



REPUBLIC OF TÜRKİYE
ALTINBAŞ UNIVERSITY
Institute of Graduate Studies
Architecture Department

**THE EFFECTS OF BIOPHILIC DESIGN
ELEMENTS IN PUBLIC SPACES ON USER
PREFERENCES: A CASE STUDY OF MAÇKA
PARK**

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Master's Thesis

Supervisor

Assoc.Prof. Dr. Elif SÖNMEZ

İstanbul, 2025

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The thesis titled “THE EFFECTS OF BIOPHILIC DESIGN ELEMENTS IN PUBLIC SPACES ON USER PREFERENCES: A CASE STUDY OF MAÇKA PARK” prepared by EZGİNAZ KARA and submitted on 01/07/2025 has been **accepted unanimously** for the degree of Master of Science in Architecture.

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DEDICATION

First and foremost, I would like to express my deepest gratitude to my dear supervisor, Assoc. Prof. Dr. Elif Sönmez, for her endless academic expertise, unwavering support, and kind-hearted guidance throughout this long and challenging process. Her encouragement and valuable insights made this thesis journey both enjoyable and fruitful. I would also like to thank my beloved family; who have always embraced me with love and compassion, believed in me unconditionally, and made me feel that whatever I do is the best in their eyes.

To my dear husband; my safe harbor..thank you for being by my side in every step I take, every decision I make, and in the pursuit of every dream I have ever had since the day you came into my life.

Lastly, I extend my heartfelt thanks to my beloved cat Kaşık, whose presence alone relieves all my stress and to whom I am forever grateful.

ABSTRACT

THE EFFECTS OF BIOPHILIC DESIGN ELEMENTS ON USER EXPERIENCE: A CASE STUDY OF MAÇKA PARK

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Date: 07/2025

Pages: 107

The rapidly accelerating history of urbanization has profoundly transformed human life and led to a gradual weakening of the bond between people and nature. This situation negatively affects physical and mental health, increasing the need for nature. In this context, biophilic design is presented as a methodological intervention aimed at enriching the increasingly diminished experience of nature in urban environments and enabling people to establish more meaningful connections with nature within the built environment. The aim of this research is to examine the effects of biophilic design elements on user experiences through the case study of Maçka Park, located in the Şişli district of Istanbul. The study comprehensively addresses the impact of biophilic design components in public spaces from both spatial and user perspectives. It is argued that such elements are more commonly found in areas where users spend extended periods of time, suggesting that the spatial arrangement of these features plays an effective role in shaping user behavior. At the user level, the focus is on how park users perceive biophilic design elements and how these features shape their experiences. Observational studies, a comprehensive literature review, and surveys conducted with 77 participants reveal that the presence of biophilic elements increases user satisfaction. The primary aim of this study is to provide guidance for public park design practices that prioritize user satisfaction and adopt biophilic design principles. The research seeks to demonstrate that biophilic design not only adds aesthetic value to spaces but also actively contributes to improving users' physical and mental well-being. Based on the

findings, it is emphasized that biophilic design plays a significant role in enhancing user satisfaction and that public spaces designed with this approach make it more accessible for individuals to reconnect with nature. This study also aims to offer a vision that prioritizes user-centered design principles and promotes an environmentally friendly design philosophy within the field of architecture. Based on the research results, it is anticipated that integrating biophilic design into public spaces will enhance users' physical and psychological well-being and contribute to the development of more sustainable urban environments.

Keywords: Biophilic Design, Sensory Experience, Urban Parks, Urban Green Spaces, Human-Nature Interaction.



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ABBREVIATIONS

ART	:	Attention Restoration Theory
DRT	:	Attention Restoration Theory (Turkish abbreviation)
QoL	:	Quality of Life
SAT	:	Stress Reduction Theory
SDG	:	Sustainable Development Goals
SPSS	:	Statistical Package for the Social Sciences
UN-Habitat	:	United Nations Human Settlements Programme
WHO	:	World Health Organization

1. INTRODUCTION

1.1 AIM OF THE RESEARCH

The concept of urbanization has significantly changed the way people communicate with natural environments. With the acceleration of urbanization, the decrease in green areas causes a decrease in the mental and physical health of the urban population. Biophilic design, as a design approach that integrates natural elements into built environments, emerges as a design feature that aims to reduce the negative public and individual effects of urbanization. This study aims to analyze the effects of biophilic design elements on the preferences of users in public spaces. Maçka Park in Istanbul was selected as the study area. The research aims to examine how biophilic elements improve spatial perception, increase user satisfaction, and contribute to a more sustainable and livable urban experience.

1.2 SIGNIFICANCE OF THE STUDY

As public spaces, parks serve as important reset points in urban life. They offer multifaceted opportunities for recreation, social interaction and physical activity. The lack of natural support in most public spaces in modern times reduces user participation and satisfaction and limits the effective use of these spaces. This research highlights the use and importance of biophilic design in urban public parks and explores how it improves the user experience. By analyzing the basic biophilic building blocks of a successful public space; it aims to provide findings that can guide future urban planning efforts. Another importance of the research is to contribute to sustainable urban development, one of the outcomes of globalization. Biophilic design, as a design method that aims to strengthen human-nature communication from a new perspective, has the potential to improve the mental health of individuals as well as increase social interactions. The contributions of biophilic design in terms of cultural and ecological sustainability have made a positive contribution to the literature as a result of various studies. Biophilic design approaches, which can be adapted to different cultural contexts, support the preservation of spatial identity while contributing to the maintenance of ecological balance. In rapidly urbanizing cities such as Istanbul, biophilic design is promoted as an architectural approach that not only promotes environmental sustainability but also enhances the living standards of urban dwellers. The application of biophilic design not only enhances aesthetic value and mental health but also

plays a critical role in the achievement of global sustainability objectives. Therefore, the United Nations Sustainable Development Goals (SDGs) emphasize increasing the livability, health, and harmony between nature and human settlements. To be more specific, "Goal 11: Sustainable Cities and Communities" has a platform in which biophilic practice can take place, as it works towards making accessible public space as well as green spaces (UN, 2015).

1.3 RESEARCH QUESTIONS AND PROBLEM STATEMENT

The central problem addressed by this study is the lack of extensive data on the impact of biophilic design elements on people's perception and experience of space in public areas. There is also a considerable absence of scholarly research investigating the effects of natural elements on occupants' satisfaction, psychological well-being, and social interaction, beyond mere visual aesthetics, that this research aims to investigate. The analysis and understanding of the way that nature-based components influence individuals are significant, not just in terms of the individual preference for these areas but also in consideration of measuring the greater incorporation of biophilic principles within design processes. The influence of biophilic design components on user preference and spatial cognition will be addressed by this research, with the case study area being Maçka Park, which is situated amidst the very densely populated cityscape of Istanbul. The core purpose of this research is to examine the influence of biophilic design elements on perceived space, user experience, and satisfaction within public spaces. The outcome of this examination will explain the perceptual effect of biophilic design within different demographic groups, in addition to delineating the influence of this design philosophy on user preference. Therefore, this research focuses on the following questions:

- a. The natural elements of the park (such as vegetation and water features) are highly perceivable.
- b. The natural materials in Maçka Park (e.g., wood, stone) contribute positively to the atmosphere of the space.
- c. The variety of biophilic elements in the park is satisfactory.
- d. Water elements (e.g., ponds or fountains) encourage me to spend more time in the park.

- e. Shaded areas make the park more comfortable to use during summer.
- f. Organic forms and natural arrangements make me feel more peaceful while walking through the park.
- g. The biophilic design of the park positively affects my overall experience.
- h. Increasing the number of biophilic features in the park would enhance my satisfaction.
- i. Compared to other parks, Maçka Park has a superior structure in terms of biophilic design.
- j. Biophilic elements in the park provide a more motivating environment for physical activity.
- k. The presence of natural elements helps reduce my stress in the park.
- l. Biophilic design features in the park promote social interaction.
- m. The biophilic design of the park yields higher satisfaction than other public spaces.
- n. The biophilic elements in the park enhance both its aesthetic and functional value.

Based on these questions, the following hypotheses were developed:

H1: Biophilic design elements positively influence user satisfaction.

H2: Spatial arrangement enhances the effect of biophilic elements on user behavior.

H3: Visualization increases the perceptibility of biophilic design elements.

H4: Biophilic design elements are a determining factor in users' preference for public spaces.

These research questions and hypotheses aim to generate universal insights into user experiences within diverse cultural and geographic contexts, moving beyond the aesthetic and ecological dimensions of biophilic design. The study is grounded in internationally recognized theories such as Kaplan and Kaplan's Attention Restoration Theory (ART) and Ulrich's Stress Reduction Theory (SRT), both of which provide foundational theoretical support for the impact of biophilic elements on individuals.

1.4 SCOPE AND LIMITATIONS

This thesis aims to investigate the influence of biophilic design elements on people's experiences and levels of satisfaction in public areas through observational and survey-based methods. It also aims to provide a design viewpoint for the creation of environments that promote contact with nature in an urban environment. The research considers the spatial diversity of biophilic elements and their relationship to user satisfaction and behavior, both in theoretical and practical terms. The aim of this research is to declare that biophilic design presents a strategy that enhances the physical and mental well-being of individuals in urban environments, particularly at a moment when increasing urbanization undermines connections with nature. This research therefore makes both practical and theoretical contributions to literature through the description of the influence of biophilic elements on user satisfaction in the context of spatial experiences. The findings, as aimed at drawing attention to the fact that biophilic design needs to be considered as a strategy for the architectural discipline and more so in public space design, provide information that will shed light on designing user-friendly, sustainable and nature-oriented spaces. In this respect, the research is a novel addition to coming up with design strategies that will optimize user experience in both aesthetical and functional senses. The study's contribution to the literature can be outlined in two primary fields. Whereas the existing research predominantly concentrates on the theoretical aspects of biophilic design, the present study offers an in-depth exploration of the spatial variation of biophilic features in Maçka Park and their correlation with user satisfaction and experience. In this regard, it presents findings that are worth consideration in the design process. The study reveals the impact of biophilic elements, not just addressing the environmental aesthetic qualities but also the degree of user satisfaction and activity in the park. These results are crucial evidence to back up the incorporation of biophilic elements as a design principle in the development of public spaces. This research uses Maçka Park as a case study and examines the primary components of biophilic design and their influence on user experiences. The chosen park contains a spatial structure comprising the elements of biophilic design, such as vegetation, water features, shaded spaces, and natural materials. The predominance of the qualities inherent in this setting renders it particularly amenable to an in-depth exploration of the influences that biophilic features exert on user experience. Located in the center of Istanbul, Maçka Park

enjoys a heterogeneous customer base comprising various demographic segments. It is also feasible to classify the various visitor categories, including frequent park visitors, sports activity participants, families, and solo visitors. Consequently, this specific type of variety is anticipated to yield a large dataset, thus broadening the demographic base of the study. Maçka Park is an area where natural ecosystems and human-made features meet in a densely populated urban area such as Istanbul. This research will examine and evaluate the components of biophilic design present in the park, along with providing recommendations that could be relevant to the existing scholarly literature on sustainable urbanism.

1.5 METHODOLOGY AND THESIS STRUCTURE

This is a mixed-methods study that employs both quantitative and qualitative methods in investigating the influence of biophilic design elements on user satisfaction. The primary objective is to assess the influence of these elements on user experiences in public open spaces and provide insights that can be applied in enhancing future urban design strategies. The research is conducted in two primary phases. In the first phase, the spatial analysis of biophilic components of Maçka Democracy Park in Istanbul was made. The park was studied extensively, where natural features such as vegetation, water, shadows, natural materials, and organic forms were mapped, photodocumented, and translated onto a cartographic plan. Furthermore, frequently used spaces, i.e., circulation routes, seating schemes, and playgrounds, were analyzed regarding their connection to these biophilic features. During the second stage of the study, the users were surveyed by individuals who are frequent users of Maçka Park. The survey was designed to identify users' attitude towards biophilic features, the influence on the amount of time spent in the park, and the level of satisfaction indicated by the users. In order to provide variety, the sample consisted of participants with various characteristics including age, gender, profession, and patterns of usage. This design permitted gathering large and diverse data on users' perceptions and experiences of biophilic elements. The sample size required was calculated with the help of the G*Power 3.1 software program to ensure it was statistically significant. In the current correlation-centered study, the effect size was set at 0.35, which falls in the medium to large category, with a significance level of $\alpha = 0.05$ and a power of 0.80, in accordance with the guidelines set by Cohen (1988). The power analysis revealed that at least 67 participants are needed. 77 individuals took part

in the survey, thereby meeting the threshold for an adequate sample size. The minimum sample sizes for different effect sizes are presented in the Table 1.1 below:

Table 1.1: G*Power Effect Size Calculation Table (Prepared by the Author).

Effect Size (r)	Interpretation	Minimum Required Sample Size
0.10	Small	782
0.30	Medium	84
0.35	Medium-to-Large	67
0.50	Large	29

In the last phase of the investigation, the data collected from both the spatial analysis and the questionnaire study were integrated and analyzed together. The spatial analysis illuminated connections between the pattern of biophilic elements in the park and the density of users, while the quantitative survey data allowed for a numerical analysis of the effect these elements had on user experiences. This combined approach enabled a multidimensional exploration of biophilic design, not only analyzing the spatial composition of elements in the space but also their influence on the spatial experiences that are perceived by users. In this regard, the findings are hoped to be a useful tool for designers wanting to apply biophilic principles more successfully in public open spaces and to guide spatial strategies seeking to promote user satisfaction. Additionally, the study aims to provide a theoretical foundation for subsequent academically motivated research, as it underscores the value of user-centered research methods within the urban design process.

1.6 BACKGROUND OF THE STUDY

As urbanization continues at a rate never previously envisioned, the theory is that the forces operating in the urban environment shift over time, and a severe rift in the human-nature relationship is an inevitable result. The extensive urban development has contributed to the progressive destruction of the natural environment, compromising ecological balance and the physical, psychological, and social well-being of humans. In contemporary cities, the

demand for nature among humans has become increasingly evident, mainly due to the inadequate spatial provisions that are available to fulfill this demand within the urban context. In this scenario, biophilic design emerges as one of the prominent proposed solutions that have gained traction in academic literature, being one of the innovative methodologies adopted to mitigate the issues caused by urbanization over the years. Biophilic design is a design framework that seeks to improve the spatial experience of individuals through the introduction of natural elements in built environments. It is beyond an aesthetic measure since it aims to produce environments that promote psychological well-being and improve social engagement among individuals. Underpinning biophilic design as theorized in the literature review are conceptual frameworks such as Ulrich's (1984) "Stress Reduction Theory" and Kaplan and Kaplan's (1989) "Attention Restoration Theory," which suggest that access to natural environments improves overall well-being, lowers stress levels, and lessens mental fatigue. This background theory emphasizes the value of integrating natural elements into the built environment and explains the beneficial effects of natural elements on people's cognitive and emotional activities. According to the literature review, urbanization affects social ties and a sense of community among people in addition to ecological balance. O. E. Ufacık (2024). Urban dwellers live in uniform, solitary built environments that were largely created with little regard for social interaction. Consequently, biophilic design, which incorporates. Thus, biophilic design, which integrates nature with user-centred spaces, takes a central position in the development of environments that enable interpersonal interactions between users. Jan Gehl's (2011) placemaking approach stresses that public space is not just physical form; it is a design philosophy that tries to foster social interaction, meet the needs of users, and strive to make places inhabitable. In the framework of this model, both biophilic design and Placemaking principles can be viewed as two interrelated approaches aimed at enhancing not just the physical environment but also the emotional well-being of individuals. The application of biophilic design can vary significantly in various geographical and cultural contexts. For instance, in the tropics, biophilic design is likely to focus on lush greenery and water features, whereas in the desert, the emphasis will be on the provision of shade and water conservation measures. This indicates that biophilic design is a flexible framework that can take general principles and develop them into context-specific solutions for different environmental conditions. The objective of this study is to examine the effects of biophilic design elements on the spatial

experiences of residents in Istanbul, paying particular attention to the density and built-up area of the city. In particular, Maçka Park has been chosen as a case study. The park is distinctive as a place where biophilic elements are determined in social and physical settings. The current research aims to examine the influence of park biophilic elements on spatial perception and user satisfaction within both spatial and perceptual fields. Thus, the finding from this research will have valuable inputs to inform the design of public spaces in the future.

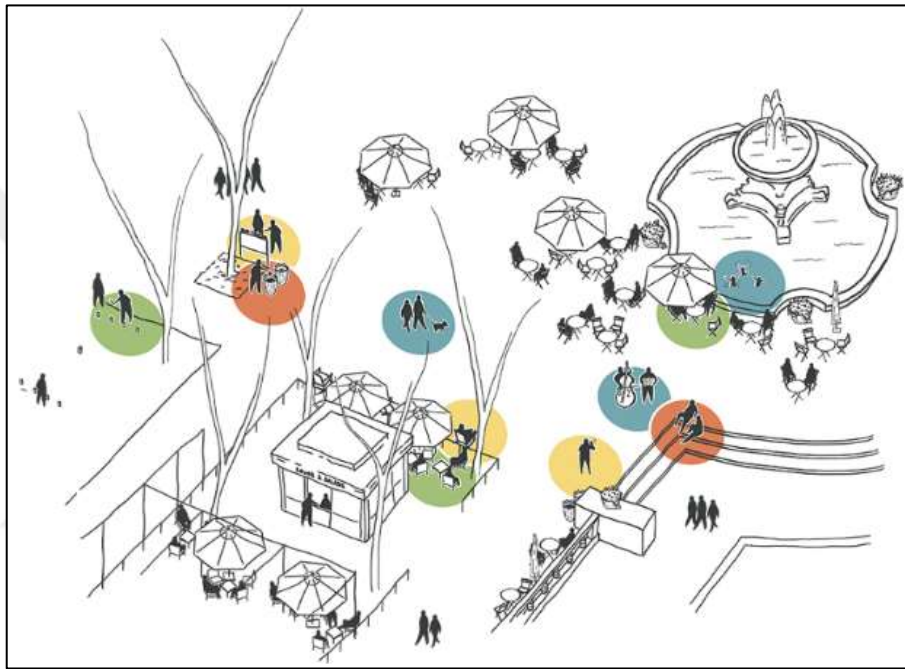


Figure 1.1: Project for Public Spaces Placemaking Diagram (Gehl, 2011).

2. SOCIO-SPATIAL RESTRUCTURING PROCESS IN CITIES

2.1 CONCEPTUAL FOUNDATIONS OF BIOPHILIC DESIGN

The concept of biophilia was first introduced by Edward O. Wilson in 1984. Wilson defined biophilia as the natural human tendency in his 1984 book, *Biophilia*, to connect with nature and to seek interaction with components of nature. This principle is rooted in human evolutionary history for the majority of their existence, humans have continued to engage with natural environments that have influenced both their actions and survival strategies. Wilson's theory extends personal biases and addresses widespread cultural movements and communal human experience. Building on this foundation, Kellert and Wilson (1993) examined biophilia from the human behavioral and psychological point of view, proposing the affection for nature is part of our inherent natural biological make-up. Kellert (2008) then highlighted that this relationship comprises not just emotional factors but also cognitive factors and physiological factors are part of the overall health of individuals. From the evolutionary psychology perspective, biophilia implies that human beings are Biologically predisposed to favor natural environments, the Attention Restoration Theory of Kaplan and Kaplan (1989) support this idea, arguing that interaction with natural settings enables to restore expended attention and mental clarity. Similarly, Ulrich's (1984) Stress Reduction Theory emphasizes the soothing and restorative qualities of nature. environments on both body and mind. Biophilic design is based on the integration of these findings into the built environment. Through incorporating nature into spatial designing either through planting, natural lighting, waterways, or forms in nature Biophilic design seeks to enhance cognitive performance and decrease stress. Recently years, the biophilia hypothesis has made inroads into disciplines as varied as sustainable architecture, environmental psychology, and urban design. Browning, Ryan and Clancy (2014) observe that the use of biophilic design has increasingly gained traction in modern planning, boosting user satisfaction and overall quality of life through nature-inspired design solutions. Overall, the biophilia hypothesis generates a fundamental theoretical underpinnings of biophilic design, and providing an empirical grounding for the incorporation of nature into everyday settings.

