a result of the studies, 63 cultural heritage sites, two medieval mosques and a Roman bridge were determined (Özdoğan, 2006). In the following processes, it is seen that the sensitivity to cultural and archaeological heritage has also increased in infrastructure works.

The number of infrastructure works carried out in line with the needs of modernization in the world and in Türkiye has been increasing in recent years and may cause negative effects on cultural heritage assets. In this context, the Athens Metro in the field of transportation, the Marmaray Project, the TANAP Project in the field of energy, the BTC Pipe Crude Oil Line Project, the dams built within the scope of the GAP project in the need for water, and the Aswan Dam can be given as examples (Table 1).

Due to the uneven distribution of energy resources around the world, energy use can be achieved through various transportation routes between countries with and without reserves. In this context, Türkiye's geopolitical position is an important point in the transportation of oil and natural gas reserves in the Caucasus and Central Asia to Europe. TANAP (Trans Anatolian Natural Gas Pipeline Project) is a natural gas pipeline project built on an 1811 km route between Azerbaijan and Türkiye. The investment project in the field of energy initially started to serve with a natural gas carrying capacity of 16 billion cubes and it is planned to increase its capacity in the future. Starting from the Türkiye-Georgia border, it passes through 20 provinces, including Ardahan, Kars, Erzurum, Erzincan, Bayburt, Gümüşhane, Giresun, Sivas, Yozgat, Kırşehir, Kırıkkale, Ankara, Eskişehir, Bilecik, Kütahya, Bursa, Balıkesir, Çanakkale, Tekirdağ and Edirne, and ends at the Greek border. The fact that Anatolia has a rich cultural layer and the areas hosted by the TANAP project are rich in terms of archaeological and cultural heritage has brought along issues related to cultural heritage affected by the project area. Within the scope of the project, studies have been carried out for the analysis of cultural heritage areas. The environmental impacts of the activities to be carried out have been addressed in national and international standards and an EIA report has been prepared by conducting studies. Cultural heritage assets belonging to the Chalcolithic Period, Byzantine Period and Ottoman Periods have been revealed. In the project, decisions such as changing the route in the project or moving the archaeological site were implemented in order not to damage the culture and archaeological sites. There are 55 areas that have been previously registered by the Ministry of Culture and Tourism of the Republic of Türkiye. As a result of the studies, 106 new areas were identified, 48 archaeological sites were found during the construction excavations, and approximately 1000 archaeological artifacts were documented and added to the cultural inventory. Çayırtepe (Erzurum), Kalebayır (Balıkesir), Oyaca (Ankara), Kahramanlar (Erzurum), Alaybeyi (Erzurum) Örenbağları, Kınalar, Demirdören are some of the areas where excavations were carried out and where many artifacts were found (Erdağ, 2019; TANAP, 2023).

Another project carried out in this context is the BTC Crude Oil Pipeline project. In addition to the transfer of petroleum energy, the project has been implemented for political purposes. The line between Azerbaijan and Türkiye starts from Sangachal Terminal and reaches Ceyhan Sea Terminal (Altuğ & Demirtaş, 2021). The project has been one of the studies in which decisions have been taken in accordance with national and international standards within the scope of environmental impact assessment and protection of cultural heritage. According to the status of the cultural heritage assets under and above the ground, excavation works and documentation studies were carried out or route changes were made in the project. Within the scope of this project, several studies were carried out in 10 predetermined excavation areas and 7 excavation areas during the construction works. Yüceören, Minnetpınarı, Akmezar, Çilhoroz, Tasmasor are some areas where there are artifacts (Akdemir, 2019).

