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- To develop theoretical and methodological foundations of Architecture, Planning and Design,
- To discuss the role of architects, planners and designers today and in the future,
- To compare the differences between architecture, planning and design research, practices and education in different countries,
- To bring a scientific view of current issues and discussions in field of Architecture, Planning and Design,
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Developing a Design Approach from Scenario to Space in Interior Architecture Education via the Scamper Method: Christy Brown Example

H. Özlem Yurtgün*

Abstract

This study aims to investigate the role of empathy in the disciplines of cinema and interior architecture, with a particular emphasis on individuals with disabilities. The objective is to assess the potential benefits of this empathetic approach through the learning outcomes derived from a workshop study. Workshops are recognized as effective educational tools, as they facilitate a discussion and evaluation environment that transcends conventional standards of interior architecture education. The primary focus of this research is to cultivate empathy and human-centred thinking skills, specifically through the application of the Scamper method in interior architecture design. This study aspires to provide students with opportunities for abstract and creative thinking while fostering innovative design approaches that integrate various disciplines.

The Scamper method is a technique designed to encourage creative thinking and to foster diverse perspectives in the design process. The method encompasses nine key steps: Substitute, Combine, Adapt, Modify, Minify, Magnify, Put to Another Use, Eliminate, and Reverse. It is assumed that the Scamper method will prove effective in the field of interior architecture design education by promoting a problem-oriented approach, enhancing abstract thinking, and cultivating empathy skills, particularly in the context of inclusive design. The objective of this study is to introduce an innovative educational framework for interior architecture design that prioritizes empathy and human-centred design. This approach incorporates the Scamper method within the curriculum, adopts an interdisciplinary perspective, and emphasizes the development of inclusive design practices. Additionally, the study seeks to improve abstract thinking skills in design processes and to explore experimental educational methodologies. It is anticipated that such multidisciplinary strategies and pedagogical innovations will significantly enhance the future of interior architecture design education.

Keywords: *Design education, Design for the disabled, Empathy, Inclusive design, Scamper method.*

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INTRODUCTION

The definition of Interior Architecture, which is linked to creative and design-oriented thinking, is "a profession that generates solutions to offer the most suitable designs to the users according to functional, structural, and aesthetic criteria within an architectural space," as many theorists throughout history have attempted to explain" (URL-1). The profession of interior architecture aims to create design solutions that are functional, structural, and aesthetically pleasing within an architectural space, to cater to the needs of the users. This definition has been established by various theorists throughout history. Interior architecture is primarily concerned with designing spaces that are suitable for human needs and requirements, considering factors such as user type, function, comfort, ergonomics, and aesthetics.

The objective of this research is to analyse the disciplines of cinema and interior architecture through an empathy-driven approach, with a particular emphasis on individuals with disabilities. Furthermore, the study aims to assess the potential learning outcomes that may be achieved through a workshop designed around this approach. It is estimated that around 16% of the global population have disabilities, which means that one in every six individuals is disabled (URL-3). Generating diverse solution recommendations for those with disabilities whose physical makeup and level of disability differ will improve their quality of life by enabling them to carry on with their lives without requiring support. For disabled people to enjoy their human rights and fundamental freedoms on an equal basis with other users, interior designs—which should be based on reasonable arrangement and universal design criteria—must be taken into account (Mülayim, 2017). In recent years, the biggest issue in studies focused on individuals with disabilities is the designer's lack of experience regarding the needs of disabled individuals (Pehlivanoğlu, 2012). From the standpoint of people with disabilities, accessibility and a lack of responsiveness to needs are situations that have a significant impact on life comfort. The levels of accessibility, usability, and responsiveness to individual needs, along with compliance with anthropometric standards and aesthetic value of a space, vary not only according to physical disabilities but also based on other physical conditions. These conditions include impairments related to vision and hearing, learning disabilities, age (including both elderly and paediatric populations), and pregnancy.

A person's daily social and physical existence is fundamentally intertwined with the concept of space. The principal reason space serves as a critical component of architecture is its role in accommodating individuals. As noted by (Corbusier, 1993) in his interview with architecture students, architecture is a discipline that is dedicated to serving the individual and must respond thoughtfully to both material and intellectual needs. These needs constitute the primary focus areas of architectural practice. For an area to qualify as space, there must be an individual who defines and engages with that space. In other words, the

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recognition of space is contingent upon the existence of individuals who perceive and experience their surroundings. Traditionally, society has understood the concept of space as a protective enclosure designed to safeguard individuals from external elements while facilitating daily activities. Nonetheless, space can be analysed through three distinct dialectics: perceived, designed, and experienced. The type of space that accommodates individuals within the built environment and addresses their needs is referred to as living space. Therefore, it is necessary to respond to the expectations of the living space such as refuge, security, privacy, function and aesthetics. Within this framework, the design process and design education necessitate examining the issue and potential solutions from every angle and analysing them from various viewpoints in compliance with the design standards for all.

When evaluated through the existing literature; it can be seen that workshops are types of instructions that will enhance learning by bolstering the traditional design education model. Numerous studies have examined the viability of workshops for information-age design education. Workshop studies, according to (Işır, 2022), are viewed as a working process where participants can collaborate to carry out experimental and interdisciplinary studies under the facilitator's supervision in a setting that will boost their motivation and creativity. (İnce & Işır Yarkataş, 2017) asserted that educational environments are crucial for the development of the competencies that designers are expected to possess in the information age. Nonetheless, it is important to note that formal education alone does not suffice to cultivate these essential qualities.

For this reason, it's critical that students regularly establish collaborative learning environments, particularly in the context of design education. Workshop studies also benefit the instructor in a variety of ways. To stay current, it is critical to monitor how user needs are evolving outside of the formal education system, and to assess those changes from various angles. Workshops have been a part of education with online education system in different fields during the pandemic in the world and in our country. Workshops are crucial for educators, according to (Cleaver, n.d.) because they help them gain a fresh perspective on the field of design, participate in the continuous design process by sharing with students, generate creative ideas in a group setting, and take part in the process of learning in a democratic and critical setting. The designer's field of observation encompasses the entire built environment that currently exists, according to (Yürekli & Yürekli, 2004). Therefore, the environment should be considered as an educational environment. Moving away from formal education, design training conducted outside of the educational process is regarded as an informal education model. Education models that allow for specialization in a predetermined subject and centre on it are known as informal education models. As a result, in terms of learning outcomes, informal educational structures like workshops aid in the design process. However, there exists a notable gap

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in the literature concerning experiential workshops designed to foster empathy for individuals with disabilities. There are essentially two approaches to handling workshops, based on their purpose and organizational structure. The first group concentrates on a topic, concept or problem, and addresses a range of solution processes from simple to complex. The second group focuses on a single method of solution and will help with the production of solutions progressively and practically (Işır, 2022). From Scenario to Space Workshop was created to manage both kinds of applications in this particular context. The study is structured as follows.

Undergraduate design students were invited to participate in a workshop organized by the Interior Architecture Department of Seljuk University. The event, which employed the Scamper method, was announced through a poster detailing the workshop agenda. As a result of the open invitation, 35 students voluntarily registered for the workshop. The full-day session was conducted in small groups consisting of four to six participants each. The final products were evaluated through presentations made to the faculty members of the interior architecture department, utilizing presentation sheets to convey the learning outcomes.

This study aims to enhance students' creative thinking, empathy, and inclusive design skills by implementing innovative and collaborative learning methodologies in interior architecture education. The objective is to enable students to develop a design approach tailored for individuals with disabilities through an empathetic framework. This involves fostering an understanding of the diverse experiences of various user types based on their disabilities and engaging students in generating abstract concepts during discussions that arise from a selected film. Students will be encouraged to propose solutions that align with the specific needs, requests, and expectations of users, thereby adopting an inclusive design perspective through appropriate conceptual definitions. As such, it is anticipated that students will cultivate the ability to empathize, engage in abstract thinking, convert concepts into tangible ideas, participate in discussions, and articulate their design visions by crafting personalized layouts in a collaborative setting that extends beyond traditional educational paradigms.

The original contribution and significance of this study are rooted in the adaptation of the SCAMPER method to the domain of interior architecture, providing students with essential tools to enhance their design competencies. Additionally, workshop-style sessions facilitate both theoretical knowledge and practical experience, allowing students to address design challenges grounded in real-world contexts. This educational model promotes the development of innovative solutions through the integration of interdisciplinary perspectives throughout the design process. By prioritizing the needs of individuals with disabilities, this study seeks to improve designers' empathy skills and foster the creation of inclusive environments that can be accessed by all members

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of society. Furthermore, the study addresses a critical gap within interior architecture education by promoting a curriculum centred on empathy and inclusive, human-centred design approaches. It contributes to the future of design education by exploring the potential of multidisciplinary methodologies and pedagogical innovations within the field of interior architecture. Consequently, this study presents a significant model for shaping the future landscape of design education.