2.1.1 Definition of Biophilic Design In The Context of Architecture and Urban Planning

Biophilic design is a theoretical framework for improving human health by integrating elements of nature into built environments (Kellert, 2008). For architecture and urban planning disciplines, biophilic design addresses the necessity of those environments that promote regular interaction between humans and nature (Beatley, 2011). As opposed to conventional architectural approaches that are concerned primarily with functionality and efficiency, biophilic architecture is designed to address the emotional and physiological requirements of humans (Kellert & Calabrese, 2015). From an architectural perspective, biophilic design involves the inclusion of elements such as natural light, vegetation, water features, natural materials, and forms inspired by nature (Browning, Ryan & Clancy, 2014). These elements have been proven to lead to reduced stress and improved mental recovery (Ulrich, 1984). Modern building design has progressively incorporated features like green roofs, inner gardens, and biomorphic structures, proof of the growing emphasis on biophilic design. (Kellert, Heerwagen & Mador, 2008). Empirical evidence illustrates that designs based on natural patterns and shapes enhance individuals' spatial awareness (Joye, 2007). In urban planning, biophilic design entails the incorporation of parks, verdant corridors, community gardens, and water elements in the urban environment (Beatley, 2016). Jan Gehl (2011) stresses the incorporation of natural features into urban landscapes, contending that cities designed in accordance with biophilic principles possess friendlier and more agreeable public spaces. Also, such buildings provide genuine benefits, including enhanced air quality, reduced urban heat, and increased social interaction possibilities (Newman, Beatley & Boyer, 2017). In general, biophilic design principles of architecture and urban planning aim to shape the environment towards an increased interaction with nature. Aside from its spatial experience and aesthetic value, it also contributes significantly to physical health and mental well-being. Therefore, biophilic design is strongly needed in the creation of more livable and sustainable cities (Kellert, 2008).

2.1.2 Biophilia and the Human Instinct for Connection with Nature

The biophilia hypothesis suggests that humans have an inherent tendency to affiliate with nature, a tendency that has been shaped over the course of evolutionary history (Wilson,

1984). Throughout the course of human evolution, survival has demanded intense contact with natural environments, as humans relied on these ecosystems for food, shelter, and protection (Kellert & Wilson, 1993). As such, biophilia is seen as not just a psychological preference but more as an essential biological necessity. Drawing on environmental psychology and evolutionary biology, this connection to nature is neurologically and physiologically scientifically founded. Evidence suggests that brain regions associated with emotion and memory, i.e., hippocampus and limbic system, are stimulated by experiencing natural environments. Being exposed to green spaces has been found to be capable of inducing feelings of calmness and peacefulness (Ulrich, 1984). Furthermore, daily contact with natural settings can alleviate stress through the decrease of cortisol levels, hence promoting general well-being and health (Kaplan & Kaplan, 1989). Nonetheless, the biophilia hypothesis also identifies an increasing divergence from nature in contemporary urban settings. Louv (2008) describes that the alienation may lead to a situation he has termed "nature-deficit disorder," especially in children. Deprivation of nature access has been associated with attention difficulties, mood disorders, and social interaction reduction. In the field of architecture and urban planning, the biophilia hypothesis has become a leading paradigm in creating healthier and interactive environments. Jan Gehl (2011) observes that incorporating nature in cities is not only aesthetically pleasing, but it also builds social relationships and emotional connection to specific places. In this case, biophilic design is proposed as a conscious approach to reconnect humans and nature in urban areas (Beatley, 2016). Last but not least, the term biophilia signifies an innate human necessity that has direct effects on psychological and physical health. Sustaining and reconstructing this connection in present contexts is becoming increasingly regarded as the key to individual well-being and sustainable urban life (Browning et al., 2014).

2.2 FUNDAMENTAL COMPONENTS OF BIOPHILIC DESIGN

2.2.1 Direct Experience of Nature

Direct nature experience, which involves physical and sensory connection with nature, is among the key principles of biophilic design and hence enhances the quality of space. As presented in Figure 2; such experience is possible through the integration of principal biophilic features natural light, water features, plants, and wildlife into space design to

realize exceptional benefits in human health, mental health, and space unity (Kellert, 2008). The direct contact with natural elements has assisted in the regulation of physiological and psychological conditions in humans by alleviating stress, improving attentional capabilities, and improving overall mental health (Ulrich, 1984; Kaplan & Kaplan, 1989). Natural light is of particular significance among the various components of biophilic design. It is required for modulation of the human circadian cycle and thereby improving cognitive function and psychological well-being (Heschong, 2002). Natural light conditions also enhance visual comfort of users, reduce the need for artificial lighting, and encourage environmental sustainability in terms of energy efficiency (Boyce, 2010). Research indicates that daylight exposure improves happiness levels and general indoor air and light quality (Veitch & Galasiu, 2012). Apart from regulating biological rhythms, daylight fosters psychological relaxation, productivity, and overall life satisfaction (Veitch & Galasiu, 2012). Integration of water elements is crucial in biophilic design due to the visual, psychological, as well as sensory advantages they have to offer. The use of these water features enhances spatial experiences through relaxation induction and cognitive restoration (White, Smith, Humphries & Pahl, 2010). Ulrich's (1984) stress reduction theory argues that both visual and auditory water stimuli have the capacity to decrease anxiety as well as stimulate recovery processes based on psychological and physiological factors. Similarly, incorporating vegetation and foliage is important since it enhances human beings' relation to nature and enables direct contact with natural surroundings. Attention Restoration Theory, as developed by Kaplan and Kaplan (1989), contends that nature contact or viewing greenery contributes to the reduction of mental fatigue and the enhancement of cognitive functioning. In addition, exposure to green spaces encourages social interaction, enables physical activity, and enhances general well-being (Hartig, Mitchell, de Vries & Frumkin, 2014).

The distribution of green spaces within urban centers leads to cleaner air, protects public health, and fosters ecological sustainability.



Figure 2.1: Biophilic Design Elements and Their Effects (Prepared by the Author).

Interaction with animals is another central aspect of direct nature experience. Integration of wildlife particularly birds, butterflies, and insects in cities significantly increases individuals' sense of attachment to nature and spatial experience (Kellert & Wilson, 1993). Fuller, Irvine, Devine-Wright, Warren, and Gaston's (2007) research confirms that biodiversity increase is directly linked with psychological well-being and has a positive influence on people's spatial perception. The other essential element for direct nature experience in biophilic design is the sensory impact of natural sound and scent on spatial experience. Natural auditory and olfactory stimuli enhance users' spatial awareness and allow mental relaxation, lessening the high and sometimes inevitable stressors of urban life (Alvarsson, Wiens & Nilsson, 2010). Empirical research has established that auditory stimuli such as the sounds of running water, birdsong, and rustling of leaves induce psychological relaxation and enhance attentional capacity (Ratcliffe, Gatersleben & Sowden, 2013). Similarly, the impact of natural scents on humans, both physiological and psychological, is of immense importance. It has been established that volatile organic compounds released from plants have the ability to improve mood, lower stress levels, and aid in cognitive function (Klemm, Heusinkveld, Lenzholzer, Van Hove & Kramer, 2015). As a result, the incorporation of varied vegetation, as well as the incorporation of fragrant species that yield herbal and grassy aromas into spatial designs, fosters a deeper sense of connection between human beings and nature while enhancing the quality of spatial experiences. The interconnection between natural ecosystems and spatial continuity is another critical element of biophilic design, especially when considered from

the viewpoint of sustainability. The integration of natural systems in urban areas helps preserve ecological balance, increases diversity, and improves the bond between people and nature (Beatley, 2011). Landscape strategies that aim to maintain ecological integrity, such as urban green corridors, rain gardens, and natural drainage systems, allow for the smooth functioning of natural processes in cities (Benedict & McMahon, 2006). The incorporation of ecosystem services in spatial planning not only generates environmental sustainability but also enhances users' experiential contact with nature. The application of approaches that promote direct contact with nature in the design of public spaces is both human well-being and ecologically sustainable, thereby contributing to user quality of urban life. Mental health is linked not just to the presence of green areas but also to the degree of biodiversity within them (Fuller, Irvine, Devine-Wright, Warren & Gaston, 2007).

2.2.2 Indirect Experience of Nature

The second key component of biophilic design is the indirect experience of nature, which enables biophilic interaction through spatial arrangements that refer to nature without requiring direct physical contact with the natural environment (Kellert, 2008). This strategy includes a set of techniques, including the application of natural materials, biomimetic design, and design principles inspired by nature, along with natural lighting and ventilation systems. Where there is constrained or no direct access to nature, indirect exposure to nature provides cognitive, affective, and psychological access to the natural environment, promoting spatial perception and psychological health (Browning, Ryan & Clancy, 2014). The application of natural materials is among the most powerful indirect biophilic connections. Some of the natural materials such as wood, stone, clay, bamboo, and marble create visual and touch interfaces with nature that positively impact the psychological health and relaxation of the inhabitants of the buildings (Joye, 2007). Research indicates that settings incorporating natural materials are experienced as warm and serene, in contrast with artificial or highly processed surfaces, which detract from the spatial experience (Kotradyova et al., 2019). Specifically, wood use has been demonstrated to decrease stress levels and increase spatial comfort perceptions, thereby reinforcing individuals' psychological bonds with nature (Tsunetsugu, Miyazaki & Sato, 2007). Likewise, textural diversity provided by rock and other natural surfaces adds a quality of organic authenticity to the space, reasserting the indirect connection with nature (Pallasmaa, 2012). Biomorphic

forms and organic patterns are also at the core of biophilic design, being fundamental elements by which natural structure and geometry are invoked. Biomorphic design uses geometric patterns found in nature, fractal patterns, and curvilinear shapes in spatial composition (Salingaros, 2012). Gaudí's, Wright's, and Hundertwasser's architectural designs provide good examples of how organic shapes are utilized in creating an indirect connection between built environments and nature (Alexander, 2002). The incorporation of fractal patterns and organic curves within interior spaces has been shown to increase users' biophilic experience and spatial experience (Joye, 2007). Additionally, it has been shown that visual representations of nature in the form of patterns and shapes promote psychological relaxation and visual comfort (Taylor, Spehar, Hägerhäll & Van Donkelaar, 2011). Nature-inspired design elements, therefore, facilitate cognitive connections with nature and improve spatial perception. The use of natural light and ventilation in space design is another strategy aligned with the elements of biophilic design to facilitate comfort and well-being. The optimum integration of daylight into indoor spaces regulates circadian rhythms, supports cognitive function, and promotes psychological well-being (Heschong, 2002). Literature shows that adequate natural light in indoor spaces enhances productivity and promotes general well-being (Veitch & Galasiu, 2012). Similarly, natural ventilation systems improve indoor air quality, rendering environments healthier and more comfortable for occupants (Brager & de Dear, 2000). Compared to mechanically ventilated areas, spaces that utilize natural airflow improve respiratory health and positively impact attitudes towards the built environment (Fisk, 2017). As such, prioritizing natural lighting and ventilation assists indirect nature experience and aligns with the spatial sustainability principles of biophilic design. As a concluding remark, indirect experience of nature, as a key component of biophilic design, reinforces cognitive and sensorial connections with nature through the use of natural materials, biomorphic forms, and nature-referential concepts, along with daylight and natural ventilation. Integration of these concepts in spatial planning enhances user perception of space, maintains psychological and physiological well-being, and helps attain a sustainable mode of urban living. The application of indirect nature experience strategies on a continuum of spatial scales from interior design to public space plans serves as a cohesive component in enhancing the efficacy of biophilic design.

2.2.3 Spatial Organization

Another fundamental component of biophilic design is spatial organization, which is considered a set of strategies that enhance the interaction between nature and space by addressing users' psychological, physical, and sensory needs (Kellert, 2008). Within the scope of spatial organization, the ways individuals perceive space, the cognitive and sensory connections they establish with the natural environment, and their spatial experience processes are examined. The Prospect-Refuge Theory (Appleton, 1975), one of the point approaches of biophilic design regarding spatial organization, emphasizes spatial arrangements that simultaneously fulfill users' need for both security and visual access. The Sustainable environmental design is supported by the implementation of transition areas guaranteeing continuity between interior and outside spaces as well as biophilic spatial arrangements in public areas, which improves urban quality of life. Created by Appleton (1975), the Prospect-Refuge Theory holds that natural human instincts shape environmental perception and that spatial arrangement is judged according to these instinctual preferences. The theory holds that people must be given the components of prospect and refuge in a balanced way if they are to feel safe in a space and also be able to see their surroundings (Appleton, 1975). While the prospect component guarantees that the person has a wide field of view from their position, the refuge element lets them feel safe and protected (Gibson, 1979). This concept is a major guide for the inclusion of nature in spatial organization under the biophilic design paradigm; it especially stresses the need of strengthening indoor spaces, transition zones, and public areas with techniques that allude to natural surroundings (Kellert & Calabrese, 2015). For example, in natural landscape and urban parks, large areas offering broad visual access (prospect) allow individuals to see their environment without any difficulties, and areas of safety such as wooded areas, shaded shelters, or semi-enclosed spaces (refuge) give the perception of safety (Hildebrand, 1999). Empirical studies and literature indicate that environments designed with biophilic design principles play a significant role in lower levels of stress, improved attention capacity, and an improved sense of spatial belonging among people (Ulrich, 1984; Kaplan & Kaplan, 1989). A key element of spatial organisation in biophilic design is the idea of transitional spaces and easy transition between outdoor and indoor environments. While traditional city planning and building design often generate sharp separations between indoor and outdoor environments, the

biophilic approach labors to break down those barriers, thus connecting indoor space more expressly to nature (Browning, Ryan & Clancy, 2014). Indoor and outdoor space continuity enhances individuals' connection with nature and enriches their spatial experience (Beatley, 2011). Transition spaces have been described as those semi-enclosed spaces that create a link between a building's interior and the outer natural environment, thereby providing direct or indirect exposure to nature. Some of the most significant transition spaces that help to provide such continuity include courtyards, terraces, canopies, balconies, indoor gardens, and entrance spaces with extensive openings (Hawken, Lovins & Lovins, 1999). The positioning of these spatial elements enables one to reap maximum advantages of air quality and natural light, in addition to inducing positive effects on physical along with mental health (Veitch & Galasiu, 2012). Public spaces are the inherent aspects of urban life that allow social interaction, encourage physical activity, and ensure connectivity with nature. Public spaces designed based on the principles of biophilic design significantly enhance users' spatial experience by increasing their chances of direct and indirect interaction with nature and, simultaneously, supporting urban ecosystem sustainability (Beatley, 2016). The implementation of biophilic spatial arrangements in public areas includes a range of features such as incorporating green infrastructure, ecological corridors, water elements, natural shading devices, and the utilization of natural materials (Benedict & McMahon, 2006). Specifically, the growing incorporation of natural elements of the landscape into city parks, plazas, pathways, and areas of recreation enables individuals to connect with nature more intimately (Fuller, Irvine, Devine-Wright, Warren & Gaston, 2007). Additionally, public areas created along the lines of biophilic design principles promote mental well-being, lower stress levels, and reinforce social connections among individuals (Hartig, Mitchell, de Vries & Frumkin, 2014). The use of water elements in the design of public space also has very significant value in biophilic spatial planning. The inclusion of fountains, ponds, and rain gardens in city squares, pedestrian areas, and recreational areas enhances the sensory experience of the users and positively impacts their spatial experience (White, Smith, Humphries & Pahl, 2010). In the same context, microclimates in the urban environment as a component of biophilic design principles enhance outdoor comfort conditions and support urban sustainability (Lamb & Purcell, 2020). Overall, then, spatial ordering as understood as part of biophilic design is seen to be an effective design strategy reinforcing people's linkage to nature, promoting spatial insight, and sustaining urban life. The use of the

Prospect-Refuge Theory, the design of transitional spaces, the natural fusion of indoors and outdoors, and the use of biophilic spatial structuring in public spaces are some of the main elements that can improve the performance of biophilic design in urban environments.

2.3 HISTORICAL DEVELOPMENT OF BIOPHILIC DESIGN

2.3.1 Integration with Nature in Traditional Architecture

Since the inception of architectural history, the relationship of human beings and nature has been one of the sustaining criteria to decide the spatial form. In the Ancient Greek, Roman, Ottoman, and Far Eastern traditions of building, the formation of spaces in harmony with nature has been governed by several variables such as composition of space, material usage, placement in the landscape, and sensitivity to climatic factors (Kostof, 1991). In traditional architectural design, the ethos of living in harmony with nature was not merely aesthetic but functional and environmental necessity as well. In Ancient Greek architecture, integration with nature manifested itself in the siting of temples and public structures in consonance with the environment. Such concordance served to reinforce both visual consistency and ecological sensitivity. In city planning, the figure below (In Figure 2.2) Hippodamus' grid system of the 5th century BCE represented a design principle in favor of natural ventilation and highest use of sunlight (Mumford, 1961). This indicates that even at an early stage in city planning, environmental factors were consciously considered while arranging cities spatially. In Ancient Greek architecture, the feeling of harmony with nature is expressed through temple and public building planning according to landscape design.

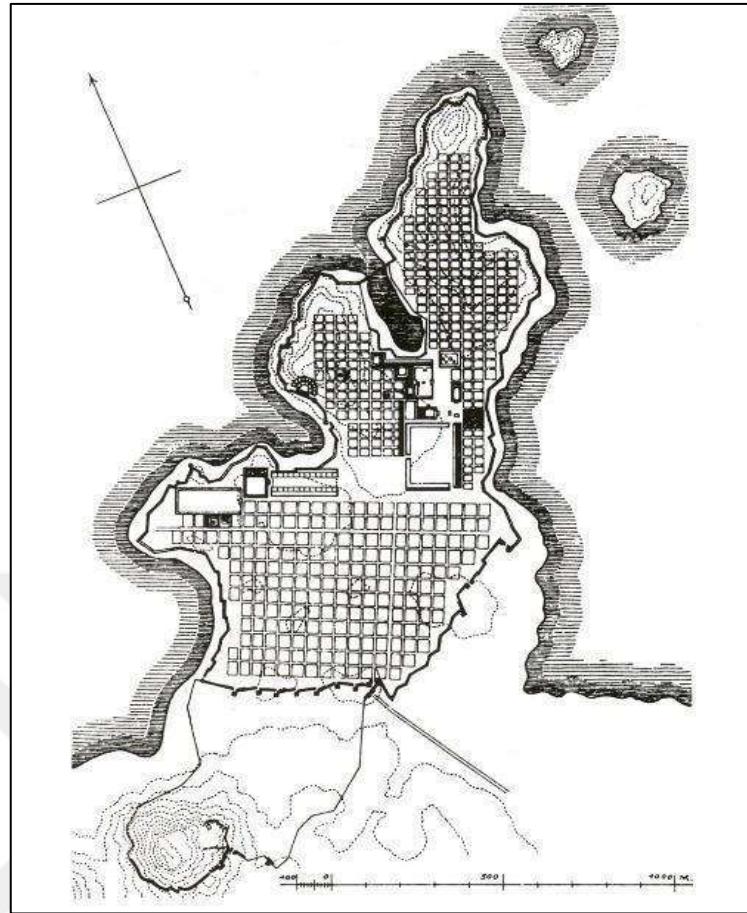


Figure 2.2: The Grid Pattern of Hippodamus, 478 BC (Höpfner&Schwander, 1994).

In addition, the figure below (In Figure 2.3) open courtyards (peristyle courtyards), stoas, and public spaces such as the agora were supported by natural light, air circulation, and vegetative landscape elements, creating a spatial arrangement in accordance with biophilic design principles (Scully, 1979).

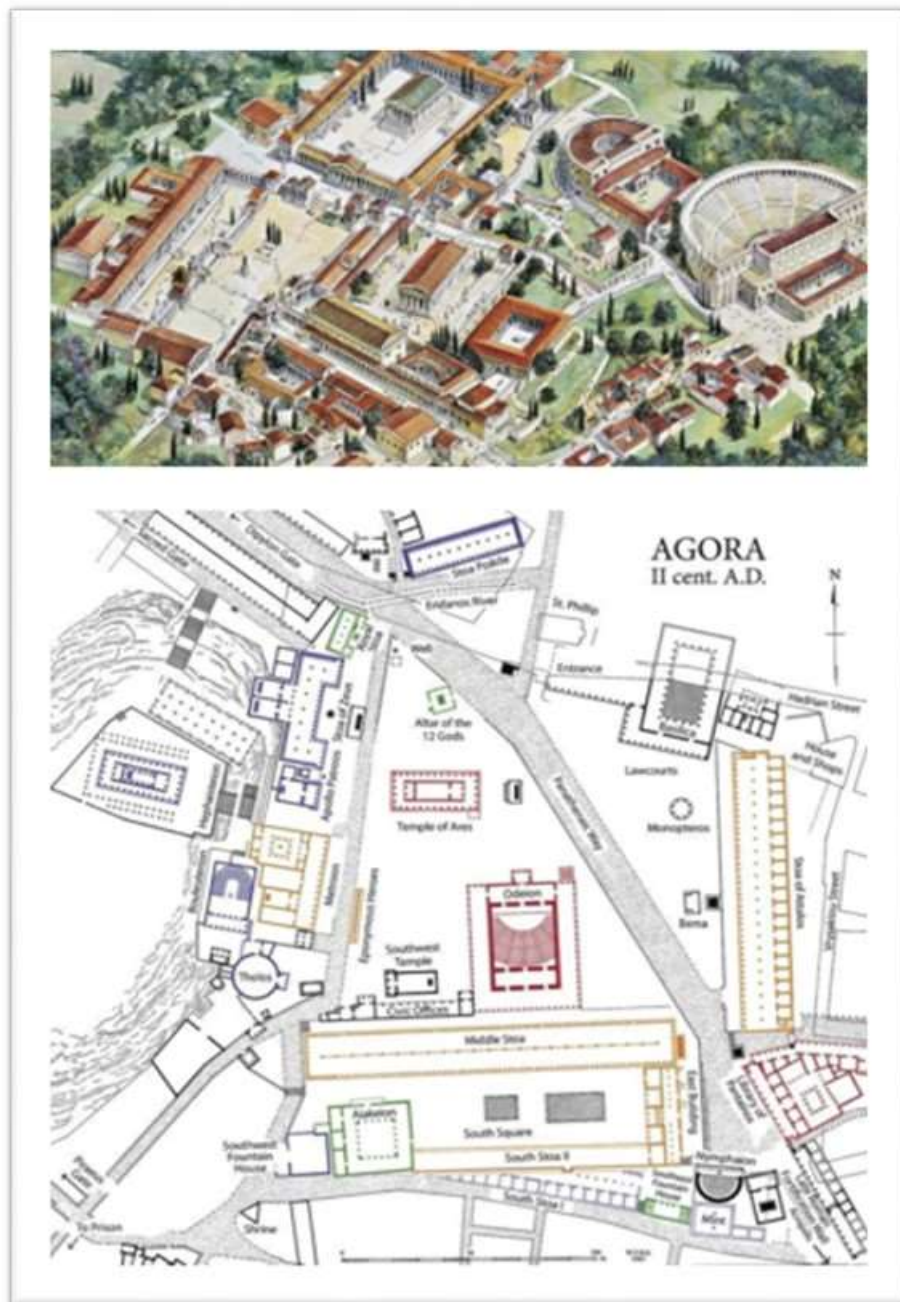


Figure 2.3: The Ancient Greek Agora and Its Plan (Taghizadehvehed, 2018).