Türkiye has a suitable geography for the settlement of civilizations in the river basin. For this reason, different civilizations have preferred river basins in the country as a settlement area throughout history. Today, the dams built in line with the development of technology and the increase in needs have resulted in the cultural heritage areas and structures left by the civilizations established in the river basins being under the dam waters. Türkiye has been a geologically favorable country for dam construction. In this direction, dams were built in different parts of the country. There are a total of 5 dams on Fırat River, which originated in the Eastern Anatolia Region of Türkiye and left the country from the Syrian border. The process started with the construction of Keban Dam in 1964 and ended with the construction of Karakaya Dam in 1976, Atatürk Dam in 1983, Birecik Dam in 1993 and Karkamış Dam in 1996, respectively. Kralkızı Dam, Dicle Dam, Devegeçidi Dam, Ilısu Dam, Batman Dam, Cizre Dam were built on the Dicle River, which originated from the same point as Fırat River and left the country with the Iranian border. Before the construction of dams that meet the water, irrigation and energy needs of the Eastern Anatolia and Southeastern Anatolia Regions of the country began, efforts were made to save cultural heritage sites. However, it is known that most of the living spaces of ancient societies were flooded with the completion of the construction of the dams (Öztekin Eke, 2014).

Another cultural heritage area under the dam waters is the Hasankeyf settlement under the Ilısu Dam built on the Dicle River. There are many cultural heritage assets in Hasankeyf, which is an important place in terms of the history of our country. Lots of immovable cultural assets in Hasankeyf were flooded by the water retention of the dam, including caves, madrasas (Artuklu Madrasa 1, Artuklu Madrasa 2, Sultan Süleyman Mosque Madrasa, Er-Rızk Mosque Madrasa, Küçük Mosque Madrasa, Şehabiyye Madrasa, Ottoman Madrasa), Tomb and Zawiyas (Zeynel Bey Tomb, Şeyh Şerafeddin Tomb, Zöhre Hatun Tomb, Hz. Verkane Tomb, Imam Abdullah Tomb and Zawiya), Churches (Kısır Church, Şabık Church and Deriki Church), Aşağı Şehir (Sur İçi), Historical Baths (Artuklu Bath, Eyyubi Baths), Yol Geçen Inn, Historical Hasankeyf Bridge and Historical Bazaars. Some of the structures under the dam were dismantled and rebuilt in their new place with the transportation process (Özdoğan, 2006a).

When we look at other dam projects carried out abroad, it is seen that the archaeological sites flooded by the water retention of the Aswan Dam built on the Nile River in Egypt were documented and protected by international organizations for the first time. Despite the limited facilities on the eastern and western shores of the Nile River, it has been determined that the archaeological site of 1753, a large part of which consists of temples and residential areas, was damaged or partially/completely flooded. Studies with the participation of UNESCO and many international organizations have been carried out in a limited area and documentation and protection practices have been insufficient (Marchetti et al., 2019). In the protection of cultural heritage assets located in a wide area on the island of Philae, where the Aswan dam is a threat, the method of surrounding the dam lake area with a protection wall has been applied (Burat, 2006).

Transportation is a necessary infrastructure project to meet the daily needs of the population in urban areas. The Marmaray Project, which was established in cooperation with foreign companies under the leadership of the Ministry of Transport and Infrastructure within the scope of transportation investment, was carried out to solve the transportation problems between the Asian and European sides of İstanbul. The completion date of the project has been extended due to the fact that the excavations carried out during the project process are insufficient for the cultural and archaeological areas in the area. In this context, UNESCO was applied for the independent evaluation of the cultural heritage values of foreign companies. Rescue studies have been carried out in accordance with international standards (Toprak et al., 2010). During the excavations, cultural heritage assets belonging to the Bronze Age, Byzantine Period and Ottoman Period were found (Özdemir, 2008). Metro construction in Athens, Greece is an important project that shows the sustainability of cultural heritage and infrastructure works together. Archaeological excavations were carried out for about 10 years in the construction of the subway line, which was started in 1991, and the subway tunnels were dug deeper than 15 meters on average to reduce the likelihood of encountering archaeological finds (Mitoula & Papavasileiou, 2023). Cultural assets unearthed in line with the excavations are exhibited in museums or subway stations built in their location. Evangelismos, Academia, Syntagmastations are some of the places where the objects found during the construction of the metro are exhibited (Maden & Avlar, 2017). Cultural heritage sites affected by infrastructure projects in Türkiye and around the world are brought together in Table 1.