INTERIOR ARCHITECTURE DESIGN WITH EMPATHY FOR DISABLED PEOPLE

Globally, the idea of designing for the disabled is regarded as a social responsibility. Numerous non-governmental organizations develop programs to assist people with disabilities in integrating into society and avoiding discrimination against them. They also propose creative projects to increase public awareness. The field of interior architecture, which primarily concentrates on people and their needs, has numerous responsibilities in this regard. Place is best described as "the space that separates people from the environment to a certain extent and is suitable for them to continue their actions." (URL-2). By analysing the components that make up the space and the overall user relationship, an area can be defined as a space. Because a person's space is an integral part of their physical and social everyday life, it should be able to satisfy needs for things like privacy, security, shelter, and aesthetics. Equal usage rights for a disabled person must be provided in space design that caters to the needs of a normal individual (Artün, 2018). A space doesn't meet design standards for everyone if it doesn't fulfil a purpose for everyone in an equitable manner. Addressing the psychological and social challenges faced by individuals with disabilities constitutes a professional responsibility rather than a mere preference. It is essential that design initiatives focus on developing solutions that effectively meet their physical needs and mitigate the obstacles they encounter in their daily lives. Rather than basing a product on standard human measurements and behaviours, the designer should create solutions that are appropriate for all user types to access and use (Hacıhasanoğlu, 2003). (Imrie, 2000), highlights that when designers consider the needs of people with disabilities in their work, they assess disability as a single movement disorder and reduce it to a wheelchair user. As per (Barnes, 2019), report on congenital visual impairment, the notion of cognitive impairment has not been broadened or accorded the same treatment as physical disability. Disability is often obscured within the interplay between the built environment and the surrounding context. In contemporary society, disability is predominantly perceived as a medical issue rather than an environmental concern. Consequently, the wheelchair—developed out of necessity—illustrates a nuanced social incompatibility, implying that such devices may serve to alleviate certain challenges associated with disability. (Guffey, n.d.).

Disability, as outlined by (Pinna et al., 2020), is not solely an issue that affects a limited segment of the population; rather, it is a phenomenon

that has implications for society as a whole and that individuals may encounter at various stages throughout their lives. The understanding of disability can be enhanced through the application of universal design principles, which acknowledge that this condition may arise at any point in a person's life and highlight its importance. Furthermore, it is essential for individuals to recognize that the process of aging will inevitably lead to some degree of physical, neurological, and psychological disabilities, irrespective of whether these impairments are the result of accidents or are inherent from birth.

With the right precautions in modern living environments, the physical, psychological, and social challenges that people with physical and cognitive disabilities face in trying to adapt to society can be eliminated. Still, according to (Morris, n.d.), comprehending an individual's-built environment requirements cannot be achieved only through understanding their disability circumstances. It also necessitates comprehending the requirements of the disabled person in light of their interactions and mobility restrictions within the built environment. Specifically, there is a cause-and-effect relationship between how physically disabled people use the built environment and how disabled they are. Living spaces must be managed with the same variability due to the differentiation of disability status and the need to privatize situations such as varying degrees of vision, hearing, movement limitation, and mental disability as much as possible. Currently, the most important thing is to ensure that people with disabilities do not experience marginalization in the built environment that has been tailored to their needs (Hacıhasanoğlu, 2003) states that healthy people respond differently to stimuli based on how they interpret their surroundings and experience them. Responses to stimuli within the built environment can manifest in various ways, including adaptation to the stimulus, experiencing discomfort, encountering challenges, seeking solutions, or maintaining neutrality. It is imperative to recognize that individuals with disabilities must invariably respond to the numerous obstacles they face in these environments. From this perspective, it becomes apparent that people with disabilities are constrained in their reactions during the stimulus-response interaction, which subsequently and detrimentally impacts their quality of life. This illustrates how the design process frequently simplifies the representation of individuals with disabilities to merely those who use wheelchairs. It is essential to comprehensively assess the diverse needs of individuals with disabilities, acknowledging the varying degrees and types of physical and mental impairments they may experience. Solutions that adhere to established design standards should be developed inclusively, ensuring that distinctions among individuals are eliminated in the final designs. Disregarding the needs of individuals with disabilities has frequently been a feature of the design and development of the built environment. (Barnes, 1991), asserts that designers frequently overlook the needs of people with disabilities and fail to take these needs into account during the design process. This

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essentially results from not being able to fully anticipate the expectations due to ignorance of the disabled person's body, deficiency and behaviour. The designer's capacity for empathy needs to be highlighted for this.

By placing oneself in the other person's shoes, empathy is the effort to comprehend or experience the viewpoint, emotions, and thoughts of another person (Ersoy & Köşger, 2016). Everyone must communicate with others at all stages of life, including childhood and adulthood. Empathy is a talent that plays a significant role in enhancing interpersonal relationships. This significance has led to the inclusion of numerous structured training programs in the curriculum, particularly for young children, intending to develop empathy skills. The goal is to acquire sensory and cognitive skills that enhance the capacity for empathy (Ersoy & Köşger, 2016). Cognitive empathy ability happens when an individual first recognizes how they are different from the other person, and then, through internalizing the feeling, they are able to discern the other person's situation and emotion (Hoffman, 1984). The capacity to understand and respond emotionally to the feelings of others is known as emotional empathy (Thompson & Gullone, 2003). It takes time and a variety of lessons to develop both cognitive and affective empathy. When a person's empathy grows, they start to behave different from other people and are able to understand the value of life and the motivations behind other people's actions (Kaukiainen et al., 1999). For a designer, empathy encompasses the comprehension of an individual's thoughts, feelings, and both physical and emotional needs within the context of their challenges. This understanding is essential for developing effective solutions that address the specific problems faced by the individual (Noraslı, 2023). It will be possible for people, particularly in the design field, to create design strategies that adhere to design standards for all parties involved during the design process and to meet the needs of people with various kinds of disabilities by developing cognitive and sensory empathy with users. In the design process, this is less of a need and more of an absolute must.

Determining the expectations and needs of disabled people also requires involving them in the design process. An application study conducted in the works of (Merit et al., 2022), has shown why and how crucial it is for physically disabled users to participate in the architectural design process, as well as the reasons behind this lack of participation. The design remains merely an artistic and aesthetically pleasing concept if disabled users are not involved in the process. Architecture will always be referred to as a visual art rather than a physical art as long as it is recognized as a discipline (Bloomer & Moore, 1977). This situation demonstrates that, while maintaining an awareness of human needs in the physical environment, modernist design approaches must take into account impartiality and homogeneity as well as socio-spatial tendencies and practices in accordance with inclusive design elements.

(Shahrom & Zainol, 2015) assert that inclusive design is an idea that ought to be applied in the education of all parties, including the

manufacturer, user and designer. This includes reviewing the design process and assessing pre-existing designs. In light of this, the inclusive design ought to have several features, including being low effort, practical, flexible, useful, applicable, egalitarian, safe, low error tolerance, easy to use, perceptible and safe. Environments that satisfy the requirements and expectations of all groups, including those who are physically impaired, visually impaired, hearing impaired, sensory impaired, neurologically impaired, wear glasses, are pregnant, elderly, young, or have children, are examples of inclusive design. According to (Osman & Gibberd, 2008), societies are set and unchangeable, but individuals are malleable and flexible from a medical standpoint. From a social standpoint, it contends that prejudice and exclusion that individuals encounter are products of society and have nothing to do with their disabilities. It encourages the configuration of a non-segregating-built environment, which is consistent with the inclusive design focus. The opportunities an architectural space provides for a person are a good indicator of its quality. Creating architectural spaces that comply with universal design standards—such as providing equal opportunities, ensuring appropriate relationships between space and equipment, and incorporating structural features that are conducive to human use—can significantly enhance the inclusiveness of these environments (Arat, 2017).