In Ancient Roman architecture, however, the approach to spatial organization differed significantly. One of the fundamental elements of biophilic design is the inclusion of interior gardens and water features that reference nature.



Figure 2.4: Pompeii House of the Vettii, Casa dei Vettii (Pompeii in Pictures, 2024).

The figure below (In Figure 2.4) is the Peristyle courtyards commonly found in Roman villas are among the spatial reflections of a design principle that embraces closeness to nature (Zucker, 1959). Moreover, the frequent incorporation of water in architectural design emerges as a significant factor enriching the biophilic spatial experience in Roman cities. Aqueducts, fountains, pools, and thermal baths are not merely considered aesthetic and technical achievements but are also regarded as biophilic elements designed to promote human health and well-being (Hodge, 2002). The figure below (In the Figure 2.5) is one of the most notable structures offering an immersive experience of nature in the Roman Empire is Hadrian's Villa (2nd century AD), which reflects the biophilic design principles of its time

through the integration of water features, expansive green areas, and a planning approach that harmonizes with the natural topography (MacDonald & Pinto, 1995).



Figure 2.5: Hadrian's Villa at Tivoli (ACE Cultural Tours, 2021).

In Ottoman architecture, the nature-oriented design approach manifests as a multi-layered design principle evident in both public and private spaces. In traditional Ottoman cities, the urban fabric of neighborhoods was shaped by biophilic design elements such as the organization of streets to enhance microclimatic comfort, courtyard house typologies, and the integration of water features into public spaces (Kuban, 2007). The figure below (In Figure 2.6) Ottoman residential architecture, courtyards, inner gardens, and oriel windows (cumba) soften the boundaries between interior and exterior spaces, enabling continuous interaction with natural light, airflow, and greenery (Goodwin, 1971).



Figure 2.6: Ottoman Gardens (İstanbul Tarihi, 2019).

Moreover, Ottoman gardens are considered among the most significant examples of spatial organizations integrated with nature. The figure below (In Figure 2.7). The courtyards, water features, and expansive landscaped areas of the Topkapı Palace offer a crucial historical reference point for understanding the early reflections of biophilic design principles (Necipoğlu, 1991).



Figure 2.7: The First Courtyard of Topkapı Palace (Melling, 1819).

In Ottoman architecture, the figure below (In Figure 2.8) particularly within mosque design, interaction with nature is evident through the presence of spacious courtyards, ablution fountains (şadırvans), and surrounding landscape elements. These features embody biophilic design approaches that enrich user experience (Eldem, 1984).



Figure 2.8: Umayyad Mosque in Damascus (Gustav Bauernfeind, 1890).

In Far Eastern architecture, nature-integrated design is prominently reflected, particularly within Japanese and Chinese architectural traditions. In Japanese architecture, nature is not only regarded as a physical foundation but also as a philosophical and aesthetic component (Itoh, 1973). The continuity between interior and exterior spaces, the figure below (In Figure 2.9) as observed in Zen gardens, Shinto shrines, and traditional Japanese houses, holds a significant place in the historical development of biophilic design.



Figure 2.9: Zen Gardens (Janet Loughrey, 2012).

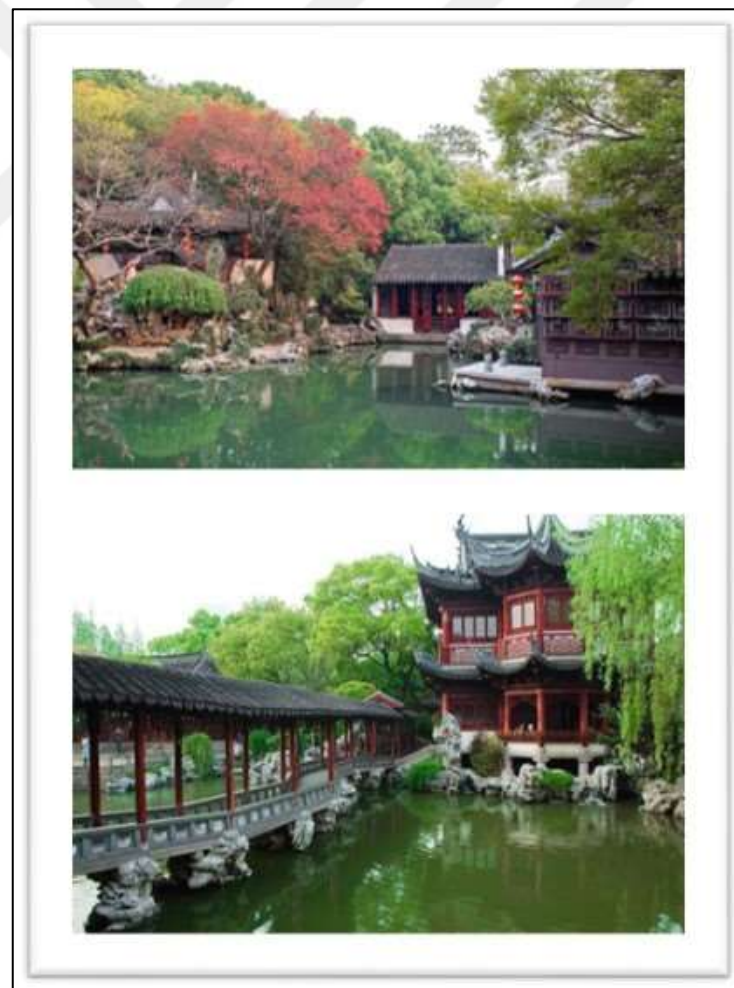


Figure 2.10: Classical Gardens of Suzhou (Francesco Bandarin, 2004).

Shoji doors, expansive verandas (engawa), and minimalist spatial organization composed of natural materials are among the most distinctive elements of Japanese architecture's integration with nature, reflecting its commitment to organic materiality and spatial harmony (Brown, 1993). Similarly, traditional Chinese garden design seeks to create a harmonious spatial experience with nature by thoughtfully balancing elements such as water, rocks, vegetation, and architectural structures (Keswick, 2003). As demonstrated in the literature on the historical development of biophilic design, integration with nature is not solely a modern design approach but rather a fundamental architectural principle adopted by various cultures throughout history. The spatial reflections of the human-nature relationship and its contributions to environmental sustainability can be traced from Ancient Greece and Rome to the Ottoman Empire, from the Far East to contemporary biophilic design practices. In this context, the implementation of biophilic design principles in contemporary urban and architectural design enables the creation of sustainable and user-centered spaces, inspired by this rich historical legacy.

2.3.2 Biophilic Approaches in Modern and Postmodern Architecture: Renaissance Gardens and Landscape Arrangements

Modern and postmodern architecture encompass periods in which the relationship between humans and nature was re-evaluated both formally and conceptually. During this era, biophilic design approaches evolved aesthetically and functionally, displaying diversity across different cultural contexts (Joye, 2007). The Renaissance period, in particular, stands out as a time when the relationship between nature and humanity was addressed through an artistic and architectural synthesis. Garden designs from this period brought nature into the spatial organization as a central element, characterized by human-scale landscape arrangements and the balanced use of water features (Hunt, 2000). In Renaissance architecture, nature was not merely considered a backdrop but functioned as an active component of architectural design. The figure below (In Figure 2.11) such as the Medici gardens, illustrate this approach through the integration of geometric layouts, water channels, pools, and sculptures manifesting a controlled aesthetic deeply intertwined with nature (Thompson, 2012).



Figure 2.11: The Medici Gardens (Özlem Numanoglu, 2016).

Under this perspective, Renaissance landscape planning is a very valuable point of reference for understanding the historical evolution of biophilic design as well as comparative purposes with today's spatial structures. In modern times, Le Corbusier's design principle referring to nature is significant since it focuses on bringing landscape and architecture together. The figure below (Figure 2.12) such undertakings as Plan Voisin, Corbusier attempted to incorporate nature in high-order urban planning methods, thus redefining the line of division between nature and architecture (Frampton, 1980).

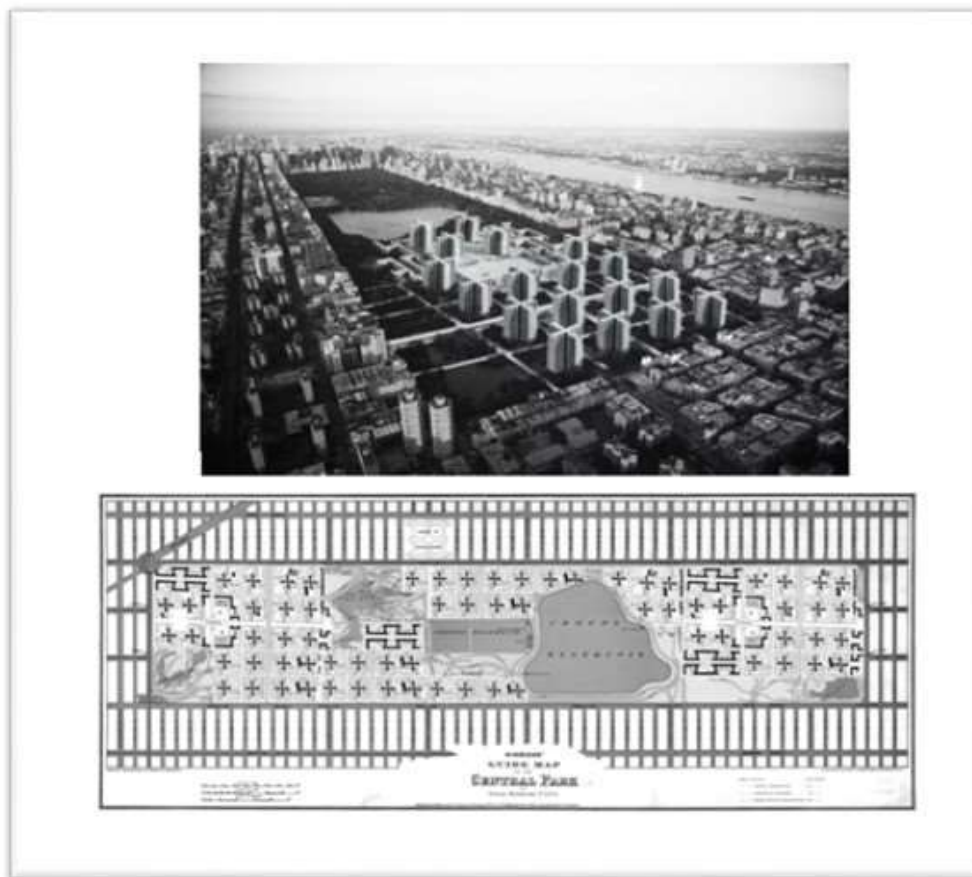


Figure 2.12: Plan Voisin of Central Park (Architizer Journal, 2017).

In the postmodern period, architects began to design more biomorphic and organic shapes with greater emphasis on those aspects that represent nature in the built world (Kellert, 2018). The curvaceous forms represented in the works of architects such as Frank Gehry and Zaha Hadid indicate the influence of nature's organic shapes on urban society and building shapes. The figure below (Figure 2.13) Zaha Hadid especially focused on the prioritization of public spaces within her structures. Her 2012 London Olympic Games Aquatics Centre is a prime illustration of doing this, since it represents the application of fluid, organic forms while also highlighting the importance of open, public spaces. Current research proposes biophilic design as an ever-changing and forward-looking practice that has a direct relation to urban sustainability trends and is repeatedly reinterpreted regarding ecological consciousness.



Figure 2.13: Frank Gehry, Guggenheim Museum Bilbao (Julian Ocon, 2025).



Figure 2.14: Zaha Hadid – London Aquatics Centre (Hufton + Crown, 2011).

2.3.3 Frank Lloyd Wright and the Principles of Organic Architecture

Frank Lloyd Wright is considered to be among the pioneers who transformed the interaction between architectural design and the natural world. Instead of seeing nature as belonging to design, Wright saw architecture as an organic extension of the landscape. In accordance with the philosophy of organic architecture, he attempted to create buildings that harmonized in with their environmental context through the emphasis on the integration of natural elements

in spatial composition (Wright, 1954). His methodology was grounded on basic principles, including the use of natural materials, the blending of structures into the surrounding landscape, and the blending of interior and exterior spaces. The figure below (Figure 2.15) is the finest examples of Wright's organic architecture philosophy is the Fallingwater House. In this specific building, the structural components were carefully measured to match the existing landscape so that a harmonious blending of such features as water bodies and geological features was achieved in the interior environment (Levine, 1996). The waterfall, situated beneath the house, exemplifies the building's congruence with the natural surroundings while simultaneously portraying nature as a fundamental aspect of the architectural composition.



Figure 2.15: Fallingwater House (Adelyn Perez, 2010).

Furthermore, the figure below (Figure 2.16) Wright's Usonian Houses project is a fine illustration of residential building architectural design that includes biophilic design principles, including the utilization of natural materials and open floor plans (McCarter, 2006).

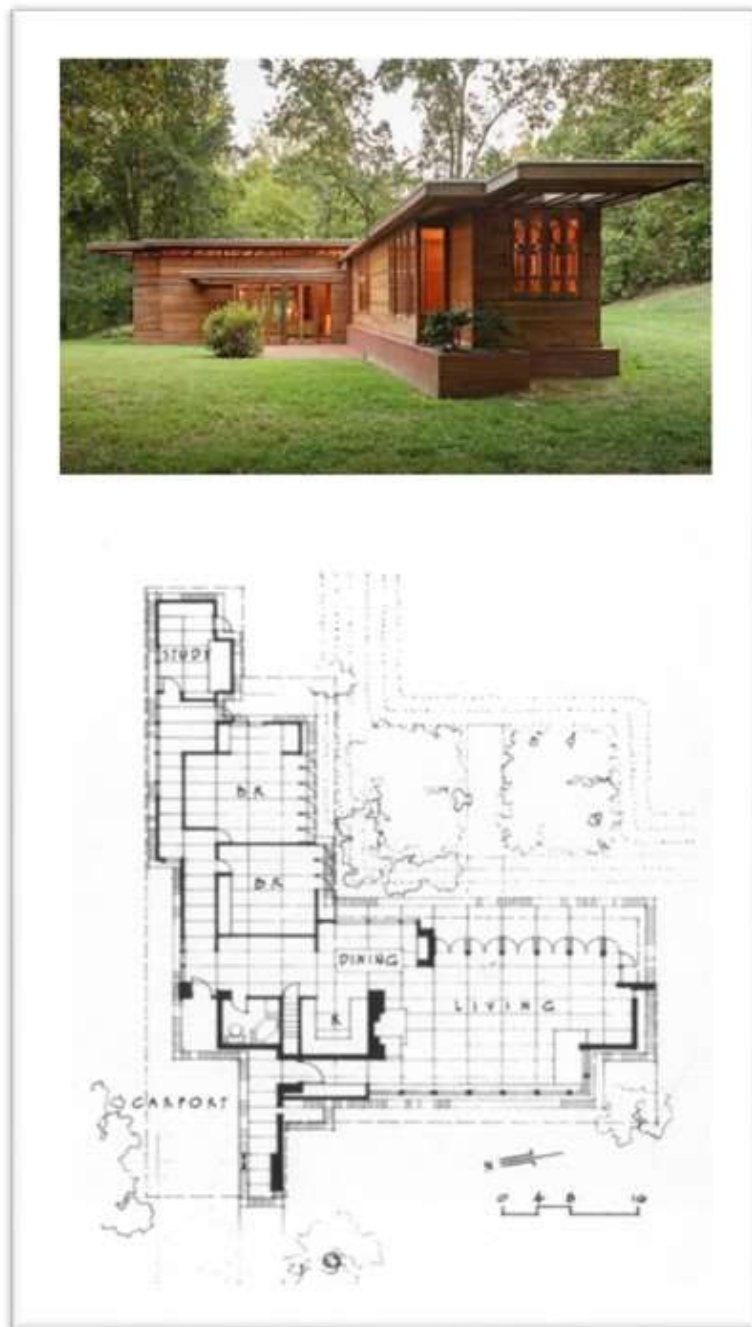


Figure 2.16: Usonian Houses (Lake Country Builders, 1940).

Wright's organic architecture principles are of significant alignment with the fundamental principles of biophilic design and have been a valuable point of reference in contemporary sustainable design practice. Contemporary architects who adopt an ecological design philosophy tend to reinterpret Wright's concepts of spatial harmony and the utilization of natural materials in their designs. These organic architecture principles not only provide an

aesthetic framework but also contribute to sustainability through solutions such as energy efficiency, natural ventilation, and the maximization of daylight use. Therefore, Wright's organic architecture is not merely a legacy of the past but continues to shape the future of biophilic design.

2.3.4 Le Corbusier's "Green City" Concept and Biophilic Design

As a pioneer architect of modern architectural practice, Le Corbusier transformed the connection between urban areas and nature with his "Green City" (Ville Radieuse) ideal. The ideal was based on incorporating natural components, large green areas, and public parks into urban planning to create a sustainable coexistence between human beings and nature (Le Corbusier, 1929). In his conceptualization of urban planning, the natural environment was viewed not merely as an ornamental element but rather as a fundamental component of urban existence. The establishment of extensive green belts, publicly accessible spaces, and structures engineered to maximize natural illumination and air circulation is both directly and indirectly consistent with biophilic design tenets and their focus on fostering a connection with nature (Curtis, 1986).

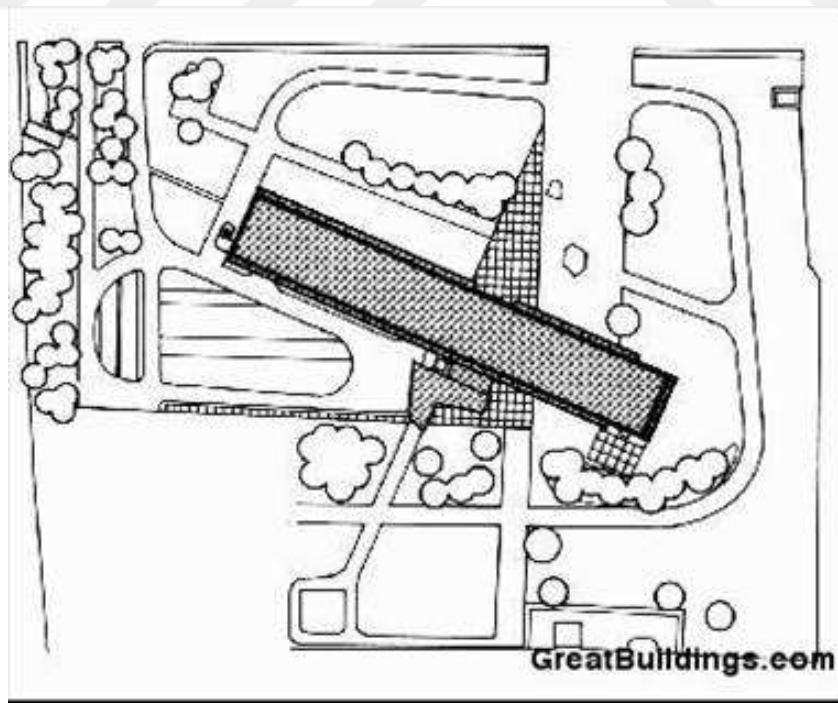


Figure 2.17: Unité d'Habitation, Le Corbusier (Greatbuildings, 2023).