Table 1: Cultural Heritage Sites Affected by Infrastructure Projects

INFRASTRUCTURE WORKS	LOCATION	PROJECT NAME	HISTORIC SITE(S) HISTORIC BUILDING(S)
TRANSPORTATION PROJECTS	Ankara, Türkiye	Ankara-Niğde Highway Project	Düğüz Mound Harhar Stream Gavurkale-2 Çölova Stream
	Athens, Greece	Athens Metro	Kerameikos Cemetery
	İzmir, Türkiye	Menemen-Aliağa-Çandarlı Highway Project	Neon-Teikhos Ancient City
	Türkiye	Gebze-Orhangazi-İzmir Motorway Project	Havuzdere Necropolis Yazırtepe Ovacık Mevkii
	Mexico	Mexican Metro	Aztec Quarter Aztec Pyramid Spanish Hospital Building
	Rome, Italy	Rome Metro	Diocletion Complex Baths Aurelius Walls
ENERGY PROJECTS	Türkiye	TANAP Project	Çayırtepe Kalebayır Şevketiye Üzümlü Oyaca Alaybeyi
	Baku-Tbilisi-Ceyhan	BTC Pipe Crude Oil Line Project	Yüceören Kayranlık Gözü Minnetpınarı Ziyaret Suyu Akmezar Abdel Mevkii Tetikom
	Elazığ, Türkiye	Keban Dam Project	İmamoğlu Mound

WATER PROJECTS			Değirmentepe Mound Köşkerbaba Mound Pirot Mound İkiz Mound Şemsiyetepe Mound Pulur Mound
	Mardin, Türkiye	Ilısu Dam Project	Hasankeyf Körtüktepe Ziyarettepe Kenantepe Salattepe Grecano Kavuşan Mound Hakemi Use Tepe
	Diyarbakır, Türkiye	Karakaya Dam Project	Korucutepe Mound Tepecik Mound Norşuntepe
	Kars, Türkiye	Karakurt Dam and HEPP Project	Rock Settlement Areas Bridges Karakurt Church Karakurt Basilica Karakurt School Karakurt Houses Karakurt Hospital Building Karakurt Police Station Building Karakurt Cinema Building

Effects of infrastructure investments on cultural heritage sites and solution alternatives

It is known that some of the residential areas where modern urban life exists today are home to civilizations that lived in the past. In these cities, which have a rich cultural layer, different societies have lived at different times and have important values in terms of cultural heritage (Akan et. al., 2021). There are some risks in terms of cultural heritage areas and assets in infrastructure projects carried out within the scope of state investments. During the implementation process of the projects, negative situations such as the destruction and extinction danger of cultural heritage sites are encountered. In this direction, it is important to protect these cities, where life continues today and which host historical areas (Yazgan & Ünay, 2020). Studies should be carried out with a multi-faceted holistic approach without stopping the projects and neglecting the protection of historical areas (Özdoğan, 2006b).

In case of that there are cultural and archaeological areas in the project area, studies are carried out to identify and protect the areas. The scope of these studies includes several issues such as planning field studies for the identification and protection of cultural and archaeological sites, preparing conservation procedures, documenting the obtained data with numerical methods, and providing training on the protection of cultural heritage sites to those who will work in the project area (Akdemir, 2019).

The damage rate varies according to the type of infrastructure projects and the importance of cultural heritage assets, construction technique, architectural features and location. Accordingly, protection methods also differ. It is necessary to prepare compatible projects by integrating the implementation processes of the projects brought by modern urban life into the protection of cultural heritage sites. The construction of infrastructure projects is not a situation where decisions can be made unilaterally. Every issue covering the projects to be carried out should be handled within the framework of the concept of integrated approach with the environment, nature, living life and cultural heritage areas. Archaeological cultural heritage assets are the information data of the history of civilization and it is extremely important to carry out conservation studies by considering the environment (Takva et. al., 2023). Before the infrastructure projects are implemented, impact assessment studies, analysis and documentation studies should be carried out and protection methods should be presented by making arrangements in the project to eliminate or minimize the damages that are predicted to be caused (Figure 2).