Within the discipline of design education, inclusive design is viewed not as a static set of design standards but rather as an evolving philosophy. This comprehension is universally valued, irrespective of an individual's disability; it can be applied equitably; it is both practical and aesthetically pleasing; it can evolve and adapt with its users. Put differently, from the standpoint of the overall user group, it entails carrying what is appropriate for everyone in every circumstance and location (Persson et al., 2014). (Lamirande, 2022) claims that inclusive design features are employed to remove the disadvantages faced by the elderly and disabled. It is the designer's responsibility to resolve the complexity involved in adapting these design efforts so that groups deemed to be minorities can use them. Instead of creating band-aid fixes, the designer should be able to create environments that will help both healthy people and people with disabilities and other disadvantages. The designer must demonstrate proficiency in empathy and observation. Each design generated as a result of these competencies should be meticulously examined and evaluated. It is essential that the space or product created is of consistent quality and efficiency for all users. To effectively address the specific challenges that disadvantaged individuals may encounter, designers ought to develop designs that are visually distinct, consistently clear, simple yet aesthetically pleasing, well-balanced, and easily controllable. Additionally, it is essential to provide alternative options for access and usage. In this way, both the created space and the user will be positively affected. Inclusive design, as articulated by (Alhusban and Almshaqbeh 2023), signifies that spaces

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must be inherently constructed to meet the diverse needs of all users, including individuals with disabilities, without necessitating alterations. This concept advocates for a built environment that is both accessible and functional, enabling individuals to navigate their surroundings without encountering barriers or requiring assistance. Promoting the social inclusion of people with disabilities is essential in the creation of such an accommodating environment, fostering a society that values diversity and equality.

MATERIAL AND METHOD

Research examining the needs of individuals with disabilities is continually expanding in contemporary society. Nevertheless, existing methodologies often fail to adequately address the diverse requirements of people with various disabilities. Current design approaches predominantly focus on a singular disability, which can lead to unfulfilled needs and substantially impact the comfort levels of those affected. This study considers the domains of interior architecture and cinema to elucidate the educational objectives of inclusive design and empathy, particularly through the implementation of a workshop experience. The Scamper method involves a series of steps designed to shape the design elements that will be presented in the workshop. It consists of asking questions to address a problem or considering various aspects of an opportunity. In 1953, Alex Osborn made the initial proposal for the Scamper method. Bob Eberle later used it to investigate children's perception, creativity, and imagination (Serrat, 2017).

The Scamper technique is recognized in the literature as an effective method for fostering creative thinking and developing innovative solutions across various disciplines. This method has proven to yield innovative and functional outcomes in areas such as product design, industrial design, education, architecture, and marketing. According to (Serrat, 2017), the SCAMPER technique plays a significant role in design and creativity processes, particularly within the product design framework. It facilitates creative thinking, enhances existing products, and generates innovative solutions. (Serrat, 2017) further asserts that the SCAMPER method possesses the capacity to produce more unconventional and innovative solutions when compared to traditional approaches to problem-solving. When employed as a cognitive strategy, it serves to guide designers in the pursuit of creative solutions. (Hassan, 2023) conducted a study with students from the Graphic Design Department at the Faculty of Design and Art, emphasizing the crucial role of idea generation through the SCAMPER method. The study highlighted this method as a means to cultivate the creative potential of students. Findings indicated that applying the SCAMPER technique in design activities positively influences graphic design students and provides a systematic approach that significantly enhances the idea-generation process in a structured manner. In a study conducted by (Aydın İ. and Çilci N., 2020) during the 2018-2019 academic year, students in the 5th and 6th grades participated in a six-week examination as part of a

Turkish language course. The study included both experimental and control groups, which were tasked with creating a new text based on a free reading sample derived from their textbooks. Statistical analysis of the collected data indicated significant differences in creativity, with the experimental group demonstrating superior quality in the texts produced compared to their control group counterparts. (Suh, S., 2019) aimed to formulate questions that enhance the effectiveness of the SCAMPER method in fostering creativity within the realm of fashion design. Given that the fashion design process encompasses multiple stages, including concept development, material selection, and colour planning, the study emphasized the formulation of queries particularly focused on design sketches and sample development processes. This methodological approach enables fashion designers and students to generate broader and more impactful creative ideas. (Perez J.E., 2024) sought to introduce an innovative management model aimed at enhancing capabilities within product and business processes. The research asserted that a coffee company could achieve significant improvements in its product offerings and organizational structure by integrating predictive collective intelligence strategies along with the SCAMPER technique. The findings suggested that this combined approach effectively contributed to sustainability and innovation within the evaluated companies. (Boonpracha, J., 2023) explored the creative idea generation processes of students engaged in product design utilizing the SCAMPER technique. Throughout an eight-week design activity, evidence demonstrated that the SCAMPER technique significantly facilitated the generation of creative solutions to existing product challenges. The results were assessed based on four components indicative of creativity: efficiency, flexibility, originality, and detail, thus affirming the technique's efficacy in nurturing creative idea generation among participants. (Özyaprak et al., 2019) structured their investigation around a design and story-writing task developed by the authors themselves. They established a training program that integrated SCAMPER and self-regulated learning techniques, applied to both experimental and control groups. The evaluation of results focused on fluency, originality, innovation, flexibility, elaboration, and workability. The data indicated that self-regulated learning constitutes an effective method for enhancing creative thinking and proficiency in utilizing the SCAMPER technique.

The SCAMPER method is underpinned by various research studies that emphasize innovation, product development, design, education, and other creative sectors. This method entails a structured approach that incorporates a series of inquiries organized into seven distinct steps, facilitating the development of a subject, problem, or product. Each letter in the acronym S-C-A-M-P-E-R represents a unique creative thinking strategy, which contributes to a systematic approach in the creative process (Figure 1.).

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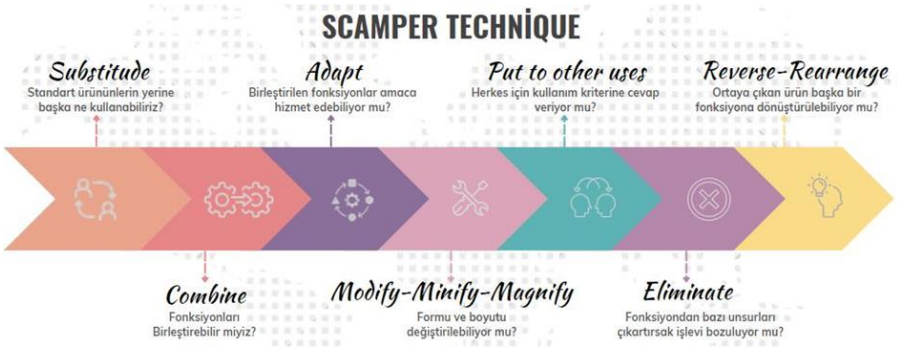

Figure 1. Scamper Technique Flow Chart

- ✓ Substitute: What other products can be substituted for standard ones? What else, for instance, could be utilized in place of a work area and a typical bed unit?
- ✓ Combine: Does the product have the ability to combine? Can various functions be used together, for instance?
- ✓ Adapt: Can the combined functions accomplish the intended goals?
- ✓ Modify, Minify, Magnify: Is it possible to alter the product's shape and dimensions?
- ✓ Put to other uses: does it adhere to inclusive and universal design principles?
- ✓ Eliminate: Will the product's functionality be compromised if certain components are removed?
- ✓ Reverse, Rearrange: Can the resulting product be converted to another function?

This study aims to involve students in a collaborative learning process by employing the SCAMPER method, which is frequently utilized in various educational programs today, within the context of interior architecture. This methodology is designed to enhance students' creative thinking and problem-solving capabilities while simultaneously fostering the development of innovative solutions through teamwork. During the workshop, students will be presented with a series of questions aligned with the steps of the SCAMPER method, specifically customized for the modules developed to address Christy Brown's requirements. This approach will facilitate students in generating creative solutions during the product design phase by guiding them to provide thoughtful responses to the relevant questions outlined below.

Creative Idea Development Process with Scamper Technique

From Scenario-to-Space workshop, which is intended for undergraduate students in Selçuk University's interior architecture department, covers the relationship between inclusive design and empathy within the framework of the Scamper method as well as how to interpret design by adopting a fresh viewpoint.

The movie 'My Left Foot', which chronicles the real-life story of Christy Brown, who has multiple disabilities and can only use his left foot due to congenital cerebral palsy, served as the inspiration for the workshop. The workshop was conducted in three stages. The first stage involved a brief interview followed by a presentation on the topics of disability, including

what it is, what needs disabled people have, and how we can better understand them (Figure 2.).

Figure 2. Workshop idea development process

At this stage, the design students were made aware that individuals with disabilities represent a significant segment of society, comprising 16%. By emphasizing the challenges that this group encounters in the physical environment, the goal was to foster awareness that an essential objective of design is to enhance the quality of life for people with disabilities. In the second phase, participants watched the Christy Brown biographical film "My Left Foot" in a workshop setting. Christy Brown's autobiographical film conveys to viewers the challenges he faced as a result of his disability, as well as his aspirations and expectations. The artist was able to closely observe his spatial requirements and the challenges he faced in his living space thanks to the movie, which was primarily edited inside a house (Figure 3). In the cinematic fiction, it is clearly stated that the first thing the artist needs, especially in the house he lives in, is a living space of his own.