Le Corbusier obviously regarded nature as the key to solving the problems of high-density urban growth, and he emphasized the necessity of residential neighborhoods that are integrated in harmony with natural elements. This is evidently reflected in his Unité d'Habitation projects, in which large green terraces and communal spaces were included in residential complexes to enable ongoing interaction between inhabitants and the natural world (Benton, 2009). This philosophy of design is strongly associated with modern principles of green architecture and biophilic urban planning. Le Corbusier's idea of the "Green City" not only affected city planning but also advocated for using nature as a guiding principle within interior space layouts. Architectural design in this context is more than just about making artificial forms and entails consideration of climatic and ecological factors. The utilization of large amounts of glazing in buildings has facilitated optimum daylight ingress into interior spaces, and the utilization of green facades and roof gardens has accelerated the incorporation of biophilic design principles (Gans, 2006). Le Corbusier's efforts at incorporating natural elements within urban planning and architectural discourse still offer an academic solid basis for contemporary ecological urban planning and sustainable architectural design. Within the perspective of environmental issues caused by fast-paced city growth, industrialization, and high-density development, focus on green spaces and biophilic design concepts championed by Le Corbusier is instrumental in informing present-day urban planning. His strategy is identified as a turning point within the development process of biophilic design over history, providing a theoretical basis for continued research in both the fields of architecture and urban studies.

2.3.5 Biophilic Design in the 20th and 21st Centuries

In the 20th and 21st centuries, biophilic design has taken shape in the context of sustainability and environmental balance and has become increasingly relevant to urban planning and architectural theory. Environmental degradation and loss of natural landscapes resulting from intense urbanization and increasing population density have made biophilic design a viable option for reversing these negative trends (Kellert, Heerwagen & Mador, 2008). To achieve this goal, the use of green roof systems and vertical gardens has been recognized as an important design method for bringing elements of nature into cities. In green roofs, adding vegetation to rooftops improves thermal insulation performance, saves energy, cleans the air, and aids in rainwater management (Oberndorfer et al., 2007).

Similarly, vertical gardens also address the lack of green spaces in highly urbanized cities by providing advantages such as microclimate regulation, noise reduction, and aesthetic appeal (Francis & Lorimer, 2011). Patrick Blanc's new vertical garden systems contribute to reducing carbon emissions and ensuring the sustainability of urban ecosystems by creating natural habitats on building walls (Blanc, 2008). Biophilic urban design initiatives are based on a holistic model aimed at protecting ecological well-being in the built environment to promote human well-being through nature-based approaches (Beatley, 2011). A holistic model includes various complex initiatives such as green infrastructure networks, ecological corridors, urban forests, and the improvement of public spaces (Benedict & McMahon, 2006). While green infrastructure integrates natural and engineered systems to improve the sustainability of ecosystem services, biophilic urbanism focuses on nature-respecting designs aimed at improving the connection between humans and nature (Beatley & Newman, 2013). In cities like Singapore, which have adopted biophilic urban planning paradigms, the integration of natural systems into the built environment is a strong indicator of sustainable urban development (Newman, Beatley & Boyer, 2017). In such urban landscapes, biophilic design plays a significant role in promoting psychological, physiological, and social well-being. As you will see in the remainder of the text, examples of parks designed with biophilic objectives from around the world and their appearances, which serve as examples based on research in the field of biophilic design, are listed. Research has shown that urban areas that provide direct access to natural elements improve mental health, reduce stress, and increase physical activity rates (Ulrich, 1984; Kaplan & Kaplan, 1989). Biophilic design parks, green corridors, public parks incorporating natural elements, and public recreational areas facilitate these positive interactions (Kuo, 2015). Therefore, the implementation of biophilic urban spaces should be studied not only in terms of human health and well-being but also in relation to ecology and social cohesion (Louv, 2008). The growing importance of biophilic design in contemporary urban planning and architecture facilitates the redefinition of the relationship between humans and nature in urban space planning and supports the construction of more sustainable and livable cities in the 21st century.



Figure 2.18: The Tuileries Garden Paris (Landen Kerr, 2020).



Figure 2.19: Vondelpark, Amsterdam (Wikipedia, 2024).



Figure 2.20: Gardens by the Bay (Wikipedia, 2012).



Figure 2.21: Hyde Park (Pedro Jareño, 2023).

2.4 BIOPHILIC DESIGN AND HUMAN–NATURE INTERACTION

2.4.1 Psychological Effects of Biophilic Design on Humans

Biophilic design is a process that seeks to create environments that reflect mankind's inherent love for the natural world. This design process has gained particular prominence in urban areas where human-made buildings and infrastructure have a tendency to disconnect humans from natural elements. Current research in environmental psychology, neuroscience, and design practice underscores the positive psychological impact of biophilic design on human well-being and happiness (Kaplan & Kaplan, 1989; Ulrich, 1991; Kellert, 2008). Benefits accrued span a variety of dimensions that include alleviation of symptoms linked to attention-deficit/hyperactivity disorder (ADHD), facilitation of perceptual relaxation, and facilitation of cognitive renewal. Research findings linked to children and adolescent studies indicate that exposure to nature increases attention capacity and diminishes hyperactivity (Taylor & Kuo, 2009; Berman, Jonides & Kaplan, 2008). The Attention Restoration Theory (ART) developed by Kaplan (1995) suggests that natural environments can restore directed attention and hence avoid mental fatigue and enhance cognitive functioning. ART theory holds that natural elements reduce mental fatigue and enhance a person's ability for attention. Evidence suggests that people with ADHD show better attentional abilities in settings with high levels of biophilic elements, implying that these environments play a role in modulating hyperactive behaviors. Compared to children who live in urban areas with sparse green spaces, those who play in parks, gardens, or nature-infused playgrounds have lower levels of ADHD symptoms (Faber Taylor & Kuo, 2011). In academic environments, the incorporation of biophilic features, including natural light, indoor plants, water installations, wooden materials, and organic shapes, has been demonstrated to enhance academic outcomes while simultaneously lowering stress levels (Barrett et al., 2015; Klatte, Lachmann & Meis, 2010). Furthermore, the cognitive advantages associated with biophilic design extend beyond just educational settings. In workplace settings, particularly in open-plan offices, incorporation of natural elements has been linked to better attentional abilities and decreased cognitive fatigue (Browning, Ryan & Clancy, 2014). These findings highlight the extended societal benefit of applying biophilic design principles, which encompass not only individual health but also public health and productivity. Along with alleviating Attention

Deficit Hyperactivity Disorder (ADHD)-related symptoms, a basic psychological benefit of biophilic environments is that they assist in promoting perceptual relaxation and mental restoration. Prolonged stays within highly concentrated built settings can result in increased cognitive demands, higher stress levels, and elevated mental fatigue (Ulrich, 1991). The use of natural elements with biophilic design promotes peace and balance by minimizing the secretion of stress hormones and improving psychological resilience (Van den Berg, Hartig & Staats, 2007). Empirical research has also established that individuals who are put in environments with abundant nature have lower cortisol levels, slower heart rates, and better general mood states (Ulrich et al., 1991). The neurobiological underpinnings of perceptual relaxation elucidate that natural stimuli directly influence brain regions, including the limbic system and prefrontal cortex (Berto, 2014). More precisely, exposure to natural settings has been found to calm the amygdala, the primary brain region for emotional processing, and even activate the parasympathetic nervous system (Ulrich, 1984). The implications of such effects are that they increase the state of mental relaxation, dampen stress responses, and enable regulation of cognitive processes. The positive impact of biophilic design is particularly significant to professionals in the workforce. Contemporary workplaces, typically characterized by demanding pressures and persistent digital distractions, can quickly drain cognitive resources and result in diminished attention span (Kaplan & Berman, 2010). However, even brief interactions with nature have been proven to replenish cognitive resources and increase attentional capacity (Berman, Jonides & Kaplan, 2008). As a result, incorporating biophilic features into open-plan offices and shared areas may augment mental restoration and general productivity (Browning, Ryan & Clancy, 2014). In conclusion, biophilic design illustrates a wide array of psychological advantages, such as attenuating ADHD symptoms, offering perceptual comfort, and supporting cognitive restoration. Within the backdrop of accelerating urbanization, integrating biophilic design in buildings is both experimentally tested and pinpointed as a key strategy for bolstering psychological well-being. Research consistently shows that environments that are aligned with nature not only enhance the well-being of occupants but also play a significant role in promoting social welfare in general. Thus, incorporation of biophilic design into urban planning and architectural practice should be recognized as a sustainable and human-centered approach to improving life quality.

2.4.2 Physical Health Effects of Biophilic Design

Biophilic design also affects not just the brain, but the physical body in immediate ways that benefit human well-being. Bringing nature elements into environments tends to reduce stress, moderate blood pressure, and encourage movement towards well-being. Numerous studies illustrate how environments with nature decrease cortisol and stabilize the autonomic nervous system (Ulrich et al., 1991; Van den Berg, Hartig & Staats, 2007). Natural settings trigger the parasympathetic nervous system, inducing relaxation and minimizing cardiovascular stress-related illnesses, including hypertension (Ulrich, 1984). In a seminal research study conducted in Japan, Park et al. (2010) examined the beneficial effects of forest bathing (Shinrin-Yoku) and noted significant decreases in heart rate and blood pressure and enhancement in immune function. A study by Kaplan and Kaplan (1989) showed that individuals who spend more time outdoors are less stressed. Contemporary urban settings prioritize the construction of buildings and indoor areas, thereby alienating inhabitants from the natural world. Such alienation enhances exposure to chronic stressors, which generates persistently high cortisol levels capable of causing hypertension, immune system suppression, and metabolic disorders in the long run (Hartig et al., 2003). By integrating spatially and functionally into the built environment, biophilic design provides a way to reverse these stressors and facilitate both physical and mental well-being. One of the major physical benefits of biophilic environments is that they make people move more and sit less. Parks, green spaces, walking paths, and nature reserves promote physical activity (Pretty et al., 2005). World Health Organization (WHO, 2016) says that green spaces in urban areas facilitate walking, running, and cycling, which greatly reduces the risk of cardiovascular diseases. Studies in children and youth show that an upbringing in areas with lots of nature encourages a more active life and the development of motor function at an early age (Fjørtoft, 2004). In adults, living near nature reinforces healthy mental and bone and muscle health (Maas et al., 2006). Urban United States and European surveys consistently show that residents of greener neighborhoods have less obesity, whereas sedentary habits are common among residents of neighborhoods with no open space availability (Mitchell & Popham, 2008). Exercise in nature-rich settings is linked to better heart health and better mental health, which is responsible for lower depression and anxiety rates (Nisbet, Zelenski & Murphy, 2011). Car-centered urban planning and indoor, sedentary living can harm public

health. However, biophilic design resolves such problems by creating walkable settings, green trails, and green leisure spaces that involve nature (Barton & Pretty, 2010). Urban parks, tree-lined walks, and recreational areas alongside water bring people into nature and get them moving, which reduces the risk of metabolic disease. Overall, the health benefits of biophilic design are many. By lowering stress, enhancing cardiovascular well-being, and encouraging exercise, it helps to improve long-term health. In urbanizing populations, the application of biophilic design is not just a personal health intervention but also a fundamental component of public health policy. Green infrastructure expansion, integrating buildings into nature, and applying biophilic principles to spatial planning are essential steps toward constructing healthier and more sustainable cities.

2.5 BIOPHILIC DESIGN AND STRESS REDUCTION: THEORETICAL MODELS AND APPROACHES

2.5.1 Kaplan and Kaplan's Attention Restoration Theory

As outlined in previous sections, biophilic design refers to the integration of natural elements into the built environment in order to promote human health and well-being. Within this framework, several theoretical models have been developed to explain the role of biophilic design in stress reduction. One of the most influential of these is the Attention Restoration Theory (ART), proposed by Kaplan and Kaplan (1989). According to ART, interaction with nature has the capacity to reduce cognitive fatigue and restore attention. In everyday life, individuals are exposed to continuous mental demands, which can deplete their voluntary attention resources and result in reduced cognitive performance. However, exposure to natural environments facilitates involuntary attention, thereby allowing cognitive renewal (Kaplan & Kaplan, 1989). Kaplan and Kaplan's model identifies four key components that explain nature's restorative potential: Being Away, which allows individuals to mentally detach from the stresses and demands of daily life, thereby helping them to regain mental energy; Extent, referring to the perceived coherence and richness of natural settings, which fosters a sense of connection with the environment; Soft Fascination, where natural elements such as flowing water, rustling leaves, and birdsong gently capture attention without requiring cognitive effort; and Compatibility, describing the alignment between the natural setting and an individual's internal goals and motivations, thereby enhancing mental and

physical relaxation. The positive influence of natural environments on cognitive processes has been supported by numerous experimental studies. In a study conducted by Berman, Jonides, and Kaplan (2008), participants who spent time in natural settings demonstrated significantly higher performance on cognitive tests compared to those who spent time in urban environments. This result has strong evidence demonstrating that nature-based activities permit the restoration of attention. In the same way, research by Ulrich et al. (1991) demonstrated that exposure to natural environments decreased stress levels and manifested beneficial effects on physiological responses. Individuals positioned in areas with natural landscapes showed decreased heart rates and blood pressure upon exposure to stimuli that induced stress. The evidence suggests that biophilic design elements not only improve cognitive functioning but also improve physical health. The restorative quality of natural stimuli and the cognitive improvements associated with natural environments make a strong case for the use of biophilic principles in urban design. As such, the use of biophilic design may prove to be fundamental in advancing both cognitive and mental well-being for individuals in built environments.

2.5.2 Ulrich's Stress Reduction Theory and the Influence of Biophilic Design on User Preferences

The effect of natural settings on physiological and psychological well-being has been investigated under various scientific paradigms, although Ulrich's Stress Reduction Theory (SRT) has been the most predominant theory in this context. Visual contact with natural environments activates positive emotional states, according to this theory, and is helpful for the alleviation of stress on both physiological and psychological levels (Ulrich, 1983). Empirical studies have shown that exposure to natural environments decreases stress and increases physical relaxation. In a seminal study, Ulrich (1984) discovered that hospital patients who had a view of natural landscapes from their windows recovered more quickly and took less pain medication compared to patients whose windows faced a brick wall. Subsequent research has demonstrated that individuals who are put in rooms that have natural elements in them have lower heart rates and blood pressure than individuals who are put in rooms with artificial surroundings (Ulrich et al., 1991). Being exposed to nature reduces stress and, concurrently, improves cognitive rejuvenation. Kaplan and Kaplan's (1989) Attention Restoration Theory (ART) also makes the same argument, asserting that

experience of natural settings decreases mental fatigue and a better emotional balance is achieved. Biophilic design appears to be an effective mediator in mitigating urban stressors in this context. Healthcare facilities and clinical areas are particularly crucial environments, with significant influence over the physical and psychological well-being of users. Research has established that the incorporation of biophilic elements in hospitals and healthcare facilities can be used to speed up patient recovery and minimize stress levels experienced by healthcare professionals (Pati et al., 2008). Therefore, the application of biophilic design principles not only improves experiential and aesthetic value but also exhibits quantifiable effect on health-related outcomes and user satisfaction.

2.6 USE OF BIOPHILIC DESIGN IN PUBLIC SPACES

2.6.1 The Role of Natural Elements in Public Spaces

Integration of biophilic design in urban spaces deepens humans' connection with nature, leading to beneficial effects on physical and psychological well-being. Research shows that natural features incorporated in public areas enable the reduction of stress levels, foster social interaction, and improve urban sustainability (Beatley, 2011; Browning, Ryan & Clancy, 2014). Urban environments that are complemented by nature encourage outdoor activity among people and foster collective experiences that enhance social bonding (Kuo, 2015). This is especially important in places undergoing rapid urbanization, where access to nature is limited; public spaces created in line with biophilic design principles offer essential channels through which people can maintain their psychological and physical well-being (Ulrich, 1984). The implementation of biophilic design in public areas typically manifests itself in the shape of introducing natural elements into public spaces such as parks, plazas, and sidewalks. Among all public areas in the city, parks are the locations where biophilic elements are most visibly expressed. The presence of tree structures, vegetation, water features, and aesthetics of natural scenery in park settings is responsible for improved mental health and provides an ideal atmosphere for social interactions (Van den Berg, Hartig & Staats, 2007). Ulrich's (1984) Stress Reduction Theory explains that viewing natural environments can result in the reduction of cortisol levels and the triggering of the parasympathetic nervous system, which finally results in relaxation. Likewise, the Attention Restoration Theory by Kaplan and Kaplan (1989) argues that exposure to natural areas

suppresses cognitive fatigue and enhances mental functioning. The design of the urban environment, including squares and walkways bordered with natural elements, is accountable for promoting social interaction within urban spaces. Tree-lined walkways are a critical component of biophilic design that promotes engagement in physical activity in urban spaces (Maas et al., 2006). The World Health Organization (WHO, 2016) explains that walkable cities increase the adoption of physical activity and deter sedentary lifestyles.

An example of such biophilic design being implemented on urban sidewalks is the Cheonggyecheon restoration project in Seoul. Once hidden underground and reused as a road in the 1970s, the space was revamped in the 2000s using biophilic design principles that incorporated water features and spaces landscaped with greenery. Follow-up studies showed air quality improvement, increased commercial activity to the benefit of the surrounding business community, and positive effects on psychological well-being (Lee & Maheswaran, 2011). One other notable public use of biophilic design is the institution of community gardens. Aside from facilitating contact with nature, gardens are also spaces for social encounters and the facilitation of an overall sense of community among citizens (Glover, Shinew & Parry, 2005). Okvat and Zautra (2011) further contended that gardens enhance the density of social networks among urban residents and heighten individuals' sensitivity to environmental issues. The Prinzessinnengarten project, launched in 2009 in Berlin, is a very good illustration of biophilic design with a community focus. Developed from abandoned urban spaces as a participatory project for city transformation, the program enables the locals to engage in sustainable gardening practices and develop ecological consciousness within the city (Tidball & Krasny, 2007). Likewise, New York GreenThumb community gardens bring a twofold benefit of enhancing access to natural environments and promoting food security for urban residents (Schukoske, 2000). Community gardens in urban spatial planning have both physical and psychological health benefits as well as positive effects on urban ecosystem balance. Kuo (2015) emphasizes the role of urban green areas and community gardens in urban biodiversity conservation, air quality improvement, and mitigation of the urban heat island effect. In summary, the application of biophilic design in public areas in a strategic way improves the human-nature relationship and contributes to healthier and more sustainable urban environments. By embracing natural scenery, parks, squares, pathways, and community gardens contribute to human well-being and

environmental sustainability of urban areas. According to hypotheses formulated by Ulrich (1984) and Kaplan and Kaplan (1989), recent research shows the ability of public areas with nature to mitigate stress and strengthen social cohesion. Thus, incorporation of biophilic design principles into urban design is one such promising strategy in achieving healthy and sustainable future cities.