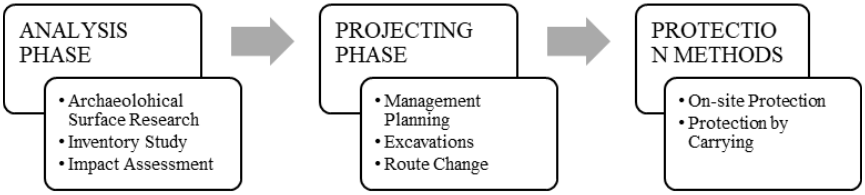

Figure 2: Safeguarding Process

Results

Infrastructure projects carried out to meet the needs of the contemporary world in different areas have also brought about the protection of cultural assets affected by the project areas. Projects are carried out not only in terms of function but also in terms of the protection of cultural values. The purpose of the protection process, which differs according to the cultural heritage and the type of project to be carried out, is to carry the past to the future. Conservation activities adopted worldwide have also been adopted in Türkiye and have been implemented over time. In this context, the protection approaches and methods applied in the world and in the country are also similar.

In the process in which the population and contemporary needs in Türkiye have increased rapidly, infrastructure needs have also increased at the same rate. Urban transformation projects have been carried out in order to create modern cities in different regions of the country; rail system, tunnel, underpass, highway, high-speed train line, metro projects in order to provide transportation; dam, HEPP, oil and natural gas pipeline projects have been carried out and are being carried out to meet energy and water needs. The projects carried out in this context cause negative effects on the biological environment, climate, people, archaeological and cultural heritage areas. Before the investment projects are made, the positive and negative effects should be determined by evaluating the environmental impact and the damages caused by the negative effects should be minimized or completely eliminated. Failure to carry out impact assessment and reporting studies in the study areas will prevent the documentation and protection of cultural heritage assets and will cause irreversible damage to archaeological and cultural sites.

When the protection process, which varies according to the characteristics of cultural values, is evaluated in terms of the contents of the legislation in force in the country and the projects implemented, it is seen that in some cases it is insufficient and the protection may not be done with sustainable methods. Considering the cultural heritage assets in the project areas as values that have an important role in illuminating the history of civilization once again emphasizes the importance of the concept of conservation.

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CHAPTER VII

Transformation of Public Space and Urban Landscape

Duygu AKYOL KUYUMCUOĞLU[1]
Doruk Görkem ÖZKAN[2]

Introduction

Cities in the world and in Turkey have entered into significant structural transformation processes after 1980. The changes and transformations observed dominantly in the spatial characteristics of the city cannot be perceived independently of the social, economic and political restructuring strategies adopted on a global scale. When the subject is evaluated from a political economy perspective, it is stated that the transformation is a process that took place in order to solve the crisis of capitalist production relations that

[1] Assist.Prof. Karadeniz Technical University, Landscape Architecture Department, Trabzon/Türkiye, 0000-0002-7191-9343,duyguakyol@ktu.edu.tr
[2]Assoc.Prof.Dr. Karadeniz Technical University, Landscape Architecture Department,Trabzon/Türkiye, 0000-0002-0127-0948, dorukgorkemozkan@gmail.com

entered a crisis in the 1970s (Harvey, 1996; Sassen, 2001). In order to cope with the economic crisis, efforts were made to revitalize capital markets, deregulation policies were adopted for this purpose and the fluidity of capital in the global environment was ensured.

In other words, cities that can be integrated into the global process have become more important than countries that can be integrated into the process (Newman &Thornley, 2005). Thus, some cities have entered into an effort to create areas of attraction for different investments depending on the harmony they provide to the whole of global relations (Sönmez et al, 2008). The competition environment between cities has made the transformation of the landscape of cities even more important because cities that can attract global investment and personnel need to come to the fore with their natural and cultural capital. For this reason, the articulation to global economic relations has caused significant transformations in the landscapes of many cities in the world and attempts have been made to create city images. (Sönmez et al,2008). These city images that have been attempted to be created have also caused changes in the form of urban public spaces and have created differences in usage in the general perspective. In this context, this study aims to define the concept of public space, to examine the concepts of public spaces included in urban landscape, to examine the changes in the historical process of public space and the transformation of urban landscape in this context under social, political and economic factors with the understanding of Modernism and Postmodernism, and to explain the effects of this on urban identity.