Figure 3. Interior scenes in intersections of my left foot

Students were asked to create a living area for the main actor in this scenario. Christy Brown uses this space for sleeping, getting dressed, eating, drinking, relaxing, and engaging in hobbies. Living areas are crucial for people with disabilities. Those created with disabled people in mind will improve their comfort and, consequently, their quality of life. Disabled people encounter many challenges when trying to socialize and integrate into society. Hospitalization rooms need to be carefully planned, especially for people with physical disabilities. Weariness from standing still all the time, requiring assistance to get around, and pain

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from their orthopaedic condition can all have a detrimental impact on the user's life and health. Because of this, design concepts that may differ should be developed with the user's disability in mind. The relationship between the bed, window, and door should be properly constructed during planning. In terms of natural ventilation, lighting direction, and visual comfort, the bed's placement should all be considered in relation to the window. The shape of the bed, its orthopaedic comfort, and its accessibility based on the disability are the most crucial aspects to take into account; however, the design of the bed should also avoid isolating or stigmatizing the disabled person. The disabled person's use should guide the placement of all other furniture in the sleeping area. It is important to make sure that nothing prevents users from accessing the content. The dressing area is another thing to think about in sleeping units. Depending on the disabled person's level of disability, these areas' dimensions, locations, and functionalities should change. For example, a visually or hearing-impaired individual will not have any problems accessing wardrobes of standard size and appearance. A physically impaired person won't be able to access or use them comfortably, though. Wardrobe placement should therefore take the user's disability into consideration. Even though designs can be made in sizes and shapes that are unique to the user group, furniture that can be moved with digital screens to take advantage of new technological opportunities helps make spaces easier to use. Once more, the user's interests should be carefully considered when designing hobby areas within the living space. For example, Christy Brown's physical disability limits what he can do in the hobby area that is specifically designed for him. The user's needs should be able to be met by the hobby areas that are to be created appropriately.

Specific to all these parameters; students were instructed to empathize with the artist in the first phase of the study to comprehend the journey Christy Brown went through. They were asked to jot down some ideas regarding the issues that were not verbally expressed but were seen from the viewpoint of a designer to comprehend the artist. These concepts constitute the essence of the message to be given. Concepts are representation and presentation methods designed to ensure that the idea to be put forward is understood. According to (Dodsworth & Anderson, 2019), the concept is "a reference for the designer and a basis for the development of the design process, which can control all the decisions made during the design process, such as the appearance of the space, the atmosphere and the elements." These concepts serve as the foundation for the design and the conceptual framework. In order to accomplish this, the participants employed a method of transfer to visualize and articulate the concept they had established. The originality of the design, along with the quality it achieves, is realized through the process of concretizing the concept and effectively translating it into the design.

In the third phase of the workshop, team members were asked to design a living space without any limitations in space and area in order to

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produce solutions that would meet the needs of the artist who is known to have lived in the 1930s, if he had lived in today's conditions, within the framework of today's technological opportunities. The problems and abstract concepts that have been identified are closely related to the type of product that needs to be produced. Every product designed in the workshop was assumed to address the issues identified by the Scamper method. By asking each other questions, the team members revised the ideas they presented during the collaborative design process. Six distinct scenarios and result products were produced during the workshop; four of these could be used with the steps of the scamper method, while the other two could not be used with it. The workshop, which took an entire day and was conducted in group settings, yielded a comprehensive array of final products and content, which are presented in detail below.

FINDING AND DISCUSSION

Freedom Team: "I felt isolated, confined to my own world, unable to interact with people, and kept out of their lives and activities as if there were a glass wall dividing my existence from theirs..." The work's concept scenario—epiphany, which refers to an unexpected awakening and awareness—is assessed in light of Christy Brown's admission in the film about his loneliness. Christy Brown's journey back to his true self, his realization of who he is via understanding his thoughts and creations, and his liberation from an oppressive life form the central arc of the work. The foundation of Solution 2 is a glass-covered living area. The space's module is made to respond to activities such as eating, drinking, sleeping, resting, and performing arts. The module was created in a way that would not marginalize a normal person by following inclusive design guidelines, rather than for someone with an external disability. Christy Brown's bed unit will be accessible because of the elevator platform that is directly in front of it. The wardrobe next to the bed features a digital sliding mechanism. The user will only need to press one button to access it thanks to this mechanism. The workspace, which accommodates readings and artistic endeavours, is likewise equipped with an elevator and a digital system. The artist will be able to freely create his art and establish a connection with nature in this way. The Freedom team's concept, scenario, sketch, 3D models, and concept sheet are all shown in great detail in (Figure 4.).

Figure 4. Freedom team's working diagram

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Compassion Team: The artist's mother was his greatest benefactor throughout his life, demonstrating the impossibility of obstacles in the face of compassion and faith. This was seen as establishing the definition of "compassion" and demonstrating that in Christy Brow's case, the seemingly impossible was, in fact, impossible. Under the heading of "design for everyone," practical designs and comfortable spaces that allow the artist to carry out numerous daily tasks in one location were introduced during the design phase. The use of soft tissues and their reflection in the environment concretize the softness perception that compassion, an abstract concept, evokes in the individual. For Christy Brown's daily activities and hobbies, an organic-shaped sleeping unit integrated with the floor was designed, and the soft-textured materials used on the surface complemented the concept. The patient must always lie in a supine position, a sky window was built directly above the sleeping area. He has a place to work on his daily artistic projects because of the seating unit and the angled work surface made of amorphous forms. The living space's aesthetic elements have been completed with the use of the artist's own works, and if he regularly views his creations, he will continue to be convinced that he has accomplished the seemingly impossible. (Figure 5.) presents the compassion team's concept, scenario, sketch, 3D models, and concept sheet in detail.

Figure 5. Compassion team's working diagram

Entity Team: The concept of "entity" was established in the story's concept scenario, which showed how Christy Brown—who was believed to be mentally disabled at birth—was able to come back to life with the help and belief of his mother and other family members, and how an invisible character became visible through extraordinary efforts and accomplishments. Existence in the universe or thought has been assessed as the definition of entity. The space setup's use of the dominant dark blue colour aligns with the artist's goal of making his presence in society known. The amount of colour that dominates the room is directly correlated with how visible and present Christy Brow is in daily life. The artist's living conditions have been attempted to be enhanced through the use of modular and functional furniture that is designed based on the user's disability. A functional computer complete with a hanging bracket was positioned in the working unit of the living area, which was designed

with technological approach elements in mind. In this manner, voice control and button-based movement of the module are possible. A large window surface in an organic form was created at the intersection of the ceiling and the headboard, by the design approach that integrated daylight and nature. The user can easily access the area because the lying unit is positioned on the floor at an angled and softly shaped elevation. Touch panels will be used to access storage and HVAC systems. (Figure 6.) presents the entity team's concept, scenario, sketch, 3D models, and concept sheet in detail.

Figure 6. Entity team's working diagram

Sky Team: Christy Brown's film editing highlights the artist's constant window-sitting as a way to reveal his connection to life. This is attributed to the artist's desire to be involved in life, through a transparent surface, and his observational spirit. The notion that Christy Brow took in his surroundings and adapted them into sketches and writings led to the conclusion that opening up the living area to the outside world was more of an obligation than a necessity. The living area is designed as a circular space with windows on all appropriate surfaces, including the walls and ceilings, which can open to the outside. Sun control was implemented on window surfaces through the use of a remote-controlled curtain system. The sleeping unit's circular appearance and curvilinear elevation on the floor contribute to the balance of the form-space relationship. A digital mechanism has been utilized to create a movable channel on the living area's floor. The artist will have easy access to the desired area of the venue because of the seating unit that is positioned on the channel. Space is saved and storage areas that are appropriate for the artist's use are created because of the work surface's ability to open and close. (Figure 7.) presents the Sky team's concept, scenario, sketch, 3D models, and concept sheet in detail.

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Figure 7. Sky Team's Working Diagram

CONCLUSION AND RECOMMENDATION

The research was created during a workshop on applying the Scamper method, which is widely applied in many modern educational initiatives, to the study of interior architecture. Asking a series of questions to solve a problem or taking into consideration other aspects of an opportunity is known as the Scamper method. The final products, encompassing the spaces and modules developed for Christy Brown, were presented for evaluation to a jury comprising four members. This jury included workshop managers who possess expertise in the field of accessible design, as well as faculty members from the Interior Architecture Department at Selçuk University. The assessment focused on the quality of responses regarding the functionality of the final products within the context of the SCAMPER method, with each aspect being evaluated separately. Consequently, it was determined that every final product addressed the questions and was appropriate for the steps of the scammer method. The study's evaluation table is shown below (Table 1.).