2.6.2 User Preferences and Biophilic Elements

The perception of biophilic design in urban areas and its effect on user satisfaction is relative to the demographic characteristics, spatial experience, and cultural background of individuals. Foremost variables that dictate user preference are age, gender, socio-economic status, education level, occupation type, and lifestyle (Kellert, 2005). These variables directly affect the utilization and interpretation of biophilic elements in public areas (Hartig et al., 2014). Research has demonstrated that individuals residing in the cities with greenery report greater life satisfaction and lower levels of depression (White, Alcock, Wheeler, & Depledge, 2013). Especially in the contemporary cities of rapid urbanization, where the presence of nature settings is decreasing, biophilic design is instrumental in reinstating individuals' connection with their environment (Beatley, 2016). In addition to enhancing the physical environment, the integration of biophilic elements also helps to promote psychological, physiological, and social wellness among users (Ulrich, 1993; Kaplan & Kaplan, 1989). Demographic variability must be taken into account to understand the variations in the influence of biophilic elements among users. Literature that targets individual age groups identifies differences in user perceptions of spaces with biophilic elements within different age groups. Children are likely to prefer areas that allow direct contact with nature, whereas young adults are attracted to areas that allow physical activity and social interaction. Older adults, on the other hand, are likely to be attracted to calm, quiet, and readily accessible natural environments (Chawla, 2015). As indicated by Kaplan and Kaplan's (1989) Attention Restoration Theory, contact with nature is likely to act against mental fatigue and promotes cognitive restoration. Biophilic design impacts on user satisfaction extend beyond age differences. Gender research indicates that women and men perceive biophilic space differently, therefore differing spatial preference (Jiang, Larsen & Sullivan, 2016). Female users are more drawn to biophilic space that is safe, open, and well-lit, whereas male users prefer environments that facilitate sport and recreational activities

(Van den Berg et al., 2010). Research also validates that immediate contact with nature positively impacts the spatial experience of users. Design parameters like the extent of green spaces, diversity of plant life, presence of water bodies, utilization of natural light, and spatial layout significantly contribute to the increase in the time spent by users in a space as well as general satisfaction levels (Browning, Ryan & Clancy, 2014). As Ulrich (1984) demonstrated, bringing water elements into urban landscapes leads to reduced stress levels along with an improvement in psychological well-being. Similarly, patients report greater satisfaction levels for spaces with high amounts of natural light, thereby indicating their desire for spaces based on longer use (Gillis & Gatersleben, 2015). However, to realize the complete potential of biophilic design, it is essential to consider aspects like maintenance and safety of users (Maas et al., 2009). Studies have shown that poorly maintained and disorganized green areas are often perceived as dangerous, and the areas end up being abandoned by the users in the long run (Van den Berg et al., 2010). A Dutch survey indicated that, if well-planned and properly maintained, biophilic spaces greatly enhance user satisfaction, and neglected ones are avoided to a similar degree (Hartig et al., 2014). Cultural factors also play a significant role in defining biophilic spaces and in user preference. Biophilic design tends to emphasize individual interaction in Western societies, while Eastern cultures tend to prefer community-oriented social interaction (Beatley, 2011). A Japanese study discloses that nature-integrated environments such as traditional Zen gardens foster mindfulness and internal peace. In European cities, however, natural elements of public spaces tend to be linked with recreational purposes (Kaplan, 2001). Therefore, biophilic design needs to be contextualized within its own culture and designed to serve the interests of its intended user group (Jiang, Larsen & Sullivan, 2016). Lastly, the success of biophilic design in urban areas relies on demographic conditions and users' spatial needs. In order to promote user satisfaction, spatial design ought to embrace such factors as adequate greenery, water features, plant richness, natural light, and accessibility (Browning, Ryan & Clancy, 2014). Harmonization of biophilic design with user preferences in urban design is needed to facilitate the creation of more human-centered and healthier urban areas.

3. BIOPHILIC DESIGN IN THE CONTEXT OF URBAN SPACE AND USER EXPERIENCE

3.1 URBANIZATION AND DISCONNECTION FROM NATURE

The rapid rate of urbanization and the ongoing substitution of natural habitats with constructed buildings have drastically undermined people's link to nature. Particularly since the Industrial Revolution, the table below (Table 3.1) shows the process of urbanization has radically changed the physical and societal aspects of human settlements. Large-scale movement from rural to urban regions, quick population expansion, and extensive building construction have greatly restricted access to nature. This transformation has significantly impacted the physical, psychological, and social health of urban citizens (Ulrich, 1984; Kaplan & Kaplan, 1989). A significant portion of urban inhabitants now live increasingly separated lives from nature because of extensive urbanization and the destruction of green spaces in the environment. The pace of urbanization has diminished opportunities for contact with natural settings, thus increasing individuals' exposure to modern life stresses. This is consistent with increased levels of stress, decreased attention spans, and general decrease in the quality of life (Kellert, Heerwagen & Mador, 2008; Browning, Ryan & Clancy, 2014). Moreover, the fast urbanization of cities has seen children maturing in settings that lack natural stimuli, which has been connected with the rise of mental disorders, including attention disorders. Similarly, adults, equally deprived of the calming and restorative effects of nature, endure immense stress from their work and city lives. Many studies have outlined the positive impacts of nature on human well-being. Nature's capacity to alleviate mental fatigue and stress is essential in promoting quality of life in general (Wilson, 1984; Ulrich et al., 1991). In addition, nature contact not only promotes individual well-being but also the quality of social interaction and cohesion. In these regards, diminished nature access as a result of urbanization adversely affects not only people's health but also communities' capacities to recuperate from adversity and social organization. Biophilic design has become a vital architectural theory for restoring disrupted connections between natural and built environments. The method seeks to improve the sensory and cognitive connection of individuals with their environment through incorporating natural elements into urban areas, either directly or indirectly. With this approach, biophilic design improves both functional

properties and beauty of environments, thereby enabling urban residents to reconnect with nature and promote general health and well-being (Kellert & Calabrese, 2015, p. 19). Biophilic design plays a critical role in alleviating the adverse consequences linked to urbanization. Public open spaces are vital spatial interfaces that allow people to momentarily get away from the pressures of daily life and re-associate with the natural world. Contact with nature alleviates mental fatigue, improves concentration, and creates more positive spatial experiences, as has been shown through the work of Kaplan and Kaplan (1989). The intentional integration of biophilic design elements in these spaces increases the spatial quality for users, resulting in spaces that are notably more calming, restorative, and social. As the relentless forces of urbanization and disconnection from natural environments continue to define our lives, the importance of public spaces, like Maçka Park, continues to increase. These parks offer city dwellers a valuable chance to re-engage with nature in the midst of the dynamics and stresses typical of urban life. The thoughtful integration of biophilic design principles in such spaces is an effective strategy to promote physical, psychological, and social well-being of occupants. Areas that utilize natural light well, have lots of plants, and include soothing water features are likely to be popular with individuals (Browning et al., 2014). In this scenario, as urbanization ever more entails a disconnection from the natural world, the solutions offered by biophilic design are becoming crucial to making urban living sustainable. By facilitating a reconnection between people and nature in highly populated city contexts, biophilic design supports not just individual well-being but also reinforces broader ecological and social resilience.

Table 3.1: Number of Cities in Turkey between 1927 and 2000 through TÜİK Data (Prepared by the Author).

Year	Urban Population	Rate (%)	Rural Population	Rate (%)	Total Population	Population Growth Rate (%)
1927	3.305.879	24.22	10.342.391	75.78	13.648.270	---
1935	3.802.642	23.53	12.355.376	76.47	16.158.018	2.13
1940	4.346.249	24.39	13.474.701	75.61	17.820.950	1.98

Table 3.1: Number of Cities in Turkey between 1927 and 2000 through TÜİK Data (Prepared by the Author) (Table Continued).

1945	4.687.102	24.94	14.103.072	75.06	18.790.174	1.06
1950	5.244.337	25.04	15.702.851	75.96	20.947.188	2.20
1955	6.927.343	28.79	17.137.420	71.21	24.064.763	2.78
1960	8.859.731	31.92	18.895.089	68.08	27.754.820	2.85
1965	10.805.817	34.42	20.585.604	65.58	31.391.421	2.46
1970	13.691.101	38.45	21.914.075	61.55	35.605.176	2.52
1975	16.869.068	41.81	23.478.651	58.19	40.347.719	2.50
1980	19.645.007	43.91	25.091.950	56.09	44.736.957	2.07
1985	26.865.757	53.03	23.798.701	46.97	50.664.458	2.49
1990	33.326.251	59.01	23.146.684	40.99	56.473.035	2.17
2000	44.006.274	64.90	23.797.653	35.10	67.803.927	1.83

3.2 THE IMPORTANCE OF INTEGRATING NATURE INTO MODERN URBAN LIFE

Biophilic design is defined as a design philosophy whose aim is to restore the natural biological and psychological connection between human beings and nature in constructed environments. Biophilic design relies on the biophilia hypothesis proposed by Edward O. Wilson in his book, *Biophilia* (1984). Wilson presumed that the connection between human beings and nature constitutes an evolutionary necessity embedded in the psychological and physiological structure of humans. Based on this hypothesis, the concept of biophilic design

tends to enhance human well-being through the integration of natural elements within architectural and spatial designs. The history of biophilic design is based on the enduring connection between humankind and nature, which consequently influences urban and architectural design. Stephen Kellert took this idea to the next level by delineating biophilic design as a scientifically based theory in architecture and urban planning, reformulating the human-nature interface in the physical environment. Kellert's version of biophilic design endeavors to revive the innate human relationship with nature mainly on the basis of empirical findings. The theoretical background of biophilic design is established upon various factors influencing human behavior. The concepts articulated by Kellert and Calabrese provide an understanding of how the environment can influence individual satisfaction and overall well-being. Among these principles, special emphasis is placed on the emphasis on organic patterns and shapes, the design of complex spatial configurations, and the abundant utilization of natural materials in interior environments. The incorporation of natural light and water features seems to be a critical element that supports the psychological restorative gains associated with biophilic design. Rachel and Stephen Kaplan's Attention Restoration Theory (ART) offers a strong theoretical framework for describing the cognitive advantages that biophilic design accrues. According to ART, natural environment experiences curtail mental fatigue and restore the capacity for attention. Similarly, Roger Ulrich's work has demonstrated the mitigation of stress brought about by biophilic elements and the ways nature-inspired designs advance general human well-being. Contemporary uses of biophilic design have been shaped by the theoretical investigations pursued by pioneer thinkers like Edward O. Wilson and Stephen Kellert. While Wilson has focused on the importance of bringing nature into human life through a focus on biological necessities, Kellert evolved biophilic design as an applied theory pertaining to architecture and urban design. The Kaplans' research, which is grounded in psychological theory, provides scientific validity to the positive effects of biophilic design on human well-being, while Ulrich's stress reduction theory explains the physiological advantages of this system. By restoring nature to everyday environments, biophilic design is a critical antidote to the disorienting effects of modern urban life. It also plays an important role in the aesthetic and functional improvement of cities.

3.3 BIOPHILIC DESIGN APPLICATIONS IN PUBLIC SPACES

Biophilic design approaches to public places intend to promote physical and psychological comfort of individuals through enabling the repair of connections between city residents and elements of nature. Application of biophilic design in cities enables individuals to connect with nature settings while they perform their everyday activities, and as such, it alleviates some negative effects of urbanization on the environment (Browning, Ryan, & Clancy, 2014). This approach goes beyond simple aesthetic preference and serves as a strategic method of creating a sense of comfort and tranquility through the user's interaction with their surroundings (Kellert, Heerwagen, & Mador, 2008). Biophilic projects in public spaces typically include methods like expanding vegetation areas, incorporating natural materials, adding aquatic features, and maximizing access to natural light. Kellert et al. (2008) highlight the necessity to facilitate visual and sensory links with natural components in the implementation of biophilic design in public areas. The enhancement of vegetation, incorporation of plants in urban areas, and inclusion of features such as water assist in enhancing the bond between humans and nature, alleviating stress, and supporting overall well-being (Kaplan & Kaplan, 1989). Notably, areas adorned with plants and aesthetically pleasing water structures foster extended interaction with the surroundings. Ulrich (1984) argues that the representation of natural elements in urban environments increases people's liking for such areas, thus making them more attractive and frequently visited. Empirical research demonstrates that visual elements of nature integrated into urban parks, plazas, and pathways have a significant influence on users' perception, thereby increasing their desire to utilize the spaces for extended durations. Trees, as well as artificial lakes within city parks, are biophilic elements that provide room for nature experience within the inner city. Louv (2008) argues that the incorporation of biophilic elements in urban parks can help people deal with what he terms "nature-deficit disorder." In addition, one of the key elements of biophilic design in public places is the use of natural materials, which adds beauty to such settings and creates a perception of being surrounded by nature. The utilization of natural materials such as wood and stone encourages the perception of cozy and welcoming ambiance, thus fostering individuals' emotional attachment to the setting (Kellert, 2008). According to Browning et al. (2014), incorporating natural materials in design leads to increased comfort levels among occupants and strengthens their affection towards nature.

Such materials fulfill the desire for nature and enable emotional associations with the natural environment compared to artificial surfaces. Natural light access is one of the most important elements of biophilic design in public areas. Kellert and Calabrese (2015) emphasize daylight as a key need of biophilic design, citing its beneficial impacts on both physical health and psychological well-being. Empirical research has established that environments open to daylight promote a sense of energy and motivation and expand the duration individuals want to occupy these environments (Ulrich, 1993; Kaplan & Kaplan, 1989). Daylight, then, performs not just a functional role but also a role that addresses the psychological in biophilic design. Water elements are also integral to biophilic public space. Kaplan and Kaplan (1989) note that water has a calming effect and suggest that individuals often want to be near it. Besides their aesthetic appeal, water elements contribute to psychological restoration by reducing mental fatigue. The use of artificial ponds, fountains, and waterfalls in public areas promotes natural affiliation and enhances people's positive perceptions of the environment (Ulrich, 1984). The diffusion of biophilic design in public spaces is becoming a promising approach to mitigate the increasing separation from nature that is characteristic of urbanized societies, thereby helping to create more habitable urban spaces. Public spaces with biophilic design improve individuals' physical and psychological well-being by stimulating individuals' affiliation with nature and improving spatial interaction (Louv, 2008). Louv also refers to the long-term beneficial impacts of biophilic design in public spaces on children and adolescents, with an argument that exposure to nature in public spaces leads to mental health as well as physical growth. The Attention Restoration Theory (ART) by Kaplan and Kaplan in 1989 is centered on exposure to nature as being key to alleviating mental fatigue and recovering attentional resources. According to this theory, the time in nature reduces the demand for directed attention and enables the engagement in a passive mode of attention referred to as "soft fascination." The cognitive shift offers cognitive recovery and psychological restoration. The key components of ART being away, soft fascination, extent, and compatibility are all closely associated with users' perceptions of biophilic elements in Maçka Park. Empirical studies show that the dense foliage, water features, and shade in the park are the key elements that provide relaxation from the stress of everyday life, thereby inducing a state of quietness and relaxation. Features such as the gentle, soothing quality of the sound of water and the foliage are inherently connected with the process of soft fascination, having gentle control over the users' attention and providing

the conditions necessary for the stress level to go down. Additionally, the exploratory nature of the walking tracks in the park aligns with the notion of "extent" in ART, facilitating longer durations of stay and greater engagement with the nature. These findings validate the postulate that biophilic design not only enhances the aesthetic value of space but also supports mental wellbeing through being embedded in public places. On the other hand, Jan Gehl's Placemaking theory (Gehl, 2010) is a design model for public spaces that places human needs at the forefront. This theoretical perspective aims to create public spaces that are responsive to the social, cultural, and physical needs of people. Additionally, the theory focuses on changing public spaces from being just transit zones to places that facilitate positive social interactions in a way that guarantees comfort as well as security. Jan Gehl is a well-known Placemaking expert whose academic work established a theoretical foundation highlighting the importance of design principles that take human-scale into consideration first. His research focuses on the significance of developing spatial intervention that appeals to the habit and needs of ordinary people, considering it as a fundamental aspect in promoting urban life. One of the primary objectives of Placemaking is to draw individuals to public places by making their time spent there more valuable. Through observation and detailed study of how individuals use urban spaces, Gehl has pointed out that good public spaces foster social interaction, facilitate movement, and improve the quality of life of individuals. The evidence presented demonstrates a close connection between Placemaking and biophilic design. Incorporating natural elements in various environments using biophilic design significantly improves the users' experience. Placemaking, on the other hand, makes sure that these elements are organized in such a way that they meet the physical and social demands of the individuals. Gehl's "human scale" principle offers a basic framework for grasping the relevance of biophilic design in spatial planning. For example, Gehl has explained that pedestrianized streets, shared seating areas, and aesthetically pleasing qualities draw individuals to a place. In that case, biophilic design possesses the ability to form settings that address users' psychological and physiological requirements by incorporating natural elements. Factors such as flora, water bodies, and organic matters lend a feeling of ease and beauty to people towards nature. For instance, results of Gehl's studies on human behavior indicate that biophilic elements enhance individuals' social interactions and their bonding to a space. A prominent intersection between Placemaking and biophilic design exists in design features that invite individuals' longer stays in public spaces. Gehl's

research indicates that passive uses like sitting, resting, and observing are more common in areas with natural elements. The principles of biophilic design, helped by Kaplan and Kaplan's Attention Restoration Theory, constitute an effective approach to the enhancement of Placemaking processes. When applied in both aesthetically and functionally appropriate manners with landscape and water elements, it helps to bring about both the sense of calmness and a sense of attachment to place. Gehl recommends that the spatial design must not only be led by aesthetic values but also be augmented with functional elements that enhance individuals' everyday life experience. In this regard, biophilic design overlaps with Gehl's Placemaking principles, thereby facilitating individuals' and collective use of spaces. Such spaces, which are well integrated with nature, cater to not only physical but also psychological and social needs. When Gehl's design principles emphasizing the "quality of social spaces" are combined with biophilic design, a spatial design vision is established that is human-centered in nature. When combined, Placemaking and biophilic design enable the making of urban spaces that are both aesthetically and functionally rich and also foster a stronger sense of place attachment in individuals.

Table 3.2: Researchers Contributing to the Literature and Their Perspectives (Prepared by the Author).

Kaplan & Kaplan	Louv	Gifford	Ulrich	Lewicka
Natural environments are important for people to relax and focus.	For children, spending time in nature is critical for their physical and psychological development.	Environments affect people's psychological states and reduce their stress levels.	Natural light and views increase the positive effects on health in spatial design.	People establish bonds with places, giving them identity and emotional meaning.
Humans must understand and explore the environment, there must be a balance between predictability and exploration.	The weakening of people's ties with nature leads to psychological and physical problems.	Biophilic design relaxes people by including natural elements in the space.	Natural elements play a role in stress reduction and the healing process.	Places are perceived not only by their physical features but also by past experiences.
The visual variety of the environment attracts attention and encourages exploration.	Biophilic designs support the healthy development of children.	How people perceive and orient themselves in the environment depends on the intelligibility of space.	Using biophilic elements accelerates people's emotional healing.	Place dependence enables people to deepen their bond with space.

3.4 SPATIAL PERCEPTION AND USER PREFERENCES

Spatial perception deals with how people perceive and feel about the environment. Research has found that spatial perception affects how people feel about a place, their attachment to it, and their chances of choosing it (Canter, 1977). The fundamental components of spatial experience are sensory, cognitive, and affective relationships that individuals have with their surrounding environment. The interpretation of a certain space is a result of both its physical qualities inherent in it and personal experiences, needs, and social contact. Therefore, the inclusion of biophilic design features raises individuals' satisfaction and joy in these environments. An insight into the psychological processes that control our spatial experiences provides knowledge about the attraction individuals have for surroundings that contain natural elements. The "Attention Restoration Theory" (ART), formulated by Kaplan and Kaplan in 1989, contends that nature exposure enables the restoration of attention and lessens mental fatigue. The theory states that individuals who have more time in nature have a better ability to maintain attention for longer durations and also have lower stress levels. Kaplan and Kaplan (1989), in their research, affirm that settings containing biophilic components are more preferable since they are able to fulfill individuals' needs for cognitive restoration. In this context, public spaces with natural elements create a positive spatial image in people and enhance their appeal. In addition, Gifford (2007) also analyzed how spatial perception is understood through environmental psychology. In his view, feelings of relaxation, security, and privacy from biophilic elements affect the perception of individuals on spaces. Gifford (2007) also clarified that people will stay in places where they feel comfortable, secure, and private. The observation signifies that biophilic design can enhance people's attitudes toward spaces in urban public areas. Bringing natural elements into a space makes people feel relaxed, calm, and connected, which heightens what they like. In this way, the presence of natural elements changes the perception of people towards the space and their liking for it (Gifford, 2007). Previous experiences also significantly affect how people perceive space. Lewicka (2011) believes that individuals' concepts of space hold a strong connection to their life histories, which further influence them to like or dislike a place for such a personal background. For instance, individuals who have had contented childhoods in natural environments like outdoor areas. Lewicka's (2011) study results indicate that human beings possess the faculty to recall their positive experiences of nature in biophilic

environments with the intention of reconnecting with nature. The presence of biophilic elements in an environment makes users think of their memories of nature as children and shape their decision. Another major study on the influence of natural elements on the impression of an environment was carried out by Ulrich (1984). Ulrich described how individuals find areas with a high concentration of nature-inspired elements positively and are more positively disposed towards them. Especially in communal areas, the use of biophilic design gives the individuals a sense that they are placed in a natural setting, thereby optimizing their usage of these areas. Ulrich's research (1984) provides valuable insight into the ways that natural elements alter the perception of space by users through an examination of the impacts of nature on the human mind. The study asserts that the positive feelings from nature render a place more attractive and more likely to be chosen. Browning and others (2014) give a detailed look at how biophilic design elements allow people to experience public spaces in a better way. Their study suggests that viewing nature-like features fulfills people's nature need and makes them happier in such places. Browning et al. (2014) indicate that individuals perceive biophilic spaces to be more relaxed, desirable, and calming. This is due to the fact that biophilic design has a positive influence on individuals' perception of space, and incorporating such elements in public spaces makes individuals appreciate such places more. By this, biophilic design assists in individuals' perception of space through the re-establishment of individuals' connection to nature and the provision of psychological comfort. Locations that meet individuals' needs for nature enhance their interest and render such locations more attractive. Louv (2008) states that individuals who are disconnected from nature can be reunited with nature through locations that possess elements of nature. Louv (2008) further states that nature-friendly settings assist in the emotional growth of children and adolescents and enhance their positive emotions towards such locations. Biophilic design influences the way individuals perceive and feel about areas since it addresses their psychological, sensory, and social needs. This renders public spaces more appealing. If individuals experience positive emotions when they are in nature, they will tend to like such spaces and think well of them. Public areas that include elements of natural design are therapeutic to people's emotional and mental health, improving the manner in which they perceive space.