In line with this purpose;

In the first section, the concepts of public space and urban landscape will be discussed and the public spaces included in the urban landscape will be exemplified.

In the second section, the transformation that public space has experienced with modernism and post-modernism and the processes by which the urban landscape has been affected by this transformation will be explained.

In the third section, the search for forms in cities and the negative and positive changes in the social structure that have occurred as a result of this transformation will be discussed.

In the conclusion section, alternative interpretations will be presented by criticizing these new identities that have formed in cities as a result of this change in two different phenomena.

Urban Landscape and Public Space Concepts

Urban landscape is considered by most professional disciplines and city users only as natural, green areas within the city. We can describe this as the narrow meaning of urban landscape arising from the impression of the city dweller. Because urban landscape is actually a phenomenon that the city dweller can describe within the period of use and impression. If the city dweller sees this phenomenon as a perceptible physical environment including all the infrastructures that make up the city, this will be the broad and correct expression of his impression. However, if he sees this phenomenon only as green and nature and makes a 'naturalization' in the city, he will see its narrowest meaning. After this situation, the concern to bring back the nature lost to the city begins and it is thought that nature is lost as it moves away from the city.

This idea also destroys the pluralism and different disciplinary understanding that the urban landscape contains. The real danger begins when this pluralism disappears. Public space is an element within the urban landscape, and parks, squares, open green areas, roads, markets, etc., which are elements that form the urban landscape, are places that form the public space and contain the concept of public space. In this context, if we were to define public space;

Cities are places where various activities, operations and views take place. Urban public spaces include urban behavior patterns, appearances, facades of buildings and all urban elements. In addition, they are open to the public and always usable, designed to respond to human demands and activities, and are generally functional spaces located between structured areas (Korkmaz, 2007). Public spaces have various roles, including physical, psychological, social, political and economic. In addition, their symbolic role should not be ignored. Urban public spaces may include elements that add high value; such as religious or symbolic meeting areas.Public spaces that reflect the cultural, historical, religious, social and political values of groups or societies become symbols for these groups and societies, and contribute to the creation of a sense of continuity with their symbolic meanings. It is possible for urban public spaces to convey meaning to the user and thus to keep the collective memory alive in the process of change (Korkmaz, 2007). Its functionality and meaning within the city increase as it fulfills these existing roles. Immediately after industrialization, the effects of modernism and post-modernism on urban landscape and indirectly on public space are quite high. These effects of change have changed the perception of space in both morphological, physical and social terms. So, what are the changes in these phenomena, how did they occur and how are these changes experienced today?

The Process of Change in Public Space and Urban Landscape

Urban public space is a show and performance area in the whole city, a place where reality is tested, a discovery of difference and identity, and areas that enable individuals to become aware of themselves and others and establish social relationships. In a sense, they are areas where multi-faceted truths exist and different ideas are adapted. In modern Asian cities, as in European cities, motor vehicle use, social and spatial diversity and complexity have increased. In parallel with the processes of Modernism and Postmodernism, developments in science and technology, and globalization, significant changes are observed in the formal and social structure of public and private spaces. With the increase in the use of automobiles in modern cities, urban public spaces have begun to fragment in the urban structure.

Figure1:İstanbul/Kentsel Dönüşüm

Figure 2: İstanbul/Kentsel Dönüşüm

This change is a change in the physical dimension of the public space. In addition, there have been changes/transformations in the morphological, functional, social, perceptual, visual and temporal dimensions. What we should consider as morphological change should be how the tools and equipment are used in public spaces. The alternatives that have increased with the development of technology and science have increased the tools. This has caused the public space to fragment and not be perceived as a whole. Industrialization, the modernization that came after the Fordist production approach, and the respect for science and doctrine have caused division in the space and, in a sense, a loss of spirit and identity in the space. The simplest example of this is the introduction of the car. In addition, the understanding of gigantic multi-storey buildings built in the urban landscape with the modernist approach, together with the grid planning approach adopted in transportation, have fragmented public spaces and caused them to lose their functionality.