Table 1. End Products Evaluation Chart

QUESTIONS ABOUT THE SCAMPER METHOD		ÖZGÜRLÜK EKİBİ	ŞEFKAT EKİBİ	VARLIK EKİBİ	GÖKYÜZÜ EKİBİ
Substitude	What other products can be substituted for standard ones? What else, for instance, could be utilized in place of a work area and a typical bed unit?	✓	✓	✓	✓
Combine	Does the product have the ability to combine? Can various functions be used together, for instance?	✓	✓	✓	✓
Adapt	Can the combined functions accomplish the intended goals?	✓	✓	✓	✓
Modify Minify Magnify	Minify, Magnify: Is it possible to alter the product's shape and dimensions?	✓	✓	✓	✓
Put to Other Uses	Does it adhere to inclusive and universal design principles?	✓	✓	✓	✓
Eliminate	Will the product's functionality be compromised if certain components are removed?	✓	✓	✓	✓
Reverse Rearrange	Can the resulting product be converted to another function?	✓	✓	✓	✓

The goal of design education is to create a framework that, in addition to the knowledge acquired from previous instruction, will generate novel and creative works based on recent fiction. This can be achieved by teaching designers to question, criticize, observe, sympathize, and

generate new ideas from a wide range of viewpoints. The limited design education found in conventional teaching approaches limits students' capacity for original thought and may be detrimental to their ability to think creatively. Maintaining a balance in the teacher-student relationship is essential to libertarian design education. Within this framework, the workshop —which is conducted voluntarily and without regard to grades—are illustration of instructional models appropriate for the liberal learning approach. Workshop uses a method that fosters collaboration between the teacher and the student and advances learning through idea sharing. Specifically, because of its flexibility and collaborative environment, the inclusive design and empathy-based "From Scenario to Space" workshop helped students develop their liberal thoughts and stimulated their creative thinking.

In this sense, the research involves assessing through a workshop, study the potentials and learning outcomes that can arise from approaching the fields of interior architecture and cinema with an empathy-based approach. Below is a list of the learning objectives that the "From Scenario to Space" workshop offered. This particular method is centred on inclusive design and empathy.

- Collaborative learning has been enhanced by applying the Scamper method to the discipline of interior architecture, resulting in an activity-based thought process.
- Thanks to its flexibility, it has helped students develop their liberal ideas, which has broadened their creative thinking process.
- Students gained the ability to design specifically for the user group identified for the shift from abstract to concrete concepts.
- They acquired the proficiency to devise a new approach utilizing abstract concepts.
- They also developed the capacity to generate solutions using the problem-oriented design development model.
- Disability status and variations in disability status have contributed to producing solutions suitable for user needs and expectations according to these differences.
- The method conveyed the ability to develop a design approach for disabled people through the perspective of empathy, enabling the students to understand the lives of different types of users according to their disability.

The study's focus, inclusive design, brings attention to the idea of egalitarian design, which will enable people with disabilities to exercise their cultural and social rights without facing discrimination and will result in solutions for environmental and everyday challenges. The study has indicated that interior architecture design students derive substantial benefits in terms of learning and experiential knowledge when they engage in the evaluation of spaces and products designed for ease of use by individuals with physical disabilities, in accordance with established inclusive design standards. The Scamper method helped students learn how to evaluate information, identify its flaws, gather the

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data needed for development, come up with original solutions, and develop ideas, products, and problems that already exist. As a result, by integrating inclusive design principles into the curriculum of interior architecture, this initiative aims to improve the quality of life for individuals with disabilities through innovative practices. Within the framework of the SCAMPER method, aspects such as inclusive design, education, research, technology, and empathy will be assessed in conjunction. This holistic approach will facilitate the development of interactive design tools and maximize the utilization of technological advancements. Furthermore, the frequent application of environmentally sustainable and accessible furniture will be prioritized, along with a preference for dynamic and flexible furnishings. Ultimately, these efforts will yield designs that are more accessible, adaptable, and user-centric.

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Resume

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Parking Suitability and Site Selection Analysis Using GIS-Based Multi-Criteria Decision Analysis Techniques: AHP, TOPSIS, and VIKOR – A Case Study of Pendik District (Istanbul)

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Abstract

Demand for parking areas has increased with the growing population and increasing number of vehicles. Large cities are suffering from a lack of parking areas, which are one of the most significant parts of the modern urban transportation system and traffic management. Locating parking areas has become a major challenge for the urban transport planners, especially in the downtown of metropolises. Geographic Information Systems (GIS) with geographic analysis tools can provide a scientific approach to determine optimum locations for parking areas. In this paper, the essential factors affecting parking site selection were considered and data sets concerning these factors were created by GIS analysis techniques. The Analytical Hierarchy Process (AHP) as a Multiple-Criteria-Decision-Analysis (MCDA) method was applied to derive weights of the selected parameters. To conduct parking demand analysis, the parking suitability map was produced by integrating the GIS with AHP. Then, suitable parking areas were determined in a zoning plan that was based on the highest suitability on the map. Other MCDA techniques including TOPSIS and VIKOR were examined and compared to determine the order of preferences among suitable parking areas. Similar to the traditional AHP method, the same results were obtained in the ranking of parking areas with the other methods. Using GIS with these MCDA techniques appears to be a usable approach for better resource allocation as well as parking site selection.

Keywords:
Parking demand, Parking suitability, Site selection, GIS, MCDA.

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INTRODUCTION

The changes in lifestyle and working disciplines have led to an increase in urbanization with more people moving to urban areas (Alkan & Durduran, 2021). The increased number of people has negatively impacted urban transportation systems through a rapid increase in vehicle numbers. Therefore, most metropolitan and developed cities suffer from a lack of parking areas that play an important role in modern urban transportation and traffic management (Jonuzi et al., 2024).

Vehicle parking areas have an important part in the modern transportation system and play an essential role in reducing traffic congestion (Kazazi Darani et al., 2018). Traffic is considered one of the main challenges of urban transportation management (Hensher and King 2001). Optimal location of parking areas not only increases the efficiency of parking activity but also reduces the marginal parking (Jonuzi et al., 2024). This in turn will increase the width of the streets indirectly which would improve the traffic flow (Karimi et al. 2009). Wrong decisions may cause inefficient traffic management of urban transportation systems, economic loss, and increased environmental degradation (Hosseinlou et al. 2012).

Accurate decision-making for the determination of parking areas is vital especially in metropolitan cities associated with high vehicle ownership rates, to ensure the transportation of people without any disruption (Selcuk Demir et al., 2021). Determining optimum locations of parking areas is directly related to disparate parameters and their relative importance. Selecting parking areas using the traditional methods cannot give us reliable results because these methods are limited by the narrow spectrum of parameter evaluation during parking area allocation. In some cases, the use of traditional methods would result in parking areas being located far away from the travel absorption centers and far from busy streets, which have negative impacts on traffic loads. It is therefore essential to develop an approach that considers all the effective parameters simultaneously. An example of such an approach is the integration of a Geographic Information System (GIS) with a Multiple-Criteria-Decision-Analysis (MCDA) that has been extensively used in selecting suitable areas for the last two decades (Jelokhani-niaraki and Malczewski 2015).

GIS is widely recognized for its capability in performing geographic analysis (Butt et al., 2017), which is designed to manipulate and manage geographic data in various thematic applications (Wang et al. 2009). The ability of GIS analysis techniques is well captured in scientific literature. This increases the reliability of results for selecting suitable areas, particularly the parking areas (Aliniai et al. 2015).

MCDA is a set of processes for analyzing complex decision-making problems. It aims to establish a connection by dividing the decision problem into small, simple, and understandable parts so that a meaningful result can be obtained from these parts (Malczewski 1999).

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MCDA methods are used as a decision-support system for complex problems where environmental, economic, social, and technical objectives are involved (De Montis 2000).