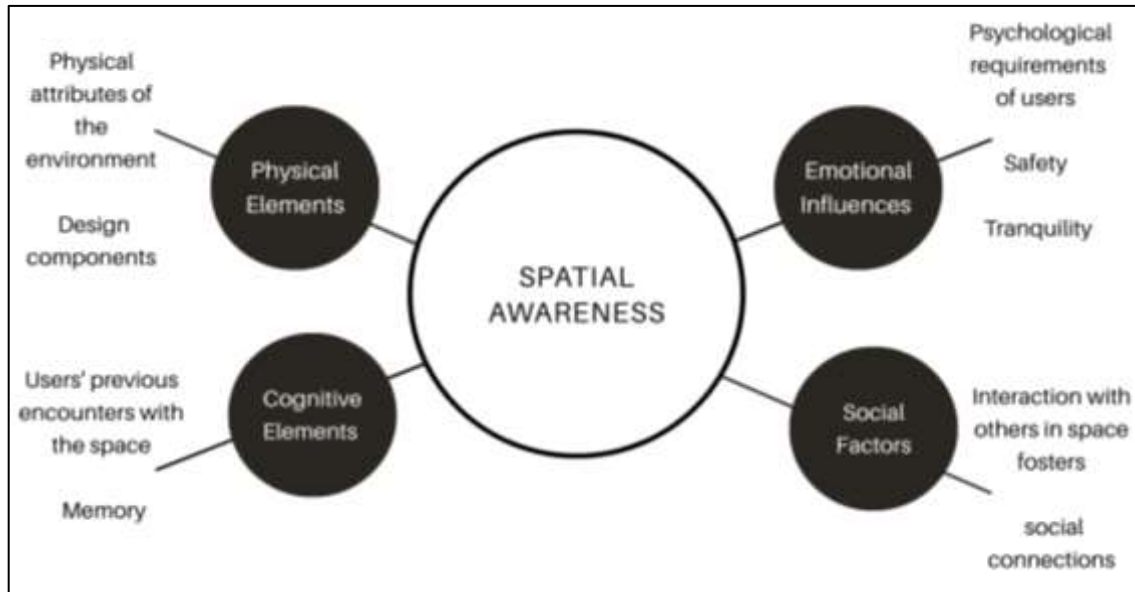


Figure 3.1: Spatial Perception Diagram (Prepared by the Author).

3.5 THE EFFECTS OF VISUALIZATION METHODS

Visualization techniques are powerful tools that have a direct influence on the perception of a space and the attitude that people develop towards it. Visualization techniques aim at visual perception by communicating the spatial qualities to users and thus establishing the first impressions of the space. Different scholars have highlighted visualization's role in the successful transmission of design ideas, inducing positive attitudes towards space, and positively affecting user decision-making (Lynch, 1960). Visualization tools allow people to perceive a space not just based on its physical attributes but on its ambiance as well. In this regard, combining biophilic design elements with visualization methods induces a more significant effect on users' perception of space. Lynch (1960), in his work on the influence of visualization on spatial perception, held that visual features accelerate users' recognition, remembering, and attachment to a place. His study indicated that certain spatial features in cities will more likely be recalled by users when emphasized through adequate visualization. This finding reveals that the support of biophilic design elements by visualization techniques helps to create more positive and long-lasting impressions of space. Proper visualization of natural elements within a space such as vegetation, water bodies, and natural light enhances users' sense of attraction and increases their preference for the space (Lynch, 1960). Another key research on the impact of visualization in terms of biophilic design elements was

conducted by Ulrich et al. (1991). Their research demonstrated that biophilic design elements facilitated through visualization techniques positively affected users' mental well-being. According to their study, the settings rich with natural elements and highlighted by application of visualization processes helped reduce stress levels among individuals as well as increase a feeling of well-being (Ulrich et al., 1991). The influential effect of visual elements increases people's perception of the presence of nature, making them more susceptible to choose such areas. Particularly in public areas, visualisation of biophilic elements increases the psychological relaxation brought about by the space, which makes the spaces more appealing to occupants. Kaplan and Kaplan (1989), in discussing the impacts of nature-themed elements on spatial perception, asserted that good visualisation of nature through different mechanisms reduces people's mental exhaustion. According to their "Attention Restoration Theory" (ART), visual representations of nature generate mental relaxation and increase the creation of positive spatial perceptions. Kaplans (1989) clarified that imagery of biophilic elements enables individuals to linger more in nature-related environments and increases their fascination with these environments. Visualization of natural elements maximizes the interaction with nature and positively influences the users' spatial preferences (Kaplan & Kaplan, 1989). The visualization techniques also improve the degree of aptitude of individuals in decoding biophilically designed public spaces and enable them to form positive emotional connections with these spaces. Browning et al. (2014) explained that visualization of biophilic design features improves the ability to convey the ambiance of a place. Biophilic environments presented through technologies like photography, virtual reality (VR), and augmented reality (AR) enhance the feeling of being present in nature, thus intensifying users' emotional connection with the environments. Browning et al. (2014) emphasized that the integration of biophilic design principles with good visualization strategies allows users to develop long-lasting, positive impressions of space. Specifically, virtual reality technology enables individuals to perceive biophilic spaces in a realistic manner, thus enhancing positive attitudes toward the space (Browning et al., 2014). The second key contribution of visualization is that it enables individuals to habituate to a space and form first impressions. For instance, Gillath and colleagues (2008) suggested that spatial features conveyed through visualization increase users' sense of belonging. Their findings stated that visualization of biophilic features generated initial emotional connection to a space, making it appear more attractive to the occupants. Gillath

et al. (2008) posit that when the natural aspects of an environment are properly visualized, they leave a positive mark on the occupants and make the space more attractive. Especially in urban areas, imagining nature-integrated public areas assists people in developing positive emotional attitudes towards them (Gillath et al., 2008). Last but not least, visualization techniques are a vital means of communicating the restorative qualities of biophilic design to final users. Louv (2008) believed that the absence of natural areas in life causes a situation called "nature-deficit disorder," which can be healed with the help of biophilic design. As indicated by Louv (2008), successful visualization of natural features negates the absence of access to nature and stimulates interest in biophilic spaces. Nature visualization produces psychological calm and adds to the beauty of the spaces. Visualization strategies in this context are critical tools that maximize the effect of biophilic design features on user perception. Through the visualization of biophilic elements with various visual technologies, users are encouraged to reconnect with nature, which also spatially beautifies such environments. Visualization of biophilic design is, therefore, a salient consideration that has beneficial effects on user preference in public spaces.

4. AN URBAN FIELD STUDY ON BIOPHILIC DESIGN ELEMENTS IN PUBLIC SPACES: THE CASE OF MAÇKA PARK

4.1 SAMPLE AND STUDY AREA: MAÇKA PARK

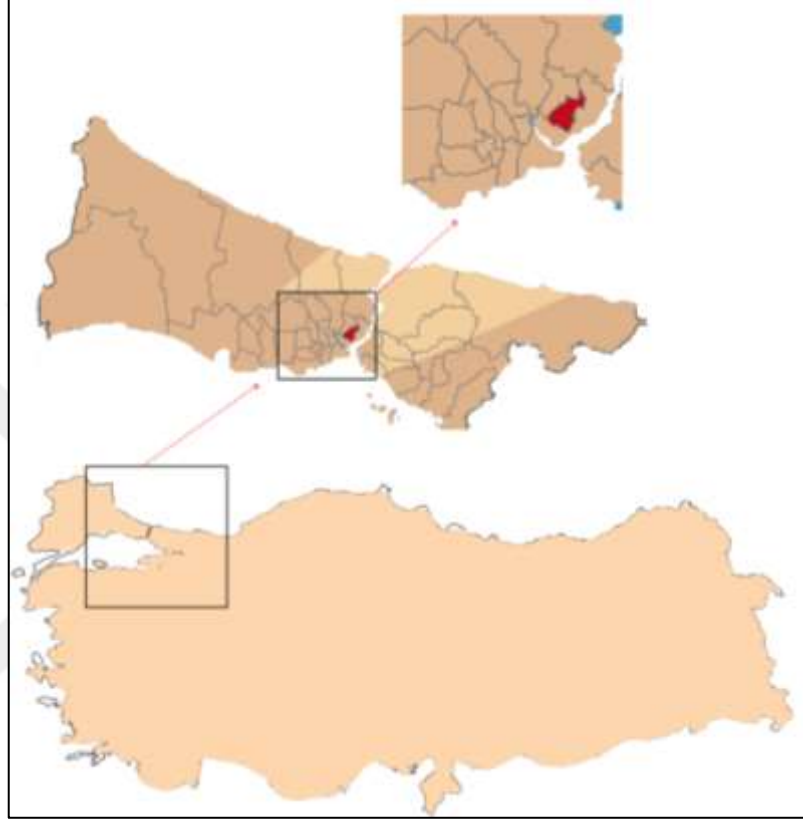


Figure 4.1: Location of Maçka Park (Prepared by the Author).

4.2 RATIONALE FOR CHOOSING MAÇKA PARK

Maçka Park, which is located at the neighborhood limits of Istanbul's Şişli district, holds importance due to its strategic proximity to the city center (Figure 4.1). The park is flanked by the Harbiye and Nişantaşı districts to the north, the Dolmabahçe coast and Beşiktaş to the south, Maçka to the east, and Cumhuriyet Avenue to the west. As a large green space inscribed within a highly urbanized tissue, it sustains public usage by way of landscape composition, pedestrian routes, and multi-purpose recreational spaces. Based on 2022 statistics from the Turkish Statistical Institute, the residential areas around Maçka Park have high population density, making the park an essential open green space for the locals in the

district. Maçka Park was selected as the research area because it is a well-known urban green area in the center of Istanbul. Among the city's rapid urbanization and concretization, green areas like Maçka Park are among the last few environments where urban citizens are able to interact with nature (Ergün, 2018). This setting offers a rare opportunity to investigate the extent of biophilic design elements and their influence on user preference. With its historic character and spatial diversity, Maçka Park accommodates a wide variety of user types. Situated near residential zones and social facilities, along with its central location, makes it a favorite everyday spot (Köksal & Yıldız, 2020). In addition, the incorporation of natural elements through intentional design features makes it an even more appropriate choice for assessing biophilic design principles. This choice is also supported by an increasing body of literature linking the heightened interest in urban park areas to environmental determinants. Researchers like Ward Thompson (2002) and Kaplan (1995) have stressed that urban green areas are key contributors to psychological, as well as physical, well-being. In this respect, Maçka Park is a paradigm case that illustrates the paramount significance of inner-city green areas in facilitating human access to nature.

4.3 GEOGRAPHICAL LOCATION AND ACCESSIBILITY

Maçka Democracy Park, on the European side of Istanbul, is under the administrative control of the Şişli district. It is flanked in the north by Nişantaşı; in the south, it is adjacent to the Dolmabahçe Valley; in the east, it overlooks Maçka Street; and in the west, it is adjacent to Harbiye, situating it in one of the most developed urban areas of the city. The geographical situation of the site matters because of its closeness to both historic urban centers and modern-day residential and commercial zones. The site is situated in a sloping valley, whose topography not only enhances the diversity of landscape architecture but also adds to the users' spatial experience. In terms of transport, Maçka Park is reachable through pedestrian paths as well as a host of public transportation means. The park can be reached from the northern Teşvikiye and Nişantaşı areas, and the southern Dolmabahçe and Beşiktaş districts. It is well connected via multiple transportation systems, such as metro lines, buses, and minibuses. Particularly, being in close walking proximity to the Osmanbey Metro Station improves its connectivity within the public transportation system of the city. In addition, the Maçka-Taşkışla cable car line is both an alternative transportation option and a visual landmark that contributes to the park's panorama value. The location of Maçka Park in

Istanbul's polycentric urban structure has enabled the park to attract not just near-district users but users from throughout the city. Its diverse interaction with the cultural, social, and economic fabric of Istanbul makes it not merely a space for recreation; rather, it is an active platform for public engagement and urban vitality.

4.4 SPATIAL FEATURES OF THE PARK AND USER PROFILES



Figure 4.2: Analysis Map of Maçka Park (Prepared by the Author).

Maçka Park is a public urban space with discrete spatial zones suited for active and passive uses. It has an area of approximately 156,000 square meters and contains walkways, children's playgrounds, outdoor exercise areas, seating and resting places, and lawn areas for various social activities. This spatial variety enables the park to accommodate various urban uses. There are at least five main entrance gates to the park: Nişantaşı Gate, İnönü Gate, Cemil Topuzlu Gate, Vodafone Park Gate, and Cable Car Bridge Gate. The crowd density is based on the population density of the surrounding area and the urban environment around

each gate. The flora within the park is a dense composition of indigenous and non-indigenous plant species, forming a natural environment while also facilitating the structural basis for biophilic design elements (Külçür, 2019). Further, the presence of water bodies distributed across the park adds to the visually appealing and serene environment. With these natural features incorporated through thoughtful design, they significantly contribute to users' affective and sensual connection with the space. Maçka Park is a meeting point for various social groups in Istanbul. The population of users consists of a broad spectrum, ranging from youth, families with kids, older individuals, and single visitors. Among the most active user groups are university students from the surrounding universities, working individuals, and recreational athletes. The presence of such demographic variety refers to the park's significance as an area for social integration and intergroup interaction. Satisfaction levels of users are determined by a number of factors, including cleanliness, safety, maintenance quality, and infrastructure. In a recent user survey, it was found that the presence of green areas and shaded spots is a determining factor in encouraging longer use of the park (Akpınar, A., 2024). The findings confirm that biophilic design features play a positive role in both the frequency of park usage and overall user satisfaction. Due to its spatial heterogeneity, incorporation of natural elements, and popularity among a broad group of users, Maçka Park is a model case for investigating biophilic design elements. Thus, it offers useful lessons on the implementation of biophilic principles in the urban green space development, design, and management.

4.5 HISTORICAL AND PHYSICAL CHARACTERISTICS OF MAÇKA PARK

Maçka Democracy Park is found in Istanbul's Şişli district, that is, within the Harbiye neighborhood borders. Since it is close to the Beşiktaş and Beyoğlu districts, the park is at the center of the city and readily accessible from the surrounding neighborhoods. Prompted by the growing need for green public areas in the late 19th century, Maçka Park plays an important role in the history and urban growth of Istanbul. The park's initial intent, along with the various functions it has assumed over its lifetime, demonstrates the change that occurred from the late Ottoman to Republican eras. The park was designed in 1936 by Henri Prost as a strategic move to utilize the valley between Taksim and Maçka. As part of Prost's design philosophy, a continuous green corridor was designed to connect Taksim Gezi Park, Maçka Democracy Park, and the Congress Valley (Bilsel & Pinon, 2010). In the 1990s, a

comprehensive revitalization project was carried out under the auspices of Istanbul Technical University academics, Prof. Dr. Hande Suher, Prof. Dr. Ayten Çetiner, Prof. Dr. Ahmet Yıldızcı, and Prof. Dr. Mehmet Ocakçı (Karakeçili, 2015). The park, together with the slope falling towards Taşkışla on Kadırgalar Avenue, is owned by the Istanbul Metropolitan Municipality. In 1990, the park was given the name "Democracy Park" by the mayor at that time, Nurettin Sözen (Suher, 1993). This was aimed at highlighting the function of the park as a platform for enhancing social cohesion and civic participation. In pursuit of this, some public events and social facilities were organized to facilitate the integration of newcomers to the city and peaceful coexistence of various social groups (Suher & Ocakçı, 1997). One of the key objectives while designing the park was to establish the physical and intellectual growth of the city. Maçka Democracy Park not only provides a place for recreation and recuperation, but at the same time, it is also a place for cultural and social activities, thereby contributing to the cultural dynamics of Istanbul (Suher, 1993). The area where the park is located has a historical heritage that dates back to the Ottoman Empire. In the 19th century, efforts were made to create public areas and parks influenced by Western styles across Istanbul. Due to the Tanzimat reforms, public areas began to be identified as crucial components of modern urban planning (Gül, 2009). Driven by Western precedent, the Tanzimat era promoted the establishment of public areas for social and cultural interaction. In the early Republican era, especially in the 1930s, there was an intense preoccupation with the establishment of parks and public squares under Mustafa Kemal Atatürk's leadership. Such green areas were intended to fulfill the recreational and leisure needs of citizens (Yavuz, 2015). In the context of this larger urban change, Maçka Park was designed as a green infrastructure to address the increasing public need for accessible natural areas. The aesthetic and functional aspects of the park have developed alongside Istanbul's urban growth over time. The physical design of the park is influenced by the topography and urban texture of the city. It has a rich variety of vegetation and natural landscape features. The use of biophilic design principles can easily be seen in the landscape of Maçka Park, suggesting an intentional move towards incorporating natural elements into the urban landscape. For Kellert (2008), "Biophilic design reflects the human desire to be close to nature by increasing the presence of natural elements in architecture and urban design." In the case of Maçka Park, this approach is manifested through the lush tree cover, diverse plant life, and overall naturalistic layout. The park spans large areas of grass, walking trails, ponds,

and elements that promote biodiversity. This aligns with the fundamental biophilic concept of "access to nature." The landscape design of the park incorporates walking trails, seating places, playgrounds, and sports facilities, thereby providing a dynamic setting appropriate for recreation and relaxation. These elements have been deliberately crafted to augment users' experience, promote physical activity, and provide contact with nature. Mature trees create shaded areas, raising visitor comfort and catering to both the physical and psychological well-being that pertains to biophilic design objectives (Kaplan & Kaplan, 1989). Ecologically, Maçka Park enhances air quality, mitigates urban heat, and supports habitat for a broad range of animal species. Acting as a green oasis in one of Istanbul's highly urbanized and vibrant quarters, there is a need to maintain the city's ecological balance, aligned with biophilic design principles. According to Beatley (2011), "Urban green spaces play a critical role in preserving biodiversity and maintaining ecosystem stability." In addition, Maçka Park is a sociocultural interaction point. It contains various social, cultural, and recreational activities, thus providing interactions among various sections of society. Public spaces are said to promote social interaction and create a sense of community (Whyte, 1980). The park provides various activities that can be enjoyed by all ages, thus ensuring that the user engages with nature and enjoys the health-enabling features of outdoor settings. Cumulatively, the physical and historical characteristics of Maçka Park, when assessed on biophilic terms, demonstrate its worth as a social and ecological resource in Istanbul's urban landscape.

4.6 BIOPHILIC DESIGN ELEMENTS OF THE PARK

Biophilic design is an approach that enhances the human-nature connection by integrating natural elements into urban and public environments. It aims to improve human health, well-being, and productivity through the innate human tendency biophilia to affiliate with nature. Green spaces such as Maçka Park, located within densely built-up areas, provide ideal settings for the implementation of biophilic design principles. The park's biophilic features are explored through its natural components, spatial organization, and their psychological benefits for users.

4.6.1 Natural Elements and Ecological Diversity

In spite of its highly central city position, Maçka Park is distinguished as an important green area in the city by the intensity and variety of its vegetation. The variety of vegetation found in the park not only enhances the landscape's aesthetic values but also the environmental functions. The site consists of a rich variety of native tree species such as linden (*Tilia*), poplar (*Populus*), hornbeam (*Carpinus*), chestnut (*Castanea*), oak (*Quercus*), black locust (*Robinia pseudoacacia*), plane tree (*Platanus*), boxwood (*Buxus*), alder (*Alnus*), walnut (*Juglans regia*), and ash (*Fraxinus*). The site is also inhabited by a large number of herbaceous and woody plant species exhibiting a broad range of ecological characteristics. This heterogeneity is important to the maintenance of biodiversity in urban environments (Kowarik, 2011; Tzoulas et al., 2007). The vegetation accounts for ongoing ecosystem services while simultaneously providing wildlife habitats in the city (Bolund & Hunhammar, 1999). It also allows humans multisensory contact with nature, which is a fundamental principle of biophilic design. Kellert (2005) points out that biophilic design goes beyond the physical existence of natural elements to include emotional, cognitive, and perceptual connections that users form with these elements. In these conditions, Maçka Park's spatial planning according to ecological diversity supports beneficial perceptions and strengthens emotional bonds among the users (Beatley, 2011). The park's botanical diversity has an integrated significance, working not just as a recreational and aesthetic asset but also within the context of urban ecological processes, biophilia-inducing experiences, and sustainability principles. Promoting such biodiversity in urban areas supports both sustainability principles. Promoting such biodiversity in urban areas supports both environmental resilience and greater user satisfaction (Jim & Chen, 2009).