Carr emphasized that “as a result of his studies on the use and design of urban public spaces, these spaces should be meaningful, democratic and responsive to needs”. He stated that urban public spaces should respond to five important needs. These are; comfort, rest, passive interaction with the environment, active interaction with the environment and discovery. (Carr et al,1992). Recently, the use of vehicle-based transportation or people going to the places they want to go by car does not make it possible for urban dwellers to question public spaces in terms of functionality. However, the person who uses the space as a pedestrian sees public spaces only as temporary places and does not see them as an area where social activities, cultures and views are shared within its boundaries. In addition, even if the public space is used as a temporary tool, if the elements created around the space are not positioned in accordance with certain principles, the user's communication with the environment decreases.

Another factor is the social dimension. Urban public spaces were moved to the outer edges of the city as the industrial revolution began to destroy the city center. This public space began to move away from the image of an area that offered equal use to all people and began to be perceived as spaces created for the use of certain classes. The most typical examples of this were seen very clearly in England and France during those periods. Parks, which were a part of the urban landscape, began to be isolated and became areas that only the nobles of the country could enter and benefit from. In America, however, this process was a little different. When the nobles began to settle in the suburbs, public space was divided into two poles and began to gain the concept of common space. Because separate public spaces were created for the nobles outside the city, and separate public spaces were created for the working and poor classes in the city center. This caused the public space to lose its main function of communication, cultural integration and social sharing.

Another factor that should be considered here is the perceptual dimension. Public spaces could not offer a strong visuality with modernism. Visuality was attributed to large-scale structures in the city. With postmodernism, the city was thought of as continuous parts and parcels, each professional discipline designed and planned according to its own understanding, and as a result, the necessary imaginative powers could not be attributed to the space. This made it difficult for the city dweller to perceive and care about the space. The time dimension in urban public spaces; the maintenance of semantic integrity between the past and the future requires the control and management of the time dimension and spatial changes over time. Ensuring this continuity over time will ensure the survival of the collective memory.

The changes experienced in cities today are irreversible. In addition to causing physical negativities in cities, these changes also cause the process to be interrupted temporally, thus preventing the collective memory and semantic sustainability, and preventing the space from being adapted to contemporary uses (Korkmaz, 2007). The fragmented understanding that emerged with the rapid and irregular urbanization movements with the industrial revolution and later the development of information technologies initially caused the urban landscape to be divided and fragmented. In our cities where intense migrations are experienced with the desire to become urban and where continuous growth continues, the result of this fragmentation also brings about distortion. The economic difficulties of the population concentrated in cities pushes housing and social activities to the background and gives rise to the concept of 'village city'. On the other hand, as every step of the city begins to transform into capital spaces, it has revealed the phenomenon of rent in cities. This distracts us from perceiving the value of the city's landscape. All of this brings about social problems.

Cities Shaped by Transformation/Change

Aesthetic and environmental problems resulting from rapid urbanization increase the importance of planned urban green areas. While the longing of urban people for nature is tried to be satisfied with these planned green areas, the negative characteristics of urban life are also masked (Özdemir, 2009).

With this planning approach, urban landscape, as mentioned at the beginning, is moving away from its pluralism and is reduced to just green areas. Especially in urban transformation applications, the fact that the capital value of the spaces gained is at high levels, the presence of private gardens, industrial facilities, historical places, restoration and renovation works according to the place also reveal our perspective on urban landscape.

This fragmentation that comes with capitalization often makes it impossible to create public areas on an urban scale. People try to meet their green areas and recreation needs within their own small parcels. Therefore, the concept of urban environment is reduced to the parcel scale rather than a superordinate identity.