Selecting a suitable location for the parking area is a multi-criteria decision-making problem, as it depends on various parameters. The GIS integrated with the MCDA approach allows for the study of complex problems and provides sufficient results to decision-makers. This approach has the ability to analyze multiple essential parameters simultaneously for selecting parking areas effectively. Numerous studies and research have focused on parking area selection problems by using GIS-based MCDA techniques. Jonuzi et al., (2024) used combined application of GIS and AHP techniques for the selection of new parking areas. Alkan & Durduran (2021) employed the GIS-AHP technique to identify optimum locations for parking facilities within the city of Konya. Demir et al., (2021) employed GIS-based Fuzzy AHP approach to determine optimum locations for parking supply in the four districts of Istanbul. Some authors used other MCDA methods related to parking site selections. Aydinoglu et. al., (2024) used Best Worst Method (BWM) and Fuzzy Logic (FL). Ozturk & Kilic-Gul, (2020), Aliniai et al, (2015), Jelokhani-niaraki and Malczewski (2015) used Ordered Weighted Average (OWA) method. Palevičius et al., (2013) employed the Complex Proportional Assessment (COPRAS). Darani et al., (2018) used the integration of Fuzzy AHP and the technique for order preference by similarity to ideal solution (TOPSIS) to locate a new public parking lot in Tuyserkan, Iran. And Samani et al., (2018) and Farzanmanesh et al., (2010) utilized AHP and Fuzzy Logic for parking site selection.

It's essential to develop an approach that considers all the effective parameters simultaneously and also to determine the best suitable parking areas in the transportation planning of metropolitan and developing cities. According to these considerations, the objective of this study is to design a geographic analysis method for determining suitable parking sites in urban metropolitan areas and to prioritize suitable parking sites. In the method section, the AHP technique was used for determining weights of effective criteria and TOPSIS and VIKOR techniques were examined for giving priority to the suitable parking areas. In the case study section, the Pendik district of Istanbul was explored to test the methods. A parking suitability map was produced, and priority was determined for the suitable parking areas by using GIS and MCDA methods. In the last section, as a new hybrid approach, these techniques and prioritizing results were examined and compared.

METHOD

The methodology used in this study is explained in Figure 1. Firstly, criteria for parking suitability were examined. The AHP method was considered to compute criteria weights as explained in this section. To create a pairwise comparison matrix among parking criteria, a

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questionnaire survey was designed and distributed among researchers and experts from the Parking Authorities of Istanbul Metropolitans Municipality. According to the survey results, criteria weights were calculated using the comparative matrix. According to criteria weights developed from AHP, data sets were collected for the case study area, and a parking suitability map was created by using GIS analysis techniques. Then, suitable parking areas were determined in the zoning plan, based on the highest suitability on the map.

Other MCDA methods were examined, and TOPSIS and VIKOR were determined to prioritize suitable parking areas. The decision matrix used in both methods consists of alternatives as rows and criteria as columns. Suitable parking areas were used as Alternatives and parking criteria calculated with the AHP method were used as Criteria. Each criterion value of alternatives was calculated with GIS analysis techniques. Then, TOPSIS and VIKOR methods were processed and the results of these methods were compared to prioritize suitable parking areas. These MCDA techniques; AHP, TOPSIS, and VIKOR were examined in this section.

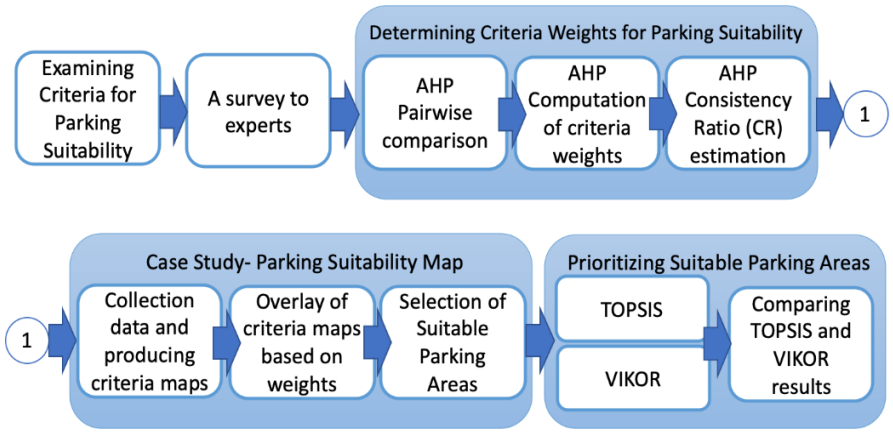

Figure 1. Methodology flow.

Criteria for Parking Suitability

All the criteria affecting physical, legal, and geographical suitability for parking areas have been examined to specify the areas suitable for vehicle parking. The criteria were divided into sub-criteria for the implementation of the MCDA method. Based on literature reviews, experts' opinions, and available data, all criteria were grouped into three main classes including transportation criteria, parking criteria, and travel absorption criteria. It is required to weight the data at the level of criteria and sub-criteria during the implementation of the MCDA technique. Figure 2 illustrates the hierarchy of criteria and sub-criteria for determining suitable parking areas.

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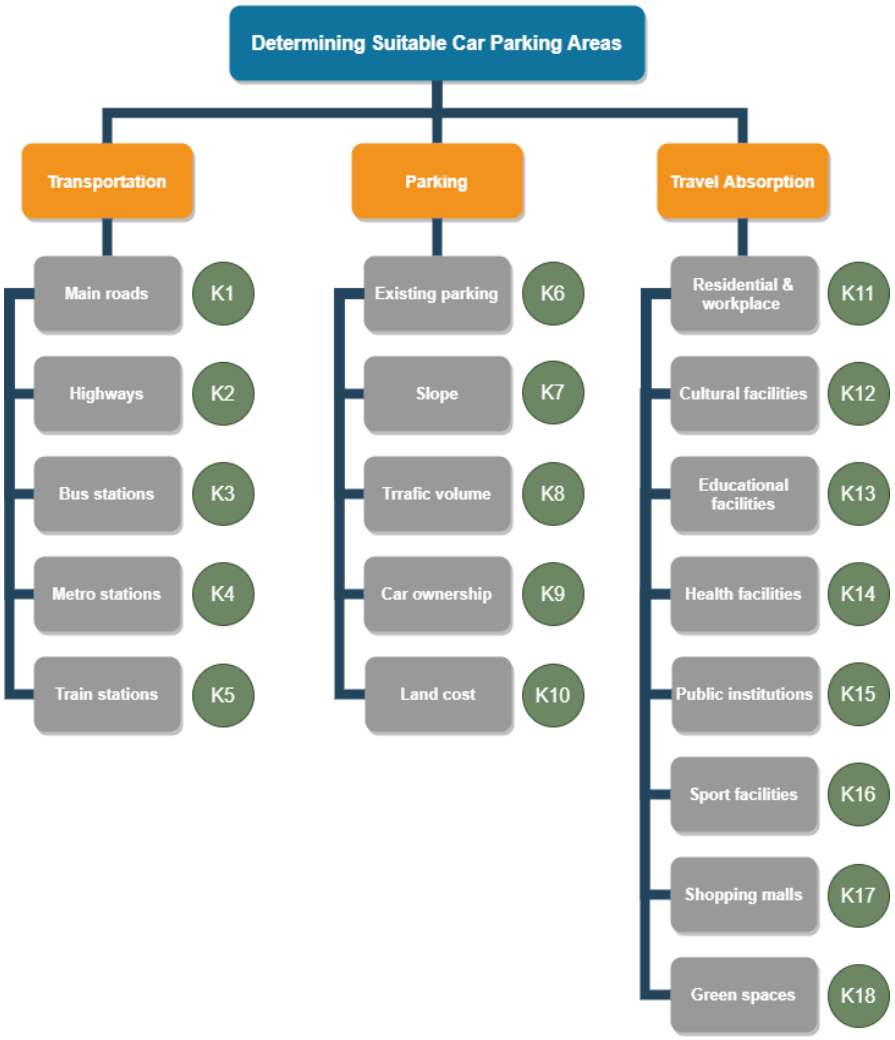

Figure 2. Hierarchy of criteria and sub-criteria.

Transportation criteria: These are significant for the selection of parking areas because transportation facilities attract more travelers than other criteria. Selecting parking locations near highways and transportation stations such as bus stations, train stations, and metro stations, which attract and absorb a massive group of travelers, is a vital factor in allocating parking areas. Moreover, some travelers may park their vehicles in proximity of stations and prefer to use public transport (Demir 2016; Jelokhani-niaraki and Malczewski 2015).

Parking criteria: These criteria include existing parking sites, slope, traffic volume, car ownership, and land cost. Further to these, a limitation factor, such as existing parking, is also included. The location of new parking areas should be far from the existing parking areas (Hosseinlou et al. 2012). Car ownership increases with the number of vehicles joining the traffic day by day. With increasing car ownership, demand for parking and traffic load also increases indirectly. Parking demand increases in places where vehicle mobility is at a high level. Accordingly, the traffic volume also increases in those places or routes. For building a parking area, land cost is one of the desirable factors for experts in transportation and urban management. Experts try to

construct parking areas in places with low land prices. Slope criteria have an impact on accessibility and building a parking area. Thus, to build a new parking area we need to find areas with flat land considering that steep slopes are generally not suitable for building parking areas.