Figure 4.3: Ornamental Pool Area and Its Surroundings in Maçka Park (Photographs are from the Author's Archive).



Figure 4.4: Visuals of the Green Spaces in Maçka Park (Photographs are from the Author's Archive).



Figure 4.5: The Pond Zone and Surrounding Landscape of Maçka Park (Photographs are from the Author's Archive).



Figure 4.6: Different Pavement Types and Pedestrian Walkways in Maçka Park (Photographs are from the Author's Archive).

4.6.2 Visual and Spatial Arrangements

The second significant element of biophilic design elements consists of spatial configurations. Maçka Park offers the user various views of nature with its nature-compatible configuration in the form of walking paths, green areas, ponds, and resting points. Kaplan and Kaplan (1989) noted that natural landscape elements not only need to be visible but also physically accessible and interactive. The spatial design in Maçka Park promotes the open movement of people and welcomes them to be immediately engaged with the nature around them. Further, the pathways within the park have been constructed on biophilic design principles that are typified by their curvaceous and organic shapes. These meandering paths create a sense of natural continuity and make people move within the park more readily and curiously. These spatial patterns form a sense of enclosure in the natural setting, enabling people to minimize stress and experience the therapeutic effects found in the natural environment (Ulrich, 1984).



Figure 4.7: Visual and Spatial Arrangements in Maçka Park (Photographs are from the Author's Archive).

4.6.3 Water Elements and Natural Sounds

Water is a particularly effective element of biophilic design. Aquatic features enhance the calm and rejuvenating ambiance typical of biophilic spaces. In Maçka Park, ponds and water courses are main features of biophilic design. Apart from rendering the environment visually more pleasant, these features generate a calm ambiance through the soothing sounds of flowing water, thereby playing a role in reducing stress levels. Empirical research has revealed that exposure to water provokes sensations of peace and calm, thereby positively influencing the mental well-being of urban dwellers (White et al., 2010). In this case, the incorporation of water elements in Maçka Park is relevant to biophilic design as it responds to the natural tendency of humans to connect with nature.



Figure 4.8: Water Elements and Arrangements in Maçka Park (Photographs are from the Author's Archive).

4.6.4 Light and Shadow Arrangements

Maçka Park's light and shadow arrangements are considered to be a vital component of its biophilic design. The broad-leaved trees produce shaded spots in different locations within the park throughout the day, allowing users to take shelter from the sun. These shaded spots allow the park to retain its coolness in summer, making it a more inviting place to use. Ulrich

(1984) implies that settings with a harmonious interplay of light and shade have a positive impact on physical and mental well-being. In addition, the biophilic elements in the park enable user experience through the active interplay of light within the different zones, providing multiple levels of sensory stimulation. For example, during early morning, sunlight filtering through the foliage enables users to watch the rhythms inherent in nature. These natural light and shade patterns reinforce the nature-oriented atmosphere of the park and give its visitors a sense of being part of the natural rhythms (Kellert, 2008).

4.6.5 Stress-Reducing Effects and Health Benefits

The primary purpose of biophilic design is to enable human well-being and stress reduction. Maçka Park is an area where human beings can restore their bond with nature, facilitated by its natural qualities and biophilic elements, thereby inducing stress reduction. Researchers such as Ulrich (1984) and Kaplan & Kaplan (1989) have stressed the psychological well-being benefits related to nature and demonstrated the stress-reducing impact of biophilic design. Maçka Park's biophilic elements are believed to induce mental tranquility, emotional stability, and ultimately a healthier way of life among its visitors. To illustrate, the more subdued areas of the park are perfect locations for practicing yoga and meditation, activities which are further amplified when practiced in a natural environment based on biophilic principles. Here, Maçka Park serves a significant purpose for individuals who are in need of relief from the turbulent nature of city life and also utilizing the therapeutic power of nature. The biophilic elements integrated into the park are introduced as a balanced structure that addresses the physical, psychological, and social requirements of visitors, thereby distinguishing the park as a representative example of biophilic design in Istanbul's public spaces. These factors not only improve personal happiness and satisfaction but also create a sustainable and environmentally friendly urban environment.

4.6.6 Light, Color, and Visual Aesthetic Elements

Light, color, and visual aesthetics are a prominent aspect of biophilic design, enabling users to engage with environments that have a harmony with natural elements. The aesthetic qualities embedded in biophilic design impact not only visual enjoyment but also emotional well-being and a sense of satisfaction. Especially in public spaces, careful consideration of

aesthetic elements enhances user experience, enhances the attractiveness of the space, and strengthens people's connection with nature. The play of light, color, and ornamental features in Maçka Park offers the users a visual link with nature around them, as well as with an enhancement of the space's coherence and visual appeal.

4.6.7 Psychological and Aesthetic Effects of Colors

Color is an essential element in the visual pleasure of biophilic architecture, profoundly affecting individuals' emotional well-being in natural environments and urban areas. Empirical studies of the psychosocial impacts of color show that natural hues, including greens, blues, and terracotta, induce sensations of calmness, security, and relaxation (Kellert, 2008). Prevailing colors of green in Maçka Park provide a feel of nature interaction, while also generating a natural and soothing ambiance. Further, the extensive variety of plants in the park presents a colorful array of hues, giving the visitors a visually appealing experience. These color changes that occur with the seasons in flowering plants and shrubs contribute to the aesthetic value of a setting, making visitors have a different visual experience each time they visit. Being recognized as one of the basic elements of biophilic design, such seasonal color changes enable the creation of a setting that is synchronized with nature, thereby allowing humans to observe the cyclical nature of life. The diversity of color exhibited by the flowering species of the park stimulates emotional reactions in the tourists, thereby inducing feelings of relaxation, happiness, and vitality (Ulrich, 1984).

4.6.8 Visual Diversity and Aesthetic Arrangements

Visual diversity and aesthetic patterns are basic principles in enhancing the beauty of a place in biophilic design. Visually attractive landscapes encourage users to have a more active engagement with nature. Natural elements in Maçka Park are interspersed with pathways, tree clusters, and open areas that are strategically distributed throughout the site, thus creating a unifying aesthetic identity unique to the park. Diversity in visual properties enables individuals to walk around the space with an intrinsic sense of rhythm, creating an experience in which exploration and discovery are emphasized (Kaplan & Kaplan, 1989). Further, the availability of sculptures, seating arrangements, and diverse landscape elements throughout the park contributes to its visual aesthetic property of biophilia. These properties

are placed strategically as in sync with the nature around them, thereby complementing an aesthetically pleasing environment. Aesthetic layouts not only welcome guests to behold the park's visual beauty but also to establish a strong sense of place and spatial identity. According to Whyte (1980), visual diversity in public places increases user engagement with the environment and reinforces social bonds between individuals.

4.6.9 Spatial Arrangements and Social Spaces

The impact of biophilic design principles on the planning of spaces and social areas within public places plays a central role in encouraging people's sense of place. Depending on the inherent love for nature among human beings, biophilic design aims at establishing environments where humans can effectively connect with natural elements (Wilson, 1984). To this end, spatial configurations not only try to generate physical closeness among users but also try to generate spaces that encourage social interaction and personal wellness. Kaplan and Kaplan (1989) note that exposure to nature positively influences people's mental and emotional states, thus enabling them to relax more in social environments. Imagining biophilic features in public areas promotes affective relationships between users and their surroundings, such that people are inclined to linger for long periods of time in these areas and convert them into perfect sites for social interaction. Kellert and Wilson (1993) point out that biophilic design not only affects psychological health but also the connection between humans and their social worlds. For instance, when natural light, vegetation, and water features are purposefully incorporated into public space, they enhance overall user experience and satisfy both relaxation and socialization demands (Ulrich, 1984). Visual access to nature has also been proven to decrease stress levels in addition to promoting more constructive interpersonal interactions within common space. Ulrich's (1984) study shows that open spaces with a view of nature strongly contribute to mental well-being as it enhances users' interest in the space through aesthetic appeal. Having such biophilic configurations in urban public spaces not only allows people to re-establish connections with nature but also provides areas of refuge in the midst of the hectic city life, eventually promoting the strengthening of social bonds. The Maçka Park in Istanbul is a perfect illustration of this tactic since it offers vast green areas, pedestrian promenades, sitting areas under tree shade, and water features all being biophilic design elements that respond to the urban public's need for interaction with nature. In the case of the Maçka Park, people can sit and remain inside

nature while still experiencing social interactions, hence making the park an active social space (Grinde & Patil, 2009). This naturally enhanced public space enables place attachment for users and promotes regular use and greater social contact. Social attractiveness of the biophilic design elements has been extensively reported in the literature. Kellert (2005) presents an argument on nature-based spatial design enabling users to feel peaceful and belonging, leading to an integrated spatial and societal experience. As a result, the incorporation of biophilic elements enables public spaces to be viewed not only as physical places but also as social spaces that are dynamic. These spatial designs not only make the time spent in such places more worthwhile but also enhance users' length of stay (Kuo, 2001). Social areas that offer a connection with nature have been found to have a positive effect on user preference, illustrating the behavioral effect of biophilic design. By imagining biophilic features in public areas, people are not only capable of improving their connection with nature but also of gaining from an atmosphere that sustains social life. As Kaplan and Kaplan (1989) stress, people in touch with nature are more relaxed and more likely to establish social bonds. Public areas like Maçka Park, which are planned based on biophilic principles, therefore provide their users with a relaxed social experience in touch with nature. Literature attests that biophilic design features are an important factor in defining user preference in public areas, promoting social interaction and rendering these areas more enjoyable and significant to users.

4.7 USER EXPERIENCES AND FEEDBACK

Human experience and response provide fundamental metrics for assessing the success of biophilic design features in public areas. As biophilic design strives to facilitate physical and psychological well-being through the promotion of human-nature engagement, understanding how people experience such environments becomes imperative to plan the success of such design intervention. Urban green areas such as Maçka Park provide their users with the opportunity to alleviate stress, enhance social ties, and engage in physical activity through being in contact with nature for some time. Availability of biophilic design opportunities in such green areas positively affects user experience, enhancing the visit frequency and the park's status as a social magnet (Kaplan & Kaplan, 1989). From the perspective of user experience, individuals who occupy public spaces incorporating biophilic design elements report feeling more relaxed and calm in nature-integrated

environments. It has been found that elements such as natural light, vegetation, water features, and shaded tree areas enhance user satisfaction. Ulrich (1984) highlights the stress-reducing effects of nature exposure, emphasizing the psychological benefits of time spent in green areas. Maçka Park's biophilic features are such that they enable people to recuperate from the fatigue and stress of everyday life, so that people visit repeatedly. The feedback also reports that people like to stay for long durations in these settings and that nature-based social areas promote repeat visits (Grinde & Patil, 2009). User experiences also yield useful information on social interaction patterns and community engagement. One of the most prominent aspirations of biophilic design is to produce social space that allows for connection and shared time among people. According to Kellert (2005), biophilic design improves the intimacy and positivity of spatial experience, and nature-based space fosters more social interaction. Interviews and observations gathered in Maçka Park illustrate that seating areas under the shade of trees, walking paths lined with greenery, and water features contribute to the creation of social space wherein individuals are able to gather, interact, exercise, and enjoy time together. Users are expected to comment that these social spaces not only fulfill needs of rest and contact with nature but also assist in the reinforcement of interpersonal relations. The impact of biophilic design on user experience provides insight into the ways in which people form emotional and spatial connections with the built environment. As evident in the case of Maçka Park, public areas with biophilic elements trigger a sense of attachment that reinforces user preference. Features like the soothing quality of water features, the sense of immersion in greenery, and the comfort offered by seating areas constructed of natural materials are consistently mentioned as positive features in user feedback. Also, a general sense of being happier in places where users could connect with nature and also socialize is more often than not mentioned by a large number of users, highlighting the beneficial psychological influence of biophilic design (Kuo, 2001). User feedback also indicates that biophilic features are more than aesthetic value in architectural works they promote extended stay in public areas, enhance users' attachment to the environment, and enable sustained interest in public areas. As evident in literature, incorporation of biophilic features contributes to the general attractiveness of public areas in such a manner that individuals feel relaxed and comfortable in such places (Beatley, 2011). A close consideration of user experience is therefore required in informing biophilic design principles in guiding future public space practice.

5. DISCUSSION AND FINDINGS

Within the scope of this research, the influence of biophilic design elements on user perceptions in public open areas was evaluated with a case study on Maçka Park in Istanbul. Data obtained via a systematic questionnaire were analyzed using the SPSS program, and the correlations between the variables were investigated to clarify how user perceptions clustered together and which dimensions worked together. The results indicate that the elements of biophilic design have a statistically significant effect on user satisfaction, psychological comfort, social interaction, and the patterns of physical space use. The results indicate the complex role that biophilic elements play in promoting individual well-being and also the social interactions in urban public spaces.

Table 5.1: Pearson Correlation Coefficients Among Biophilic Design Variables (n = 77) (Prepared from by the Author) Part 1.

Variables	Natural Elements	Natural Materials	Biophilic Diversity	Water Features	Shaded Areas	Organic Form	Overall Experience
Natural Elements	1.0	0.043	0.175	-0.156	-0.101	0.029	-0.005
Natural Materials	0.043	1.0	0.148	0.001	0.234	0.613	0.124
Biophilic Diversity	0.175	0.148	1.0	0.14	0.218	0.039	0.286
Water Features	-0.156	0.001	0.14	1.0	0.277	-0.001	0.325
Shaded Areas	-0.101	0.234	0.218	0.277	1.0	0.487	0.595
Organic Form	0.029	0.613	0.039	-0.001	0.487	1.0	0.368
Overall Experience	-0.005	0.124	0.286	0.325	0.595	0.368	1.0

Table 5.1: Pearson Correlation Coefficients Among Biophilic Design Variables (n = 77) (Prepared from by the Author) Part 1 (Table Continued).

Increase in Elements	0.134	0.256	-0.123	0.034	0.151	0.344	0.141
Park Superiority	0.112	0.289	-0.168	0.05	0.21	0.523	0.045
Physical Activity	-0.041	0.181	0.317	0.235	0.324	0.336	0.379
Stress Reduction	0.563	0.181	0.155	-0.085	-0.009	0.288	0.092
Social Interaction	0.395	0.147	0.252	-0.053	-0.016	0.147	0.024
Satisfaction	0.092	0.112	0.243	0.219	0.125	-0.018	0.311
Aesthetic-Functionality	0.419	0.084	0.139	-0.288	0.021	0.071	0.102

Table 5.2: Pearson Correlation Coefficients Among Biophilic Design Variables (n = 77) (Prepared from by the Author).

Variables	Increase in Elements	Park Superiority	Physical Activity	Stress Reduction	Social Interaction	Satisfaction	Aesthetic-Functionality
Natural Elements	0.134	0.112	-0.041	0.563	0.395	0.092	0.419
Natural Materials	0.256	0.289	0.181	0.181	0.147	0.112	0.084
Biophilic Diversity	-0.123	-0.168	0.317	0.155	0.252	0.243	0.139
Water Features	0.034	0.05	0.235	-0.085	-0.053	0.219	-0.288
Shaded Areas	0.151	0.21	0.324	-0.009	-0.016	0.125	0.021

Table 5.2: Pearson Correlation Coefficients Among Biophilic Design Variables (n = 77) (Prepared from by the Author) Part 2 (Table Continued).

Organic Form	0.344	0.523	0.336	0.288	0.147	-0.018	0.071
Overall Experience	0.141	0.045	0.379	0.092	0.024	0.311	0.102
Increase in Elements	1.0	0.415	0.076	0.175	0.202	0.315	0.203
Park Superiority	0.415	1.0	0.014	-0.082	-0.195	-0.129	-0.278
Physical Activity	0.076	0.014	1.0	0.372	0.447	0.406	0.245
Stress Reduction	0.175	-0.082	0.372	1.0	0.666	0.156	0.453
Social Interaction	0.202	-0.195	0.447	0.666	1.0	0.227	0.617
Satisfaction	0.315	-0.129	0.406	0.156	0.227	1.0	0.28
Aesthetic-Functionality	0.203	-0.278	0.245	0.453	0.617	0.28	1.0

5.1 ANALYSIS AND DISCUSSION OF THE FINDINGS

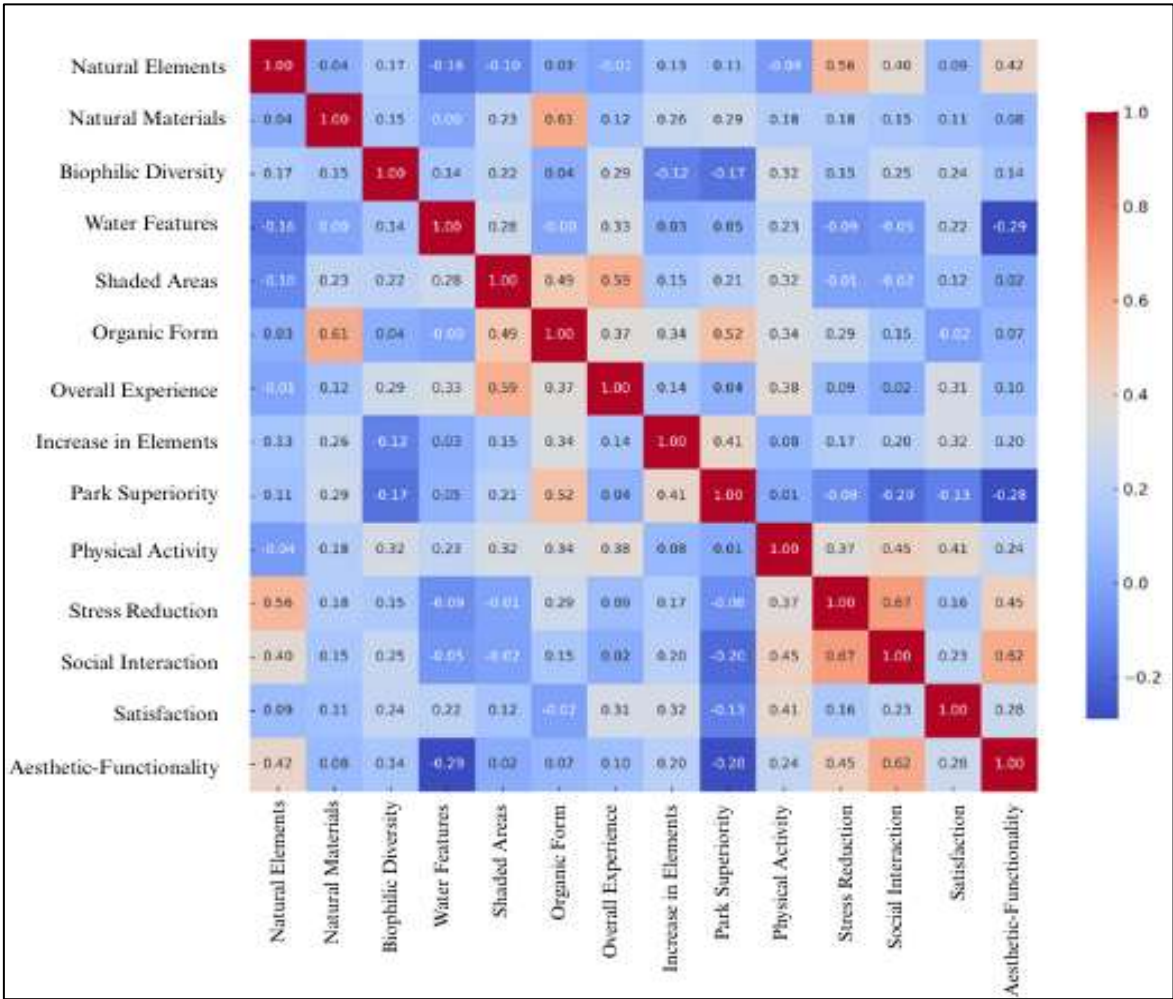
The correlation tests carried out in the context of this research offered a general overview regarding the influence of biophilic elements in public spaces on user experience. The results indicated that user experience is significantly determined by a combination of the physical environment and psychological, social, and behavioral factors. The findings revealed a strong positive relationship between Variable 6, "The sense of tranquility brought about by organic forms and natural arrangements," and Variable 2, "The contribution of natural materials to the spatial atmosphere" ($r = .613$, $p < .001$), meaning that individuals view public spaces with the utilization of organic forms and natural material as having more dimensions

of peace and livability. This result confirms one of the fundamental principles of biophilic design, that mental well-being can be enhanced by sensory exposure to the natural environment (Ulrich, 1984). Within Ulrich's "stress recovery theory," features like vegetation, natural materials, and visual access to nature positively influence individuals' affective states. Similarly, Kaplan and Kaplan's (1989) "attention restoration theory" suggests that contact with nature helps in mental refocusing and restoration of attention, suggesting that the current findings are consistent with the literature. This connection clearly supports Hypothesis H1 of the study: "Biophilic design elements positively impact user satisfaction." The ambiance created by natural materials and forms enhances the pleasure and satisfaction of users, thereby making the space more inviting. Besides, the positive relationships between Variable 7 ("The overall effect of biophilic design on the user experience") and Variable 6 and Variable 11 ("Stress-reducing effects") indicate that biophilic design influences users in various manners, i.e., aesthetic, perceptual, and behavioral. This implies that a thoughtful spatial integration of biophilic features enhances the level of users' interaction with and experience of the environment. This result corroborates Hypothesis H2: "Spatial arrangement enhances the impact of biophilic features on user behavior." It appears that, aside from the integration of natural elements in design, this integration must also promote, direct, and pacify users' movement through the space. Spatial choices, including the availability of shaded spots, social areas around bodies of water, and smoothly winding paths, directly affect user behavior. Furthermore, the positive relationships discovered among Variables 10, 11, and 12 exercise motivation, stress mitigation, and opportunities for social interaction, respectively reveal the social-level effects of biophilic design. These findings demonstrate that biophilic features not only have psychological benefits for individuals but also enhance social interaction among park users and facilitate the role of public spaces as social hubs. Kellert (2005) emphasizes the potential of biophilic design in promoting social interaction, asserting that the designs instill a sense of emotional attachment among the occupants, which has a positive influence on the quality of experience in shared spaces. Here, elements of biophilic design are recognized as a determining factor in users' reasons for choosing public spaces, thus substantively confirming Hypothesis H4: "Biophilic design elements are a determining factor in users' reasons for choosing public spaces." Not all findings were positive, however. Negative correlation between Variable 4, "Water features encouraging longer stays in the park," and