This situation causes cities to appear as settlements that mostly do not have an identity and develop with approaches far removed from the concept of planning. However, these environments where we spend our lives have very important effects on both the physical and spiritual structures of people. In this context, there is no doubt that cities that are organized in line with people's needs and have an identity are more livable places. With the recent urban transformations, city centers and public areas have started to be offered to certain segments of society. Until recently, residences, workshops, factories, shopping areas and public spaces were located together in many cities. The liberal economic understanding and the perception of urban lands as commodities caused all these facilities to be separated from each other and to lose their functions. This change has started to reveal new lifestyles and new definitions have been made for the perceived landscape in the city. In addition, the threat is growing even more with the construction of existing urban green areas. In order for local governments to mask all these negativities, the concept of urban design has been put forward and it has been said that the functions of cities will be organized within the framework of ecology and sustainability. However, many urban design projects that have been carried out so far have not been implemented by local governments because their financial returns are low or the lack of planning in cities and gaps in the laws have prevented the implementation of the project. While the approaches mentioned above construct ideal cities on the basis of stability and stagnation, in contemporary cities, the forms previously defined by designers will change over time; In this process of change, park plans, squares, open green areas, roads and markets, which are part of the urban landscape, will be reshaped.

Instead of park areas, densely populated settlements are preferred. As a result of the emergence of new consumption spaces, the lifestyle of urban people is being interfered with and recreational uses identified with open spaces are being moved to closed and private spaces.

As a result of the radical changes in the economic order in our country in the last 20 years, this communication and confusion have gained a new dimension and as a result, new consumption spaces and shopping activities have come under the control of the private. In this process, public outdoor spaces are also being privatized.

Now, the first places that come to mind for urban people to spend their free time are shopping malls that offer all the features of outdoor spaces except access to nature (Özdemir, 2009). Thus, new consumption landscapes are emerging.

Figure 3: Kızılay /Ankara Alışveriş Merkezi

Figure 4:Gaziemir/İzmir Alışveriş Merkezi

With the transformation and privatization of this public space and the forgetting of its real public functions, people have started to prefer the consumption spaces offered to them to parks and open public areas. With the new city typification, in order to encourage the rogues established outside the city, the urban landscape that was destroyed in the city is taken out of the city and positioned in areas with defined boundaries and offered to certain segments (Yılmaz, 2001).

Discussion and Conclusion

With all these transformations/changes experienced in cities, it should be asked how the ideal public space and ideal urban landscape should be.Will all these transformations created connect people socially or will they provide a completely isolated life and cause certain segments and groups to be visibly separated? Will the concept of sustainable city really take its place in the urban landscape that is being created or is being tried to be adopted? All these questions will actually guide how the urban landscape and urban public spaces, which are an element of it, should be perceived and created. The spaces created should include criteria that can respond to the demands of the city dweller. In the smallest example, in urban design applications, public logic should be more prominent than the social understanding of cities. Green areas created within cities should not be created only to create the concept of sustainability eco-city.

In the urban landscape to be created here, the contribution of the landscape to recreation, public space understanding, social activity and life should not be ignored. Because in cities created by ignoring these facts, only the concept of rent emerges, which spoils the fun of urban transformations that promise new lives implemented in cities and spoils the magic.

Frequently used approaches since the mid-20th century have aimed to position large green areas within the city in accordance with ecological principles and to integrate them with green masses located on the city periphery and in the immediate vicinity. However, at the final point reached today, it has not been possible to evaluate open spaces in cities as a part of ecological corridors with the fragmented planning approach of cities and the "Land Mosaics" approach defined by Forman (1995). In this respect, it is also obvious that the concept of eco-city or sustainable city has not been fully fulfilled.

Today, the goal of planners and designers is to create spaces where spatial communication and socialization can be controlled. We see this in special area examples such as shopping malls, satellite cities, protected settlements and thematic city parks (Boyer, 1994). However, according to Lefebvre's (1991) definition, this is not an ordinary and coincidental change. Planners and administrators, for the purpose of control, distribute people in various groups to certain parts of the city by making class distinctions and design different public spaces for each class (Özdemir, 2009). These planning approaches that will continue in the future will cause the concept of public space to disappear in people's minds and after a certain period of time, people will not worry much about the urban landscape being as it should be. For this, urban public plans should be created that will ensure that urban spaces unite with nature, that the dynamic structures of nature constantly flow into the city and that this cycle is continuous. The parks and squares that constitute the urban landscape should play the biggest role here.

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