Travel absorption criteria: Travel absorption is related to determining demand for parking areas due to the increased frequency of absorbing travelers. These criteria include shopping malls, educational facilities, public institutions, residential and workplaces, administration buildings, hospital buildings, etc. Allocating parking areas near these facility centers can attract users due to the advantages of parking activities in these centers (Darani et al. 2018; Samani et al. 2018). The distance between the transportation system and these facility centers is also important in view of the experts (Ben-Joseph 2012). The distance should be in such a way that the passengers, employees, and clients reach their destinations from a parking location with minimum walking distance. In this study, regarding the defined criteria and experts' consultations, 1 km is the maximum acceptable distance and is classified into five categories (0-125 m, 125-250 m, 250-350 m, and 500-1000 m).

Analytical Hierarchy Process (AHP)

AHP is one of the Multi-Criteria-Decision-Analysis (MCDA) methods that was first proposed by Thomas L.Saaty in 1980. AHP is an extensively used method that is easy to understand and to manage multiple criteria. In addition, AHP does not require complex mathematics as it measures qualitative and quantitative data effectively (Saaty 1980). AHP allows individual judgments authentically and overlays all the classified criteria to select suitable locations (Ullah and Mansourian 2015).

AHP involves three main principles including decomposition of the problem, pair-wise comparison, and a combination of priorities (Malczewski 1999). In the AHP technique, the crucial issue is to develop a hierarchical structure that breaks down the problem into a hierarchy of goal, criteria, and sub-criteria (Taherdoost 2017). In this study, the hierarchical structure of AHP is illustrated in Figure 2, with the topmost level being the goal, followed by the three main criteria levels which lead to the sub-criteria that is the lowest point of hierarchical structure.

AHP technique can be described in three steps (Ibraheem and Atia 2016) in calculating the weights of criteria: I. Generating pairwise comparison matrix, II. Computation of criteria weights, and III. Evaluation of consistency ratio.

I. Generating pairwise comparison matrix

In this step, we perform the pairwise comparison between the related criteria. Each criterion must be at the same level. The pairwise comparison is undertaken on a qualitative scale where the scale ranges from 1 to 9, each number indicating the relative importance of one

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criterion over other criteria (Saaty 1980). The relative importance of the criteria can be seen in Table 1.

Table 1. The relative importance of pairwise comparison.

Value	Relative importance
1	Equally
3	Moderately
5	Strongly
7	Very strongly
9	Extremely

II. Computation of criteria weights

In this step, first, the sum of each column is calculated in the pairwise comparison matrix. Next, each sum is divided into the matrix by summation of its column where the result indicates the normalized pairwise comparison matrix. The average of weights is calculated in each row of the normalized matrix and the results provide weight of criteria.

III. Evaluation of consistency ratio

The consistency ratio (CR) of the n element is being estimated to ensure whether the judgment is consistent or not. If the CR does not reach the required level then the pairwise comparison should be revised (Lee, 2007). Equation 1 calculates the CR:

$$CR = \frac{CI}{RI} \tag{1}$$

In the above equation, CI is a consistency index that is derived from Equation 2 and RI is a random index that is acquired as given in Table 2 for several numbers of variables (n) (M. Kumar and Biswas 2013), and λ_{max} is the maximum eigenvalue of the pairwise comparison matrix.

$$CI = \frac{\lambda_{max} - \mathrm{n}}{n - 1} \tag{2}$$

Table 2. Values of Random Index

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

The concept of the CR is designed in such a way that if $CR \leq 0.10$ then the ratio expresses a validation of consistency in the pairwise comparisons; if $CR > 0.10$ then the ratio values are inconsistent and require reconsideration of pairwise comparison matrix (Al Garni and Awasthi 2017).

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS technique, being one of the MCDA methods, was first introduced by Hwang and Yoon in 1981. The technique allows for a priority ranking by evaluating alternative options according to certain criteria. The basic principle of the technique can be expressed as choosing the alternative closest to the positive ideal solution and the most distant to the negative ideal solution (Figure 3) (Tzeng and Huang 2011; Beskese et.al 2015).

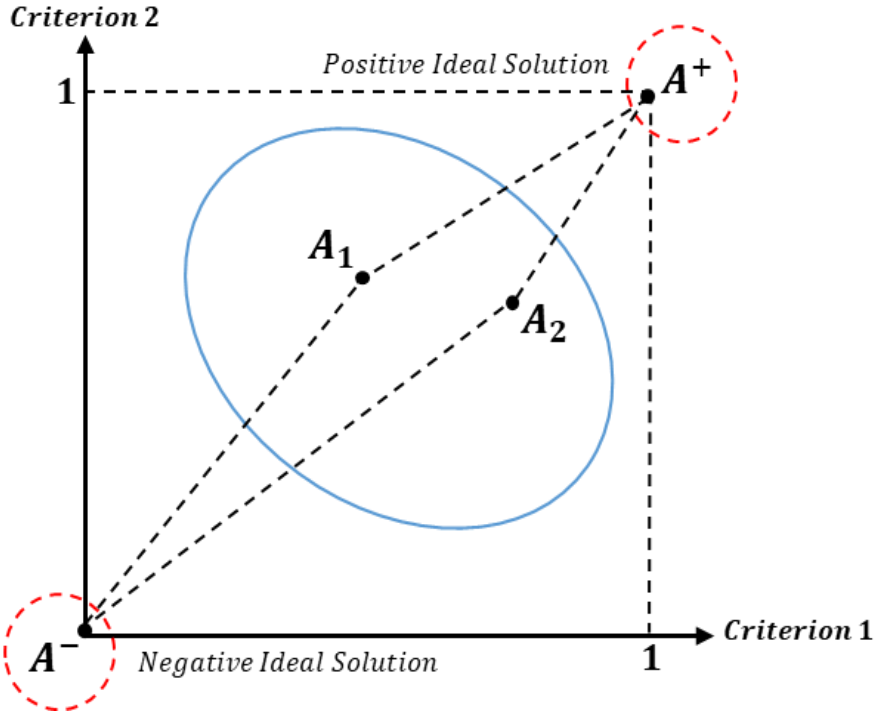

Figure 3. TOPSIS technique (Adapted from Balioti et.al 2018).

TOPSIS is an easy method to understand and interpret without any complicated mathematical expressions and complex algorithms when compared to other MCDA methods. It is also one of the most preferred MCDA techniques in the literature (Behzadian et.al 2012).

In addition, it is advantageous that the TOPSIS technique can work through integration with different MCDA methods such as AHP and FAHP. The TOPSIS technique procedure consists of the following steps. (Darani et.al 2018; García-Cascales and Lamata 2012):

I. Creating the decision matrix (A_{ij})

Firstly, a m x p dimensional matrix is created by the decision maker. While creating the decision matrix, alternative criteria are used in rows, and evaluation criteria are included in columns. The decision matrix can be seen in Equation 3.

$$A_{ij} = \begin{bmatrix} a_{11} & \cdots & a_{1p} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{np} \end{bmatrix} \quad (3)$$

II. Creating the normalized decision matrix (R_{ij})

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The normalized decision matrix is created using elements of matrix A in step 1 and Equation 4. The normalized decision matrix can be seen in Equation 5.

$$R_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \tag{4}$$

$$R_{ij} = \begin{bmatrix} r_{11} & \cdots & r_{1p} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mp} \end{bmatrix} \tag{5}$$

III. Creating the weighted normalized decision matrix (V_{ij})

Weighting is done by multiplying each element of the normalized matrix (R_{ij}) by a weighting factor such as Wi. The value of Wi mentioned here is calculated by the AHP method in this study. It should be noted that the sum of the weights of the criteria is one i.e. $W_i = 1$. The obtained weight coefficients are the only subjective parameter of the TOPSIS method. The matrix is created in Equation 6.

$$V_{ij} = \begin{bmatrix} w_1 r_{11} & \cdots & w_n r_{1p} \\ \vdots & \ddots & \vdots \\ w_1 r_{m1} & \cdots & w_n r_{mp} \end{bmatrix} = \begin{bmatrix} v_{11} & \cdots & v_{1p} \\ \vdots & \ddots & \vdots \\ v_{m1} & \cdots & v_{mp} \end{bmatrix} \tag{6}$$

IV. Determination of positive ideal (A^+) and negative ideal (A^-) solution values

After creating the V matrix, positive and negative ideal solution clusters are created in line to be achieved by considering the structure of the problem. Positive ideal and negative ideal solution values are created with Equations 7 and 8.

$$A^+ = \left\{ \left(\max_j v_{ij} \,\middle|\, i \in I \right), \left(\min_j v_{ij} \,\middle|\, i \in J \right) \right\} = \{v_1^+, \ldots, v_{1n}^+\} \tag{7}$$

$$A^- = \left\{ \left(\min_j v_{ij} \,\middle|\, i \in I \right), \left(\max_j v_{ij} \,\middle|\, i \in J \right) \right\} = \{v_1^-, \ldots, v_{1n}^-\} \tag{8}$$

where i represents benefit criteria, and J represents cost criteria.