Variable 14, "The aesthetic and functional contributions of biophilic elements" ($r = -0.288$, $p = .011$). This would suggest that water features are not equally important aesthetically or functionally for all. Whereas some individuals consider water features to be increasing their experience of the outdoors, others may consider them to be adding minimal functional value. This variation in opinion demonstrates that reactions to natural elements are affected by variables like personal preferences, age, level of education, social context, and intended use of the space. Then Louv's (2008) "nature-deficit disorder" concept is applied as an interpretative lens here, under which the behavior of a subject with respect to nature is influenced by past experiences, thereby determining spatial inclinations. Hence, Hypotheses H1 and H4 may receive unequal support from diverse user populations, given individual differences restricting universal applicability. While this research did not directly assess the influence of visualization methods via correlation analysis, the degree to which participants recognized biophilic components can be indirectly examined through their acknowledgment of organic shapes, natural substances, and arrangements of vegetation. Therefore, while a firm conclusion cannot be made about Hypothesis H3: "Visualization enhances the perception of biophilic design elements," it is proposed that visually highlighting biophilic elements increases user consciousness and has a positive impact on the quality of experience. Clarity of vision, the symbolic incorporation of nature into the environmental setting, and visual coherence can be regarded as primary design techniques that facilitate this process. The findings emanating from the Maçka Park case study shed light on the multifaceted effects related to biophilic design. Biophilic design is more than an aesthetic integration of natural elements into a space, but rather a holistic framework that influences user behavior, promotes social interaction, improves psychological well-being, and informs spatial satisfaction. The findings highlight the pressing need for more extensive, user-focused, and sensorially rich biophilic design-based approaches in public space design. The multivariate dimensions of user experience revealed through this research highlight the value of not just spatial configuration but also the requirement to consider people's psychological and social needs through design planning. In line with the World Health Organization (WHO, 2016) urban health reports, the availability of green areas in cities promotes increased physical engagement, decreases mental conditions like stress and anxiety, and enables social integration. In particular, public areas infused with natural elements have been known to enhance one's emotional connection to their immediate environment and increase their

feelings of spatial belongingness, as corroborated by the WHO's reports. Here, the positive correlations identified within the study illustrate the efficacy of a design intervention that influences user perception while concurrently ushering in immediate public health implications. Biophilic design and the World Health Organization nature-based urban solutions both play critical roles in delivering healthier, interaction-focused, and more livable public spaces.

Table 5.3: Pearson Correlation Heatmap of Biophilic Design Variables (Prepared from by the Author).



The 14-variable dataset developed to examine the influence of biophilic design elements on user satisfaction was contrasted with the use of Pearson correlation analysis. The correlation heatmap in Table 5.3 enabled the visualization of the interaction between biophilic elements and revealed some notable positive as well as negative correlations. The findings show that

biophilic design influences user experience not only through single components but also through spatial interaction between these components. The data analyzed revealed that numerous pairs of variables were positively strongly correlated. Most notably, the correlation of "Organic Forms" and "Natural Materials" ($r = 0.61$) indicates that public spaces with an inclination for natural materials are also likely to possess organic forms. This observation implies that when biophilic design is implemented with an equitable integration of form and material, it is perceived by users with greater effectiveness. Similarly, the high correlation manifested between "Organic Forms" and "Stress Reduction" ($r = 0.52$) indicates the potential of natural forms to promote psychological relief, as seen in the prominent role of nature-based spatial compositions in stress management. There were strong positive correlations between the variable "Overall Experience" and the attributes "Organic Forms" ($r = 0.59$), "Shaded Areas" ($r = 0.33$), and "Water Elements" ($r = 0.33$), suggesting that these elements play a crucial part in users' assessment of their experience in the park. In this regard, both the role of shaded areas and water is not only confined to visual appeal but also to thermal and auditory comfort. The high correlations between "Stress Reduction" and "Social Interaction" ($r = 0.67$) and "Aesthetic-Functional Value" ($r = 0.62$) demonstrate that biophilic elements in public environments operate to promote not just individual relaxation, but also social cohesion by facilitating interaction among users. Simultaneously, the noted correlations among "Physical Activity" and "Stress Reduction" ($r = 0.45$) and "Aesthetic-Functional Value" ($r = 0.24$) illustrate that a harmony of beauty and functionality enhances physical interaction within the environment. These are in favor of Hypotheses H1, H2, and H5, meaning biophilic features have a significant correlation with user satisfaction, spatial interaction, and behavioral preference. Conversely, some negative correlations among pairs of variables were revealed. The inverted relationships between "Water Elements" and both "Aesthetic-Functional Value" ($r = -0.29$) and "Park Superiority" ($r = -0.28$) imply that these amenities don't always create the intended positive impact and might even contribute to negative attitudes contingent on space configuration. The contextually inappropriate or unintentional placement of aquatic elements can decrease the perceived aesthetic value and mask the general superiority of the park. These findings support Hypothesis H2 by showing that spatial organization plays a major role in the perception of biophilic qualities. Moreover, negative correlations of "Park Superiority" with "Physical Activity" ($r = -0.20$) and "Aesthetic-Functional Value" ($r = -0.28$) suggest that user motivations to take part in

physical activities do not always align with their perceptions of park superiority. This may indicate that some user groups prefer parks for more passive and visual experiences, while physical activity expectations may be associated with different types of environments. The results of the correlation analysis numerically reinforce the multidimensional effects of biophilic design. Key indicators such as user satisfaction, stress reduction, aesthetic evaluation, and social interaction appear to significantly influence and reinforce each other. However, these interactions are not unidirectional. In some cases, spatial configuration or users' intended use of the park can reverse or alter these relationships. Therefore, the effectiveness of biophilic design depends not only on the presence of specific elements but also on their integrated placement and alignment with user behaviors.

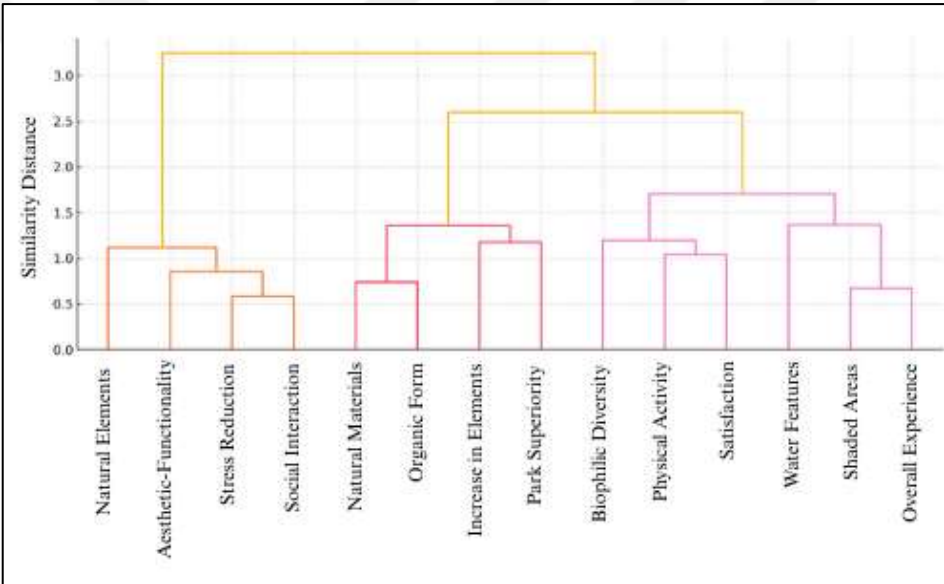


Figure 5.1: Dendrogram Chart (Prepared from by the Author).

Figure 5.1 presents the results of a hierarchical cluster analysis conducted to measure the degree of similarity among biophilic design variables. Based on the levels of similarity or dissimilarity between the variables, the analysis revealed three main clusters. These clusters offer a more holistic understanding of how biophilic design influences user perception and experience. The first cluster includes the variables “Natural Elements,” “Aesthetic-Functional Value,” “Stress Reduction,” and “Social Interaction.” A common feature of this group is their capacity to enhance users’ emotional connection with nature and promote psychological well-being. The close association between stress reduction and social

interaction suggests that nature's calming influence may also facilitate social relationships. Similarly, the inclusion of aesthetic-functional satisfaction alongside natural elements indicates that users evaluate nature-integrated aesthetic features in both visual and functional terms. Accordingly, this cluster can be interpreted as comprising "psychosocial and emotionally impactful biophilic components." The second cluster consists of "Natural Materials," "Organic Forms," "Elemental Increase," and "Park Superiority." The variables in this group are primarily related to the physical characteristics and spatial fabric of the environment. The inclusion of organic forms and natural materials in the same group indicates that form and material features referencing nature are perceived as complementary by users. The proximity between elemental increase and park superiority suggests that the quantity and variety of biophilic elements enhance users' perception of a park as more favorable compared to other public spaces. Therefore, this cluster can be defined as "biophilic components centered on physical-spatial structure and perception." The third cluster comprises "Biophilic Diversity," "Physical Activity," "Satisfaction," "Water Elements," "Shaded Areas," and "Overall Experience." The defining feature of this group lies in its association with users' direct spatial experience and behavioral responses. The grouping of biophilic diversity with physical activity and satisfaction indicates that diverse biophilic features can promote physical engagement and, in turn, contribute positively to user satisfaction. The inclusion of water elements and shaded areas in this cluster highlights the significance of microclimatic comfort and environmental variety in shaping the overall user experience. This cluster can thus be characterized as encompassing "experiential and behaviorally impactful biophilic components." In summary, the dendrogram chart illustrates that biophilic design variables are not isolated or independently functioning elements; rather, they form integrated clusters that correspond to user behavior and perception in a holistic manner. This finding underscores the necessity of approaching biophilic design as a systematic whole, wherein spatial design decisions must be aligned with multiple sensory and behavioral dimensions. Moreover, the structure revealed by this clustering analysis provides strong support for Hypothesis H2 (Spatial configuration enhances the impact of biophilic features on user behavior) and Hypothesis H4 (Biophilic design elements are a determining factor in users' preferences for public spaces).

6. CONCLUSION AND RECOMMENDATIONS

The current study aimed to investigate the impact of biophilic design on humans, taking Maçka Democracy Park one of Istanbul's popular parks as a case study. The main objective was to identify whether or not the elements of nature have a unique effect on user experience and, if so, to delineate the specific mechanisms through which this occurs. Through the assessment of data gathered from 14 individual biophilic elements, this study both quantitatively examined and investigated the intercorrelations among these elements and their collective applicability. The first hypothesis of the research, H1: "Biophilic design elements positively affect user satisfaction," was strongly empirically substantiated. The majority of the subjects expressed that the presence of natural elements in the park, including natural materials, organic shapes, water features, and shady areas, significantly contributed to the quality of their experience, rendering it more pleasurable, relaxing, and satisfying. A good illustration is the statistically significant correlation between "Natural Elements" and "Stress Reduction," which suggests that natural qualities exert beneficial influences beyond aesthetics to mental well-being. The second hypothesis, H2: "Spatial organization amplifies the impact of biophilic elements on user behavior," yielded notable results. The hierarchical cluster analysis revealed that the variables "Aesthetic-Functional Value," "Stress Reduction," "Social Interaction," and "Natural Elements" were grouped together. This finding demonstrates that all these elements do not function in isolation independently; rather, they exhibit more effectiveness in a combined form. The integrated design of these factors encourages individuals to connect more with the environment, stay there for longer durations of time, and choose to return. In essence, effective spatial design is one of the primary mechanisms for amplifying the potency of biophilic elements. The third hypothesis, H3: "Visualization increases the perceived value of biophilic design elements," was also confirmed to be accurate. Researchers emphasized that the presence of a tree, along with its location, salience, and adjacency to other features, constitutes fundamental visual elements. Visualization, as thus, entails not just the process of "revealing" but also the stimulation of attention in addition to the intensification of experience. An effectively designed biophilic environment not just optimizes visibility but also heightens users' experiential awareness of the park. Fourth hypothesis, H4: "Biophilic design elements have a significant impact on users' appreciation of public spaces," is one of the strongest conclusions of this study. Many

of the respondents preferred Maçka Democracy Park, basing their preference not only on the fact that there is vegetation, but also on its calming nature, which allows for relaxation and an ability to have a more "real" contact with nature. The deep connections that were observed among "Satisfaction," "Biophilic Diversity," and "Overall Experience" emphasize the deep influence that biophilic features exert on user behavior and space selection. That is, individuals select this park not only for fragmented walks; rather, they seek to gain a rich experience and connection with nature. Generally, the observations in this research affirm the indispensable role of nature in urban settings. Particularly for individuals traveling through the quick, stressful, and loud settings characteristic of contemporary cities, the incorporation of natural features into environments is more than an aesthetic choice; it's an essential requirement. In this case, biophilic design has become a multifaceted tool that brings tranquility to environments, optimizes user satisfaction, and contributes positively to the overall livability of cities. The research at Maçka Democracy Park is a stark demonstration of the extent to which biophilic design can impact user experience, evidenced both qualitatively and quantitatively. It has been made quite evident that simply "having" natural elements is insufficient; rather, they must be displayed in a coherent and harmonious fashion. Biophilic design has proven to be effective on all fronts, namely aesthetics, psychology, personal satisfaction, and social interaction. These observations strengthen the argument for more conscious use of biophilic design in the context of urban planning and public space design. The present research tries to analyze the impacts of biophilic design applications in public open areas on user experience under a multi-dimension framework in Istanbul's urban setting, a city with immense urbanization and fast urban development. Predominantly centered on Maçka Democracy Park as a case study, the present research tries to make an original, empirical, and user-based contribution to Turkey's literature on biophilic design, which has mostly been developed within a theoretical framework. The primary motivation for this research is to examine the significance of nature interaction in human life, not merely as an aesthetic or ornamental factor, but rather as a considerable environmental experience influencing psychological, social, and behavioral dimensions. Furthermore, it aims to explain the actual impacts of such experiences on user behavior. The evidence drawn from survey research, observational measures, and spatial analysis carried out in the context of this research unambiguously establishes the significance of biophilic design features in urban parks. From the data collected, it has been understood that biophilic

factors have not only an aesthetic function in contributing value to space but directly influence elements such as users' park usage time, levels of satisfaction, social interaction proclivity, and psychological relaxation. Notably, spatial features including water features, tree-shaded areas, seating areas constructed using organic materials, and the variety of plant species were revealed as essential spatial features influencing user preference in the park. A primary finding of the study was that a significant and positive connection existed between the occurrence of biophilic design features and user satisfaction. Most of the respondents indicated that they spent more time in spaces that contained biophilic elements and felt more serene and psychologically calmer. It was, however, stated that the spatial arrangement of these elements is just as crucial as their existence. The location of the studies' biophilic elements in a particular space has played a key role in shaping the perceptions of the users regarding such elements, how they interact with them, and their preferences for that place. The spatial analyzes and observational findings during the study included that users preferred staying in areas with high tree density and water features, which were arranged with natural material and had shaded zones. Conversely, those spaces that are devoid of biophilic features or consist of hard surfaces and no shade spaces tend to act primarily as thoroughfares for building occupants, generating little or no stay time. Correlative analysis has revealed strong and significant correlation between aesthetic value of biophilic features and occupant satisfaction. Further, the effect of biophilic design features on the level of social interaction has been a notable finding. A significant number of the participants indicated that they had better interaction with strangers in environments that bring in natural elements, and they had a greater inclination to form social connections in those environments. Notably, waterfront spaces and shaded seating areas were revealed to be the areas where social interactions were most obvious. This case demonstrates the role of biophilic design in inducing not only personal psychological experiences, but also the formation and consolidation of social ties. Another contribution of this research is the application of theoretical approaches commonly cited in the literature to field data, and an assessment of their applicability in the specific local context. Kaplan and Kaplan's Attention Restoration Theory, Ulrich's Stress Reduction Theory, Appleton's Prospect-Refuge Theory, and Gibson's Affordance Approach were empirically tested and found to have a significant contribution in the explanation of the impact of biophilic design on user experience within the case of Maçka Democracy Park. Specifically, it was found that Kaplan's principles of

attention restoration viz., distance, enchantment, compatibility, and inclusiveness were in alignment with the user experience of the park. The users considered the park an escape from the stresses of city life, with natural features eliminating cognitive fatigue and enhancing social inclusiveness. In the spatial safety and visibility theories of Appleton's Prospect-Refuge Theory, it has been noted that human beings seem to prefer areas that provide both refuge and a broad visual prospect. More specifically, sloping woodlands and those proximal to water bodies have been noted as optimum zones for fulfilling this need. Gibson's affordance theory has determined that biophilic features are not solely visual or aesthetic; they are also features that define user behavior and provide possibilities for action. Within the park, natural pathways, tree-lined clearings, and set-aside seating have appeared as spatial features that significantly influence user behavior. One of the key contributions of this study is its clear assessment of user experiences with biophilic design applications through the collection of field-level data in the Turkish context. By incorporating empirical evidence into the discourse over biophilic design discourse that has largely been limited to theoretical and abstract considerations in extant literature a framework has been established. This framework has the ability to provide actionable results for professional practitioners and municipal planners by analyzing user activity and perceptions regarding the environment. The results of this research concluded that the use of biophilic design for urban parks and public open spaces needs to be more systematic, integrated, and user-centric. It is essential that natural elements are not just included in the park but also with spatial compositions that harmonize in accordance with users' perceptions and address their psychological and social requirements. Specifically, it is clearly demonstrated that shade, water elements, seating groups according to natural elements, and rich vegetation enhance user satisfaction, social interaction, and psychological well-being. According to the findings of this research, the recommendations below have been formulated for improving the impact of biophilic design applications on urban life and user experience:

- a. It is absolutely necessary to increase plant diversity in urban parks by introducing a range of tree species, seasonally flowering plants, and ground-cover vegetation together. This ensures an enriched spatial experience for users as well as makes them feel more vital.

- b. Active and functional integration of water features within the design creates psychological calm, visual beauty, and cooling. Mini waterfalls, artificial ponds, or water channels are important elements that add value to the park experience.
- c. Naturally, the utilization of natural materials is to be encouraged; materials with natural textures and colors, i.e., wood, stone, and bamboo, are to be given preference in seating spaces, walkways, and pergola systems.
- d. Shaded spots need to be enlarged, and groups of trees, tents, plant pergolas, and semi-open buildings need to be considered as spatial solutions that provide comfort to users and preserve the biophilic effect.
- e. There is a necessity to design calm and isolated rest areas that provide an individual with alone times with nature, thereby aiding in the restoration of attention.
- f. Areas offering open vistas and sightlines should be planned to meet the need for orientation and psychological rejuvenation.
- g. Universal designs that cater to all categories of users must be adopted, and personalized micro-spaces must be designed for children, the aged, individuals with disabilities, and youth.
- h. Information areas and panels that raise biophilic awareness must be established; QR codes, sounds of nature, and seasonal plant guides need to be utilized to heighten users' biophilic awareness.
- i. The night use should utilize dim, natural-colored lighting that creates a nighttime environment consistent with nature and that does not strain the eye.
- j. Local authorities should develop urban policy documents aimed at biophilic design and implement mandatory biophilic strategies in public space developments.
- k. The findings of this study hope to serve as a model not only for Maçka Democracy Park but also for these kinds of metropolitan parks and public open spaces, and to inform biophilic design in Turkish urban public space policy and practice.

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