V. Calculation of distances to positive ideal (S^+) and negative ideal (S^-) points

Distances from positive and negative ideal solution points are calculated with Equations 9 and 10. Euclidean distance is used when calculating the distances.

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_{ij}^+ \right)^2} \tag{9}$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_{ij}^-\right)^2} \quad (10)$$

VI. Calculation of relative proximity to the ideal solution (Ci^*)

The distances from the positive ideal and negative ideal points determined in step 5 are used in calculating the relative proximity to the ideal solution. Ci^* Value is calculated in Equation 11.

$$\boldsymbol{Ci^* = \frac{S_i^-}{S_i^- + S_i^-}} \quad (\mathbf{11})$$

The Ci^* with a value in the range of 0≤ Ci* ≤1 indicates the relative proximity to the ideal solution. $Ci^* = 0$ indicates the absolute proximity of the relevant decision point to the negative ideal solution, whereas $Ci^* = 1$ indicates the absolute solution proximity of the relevant decision point to the ideal solution. Alternatives are listed with calculated Ci^* values.

VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR)

VIKOR technique, one of the MCDA methods, was developed by Serafim Opricovic in 1998 for the solution of clash problems, which conflict with each other and consist of criteria in different units (Opricovic 1998). The VIKOR method aims to determine a compromised ranking and achieve a compromised solution under the specified weights. The compromise solution is to reach an agreement on all the criteria that are optimally achieved and joint acceptance. The compromise solution is the closest to the ideal solution. The idea of a compromise solution was introduced by Po-Lung Yu in 1973, and later by Milan Zeleny (Yu 1973; Zeleny 1982).

VIKOR prioritizes alternatives and determines the solution named 'compromise' that is the closest to the ideal. VIKOR method can work integrated with other MCDA methods such as the TOPSIS method. The VIKOR process consists of the following steps (Mohaghar et.al 2012; Sennaroglu and Celebi 2018; Opricovic and Tzeng 2004):

I. Creating the decision matrix (A_{ij})

The decision matrix of the VIKOR method is the same as the TOPSIS method. The decision matrix can be seen in Equation 12.

$$A_{ij} = \begin{bmatrix} a_{11} & \cdots & a_{1p} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{np} \end{bmatrix} \quad (12)$$

II. Determining the best and worst values of all criteria

According to the evaluation criteria of all alternatives, the best and the worst values are determined with the help of Equations 13 and 14.

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$f_i^+ = max_j\, f_{ij} \quad f_i^- = min_j\, f_{ij}$ If the i-th function is benefit (13)

$f_i^- = min_j\, f_{ij} \quad f_i^+ = max_j\, f_{ij}$ If the i-th function is cost (14)

III. Normalizing the decision matrix (R_{ij}) and creating a weighted normalized decision matrix (V_{ij})

Normalization is done with Equation 15 to make the decision matrix comparable. The generated normalized decision matrix is represented in Equation 16.

$$r_{ij} = \frac{f_i^+ - f_{ij}}{f_i^+ - f_i^-} \tag{15}$$

$$\boldsymbol{R_{ij}} = \begin{bmatrix} \boldsymbol{r_{11}} & \cdots & \boldsymbol{r_{1p}} \\ \vdots & \ddots & \vdots \\ \boldsymbol{r_{m1}} & \cdots & \boldsymbol{r_{mp}} \end{bmatrix} \tag{16}$$

The normalized decision matrix (R_{ij}) is multiplied by the relevant criterion weights (w_i) to obtain the weighted normalized decision matrix (V_{ij}) as seen in Equation 17.

$$V_{ij} = R_{ij}\, w_i = \begin{bmatrix} w_1 r_{11} & \cdots & w_n r_{1p} \\ \vdots & \ddots & \vdots \\ w_1 r_{m1} & \cdots & w_n r_{mp} \end{bmatrix} = \begin{bmatrix} v_{11} & \cdots & v_{1p} \\ \vdots & \ddots & \vdots \\ v_{m1} & \cdots & v_{mp} \end{bmatrix} \tag{17}$$

IV. Calculation of S_j, R_j and Q_j values

S_j and R_j values for each alternative can be calculated with the help of Equations 18 and 19. The w_i value in the equations represents the weighting coefficient determined for each criterion.

$$S_j = \sum_{i=1}^{m} \frac{w_i(f_i^+ - f_{ij})}{(f_i^+ - f_i^-)} \tag{18}$$

$$\boldsymbol{R_j = max}\left[\frac{\boldsymbol{w_i(f_i^+ - f_{ij})}}{\boldsymbol{(f_i^+ - f_i^-)}}\right] \tag{19}$$

After calculating S_j and R_j values, Q_j values are calculated with Equation 20. S^* and R^* values represent the minimum values calculated, while S^- and R^- represent the maximum values as seen in Equations 21 and 22. The value of v indicates the weight of the maximum group benefit and is determined by the group decision. For the maximum group benefit, v > 0.5 represents the majority preference, v = 0.5 is agreement, and v <0.5 is veto (Opricovic and Tzeng, 2004). The value of v was used as 0.5 considering the compliance state.

$$Q_j = \frac{v\left(S_j - S^*\right)}{(S^- - S^*)} + \frac{(1-v)\left(R_j - S^*\right)}{(R^- - R^*)} \quad (20)$$

$$S^* = min\, S_i \;;\; R^* = min\, R_i \quad (21)$$

$$S^- = max\, S_i \;;\; R^- = max\, R_i \quad (22)$$

V. Ranking S_j, R_j and Q_j values

The S_j, R_j and Q_j values that are calculated for each alternative are sorted from small to large. Three different rankings are obtained for alternatives.

VI. Determining acceptable advantage (C1) and acceptable stability (C2) clusters in decision making

Acceptable advantage (C1) and acceptable stability (C2) clusters are determined by ranking the S_j, R_j, *and* Q_j values. One of the alternatives needs to provide equality to be included in cluster C1. Equations 23 and 24 are applied to all Q_j values to determine which of the alternatives are in the C1 set. The following two conditions must be satisfied to suggest a compromise solution (a').

C1: Acceptable advantage;

$$Q(a'') - Q(a') \geq DQ \quad (23)$$

$$DQ = 1/(1-m) \quad (24)$$

where; m represents the number of alternatives and a'' is the second alternative in the ranking list by Q(min) value, a' is the best alternative in the ranking list by Q(min) value.

C2: Acceptable stability in decision-making;

Alternative a' must also be the best ranked by S or/and R. Alternatives that exist in both the C1 and C2 clusters show stable decision points in a decision-making process.

If one of the conditions is not provided, then a set of compromise solutions is proposed, which consists of:

If condition-2 cannot be satisfied, alternatives a' and a'' are both determined as the best-compromised solution.

If condition-1 cannot be satisfied, alternatives $a', a'', \ldots\ldots, a^{(M)}$ and its value is determined by $Q\left(a^{(M)}\right) - Q(a') < DQ$ for maximum M. The best alternative, ranked by Q, is the one with the minimum value of Q (Opricovic and Tzeng 2004).

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CASE STUDY

Determining Study Area and Preparing Datasets

Pendik district of Istanbul was chosen as the case study for this research. Figure 4 displays Pendik district, surrounded by Tuzla from the east, Kartal and Sultanbeyli from the west, Sile from the north, and Marmara Sea from the south. The population of Pendik is 743.774 according to 2023 statistics and it is the third most populous district of Istanbul (TÜİK 2023) with an area of 190 km2, has a coastline of 7.5 km. In recent years the Pendik district has been developing rapidly in terms of transportation infrastructure and urbanization and accommodates different urban development dynamics as a metropolitan city. Railway infrastructure investments, road investments, and access to the sea are remarkable in the region. Due to these reasons, this district has become an attractive center and is faced with a lack of several city services including parking areas.

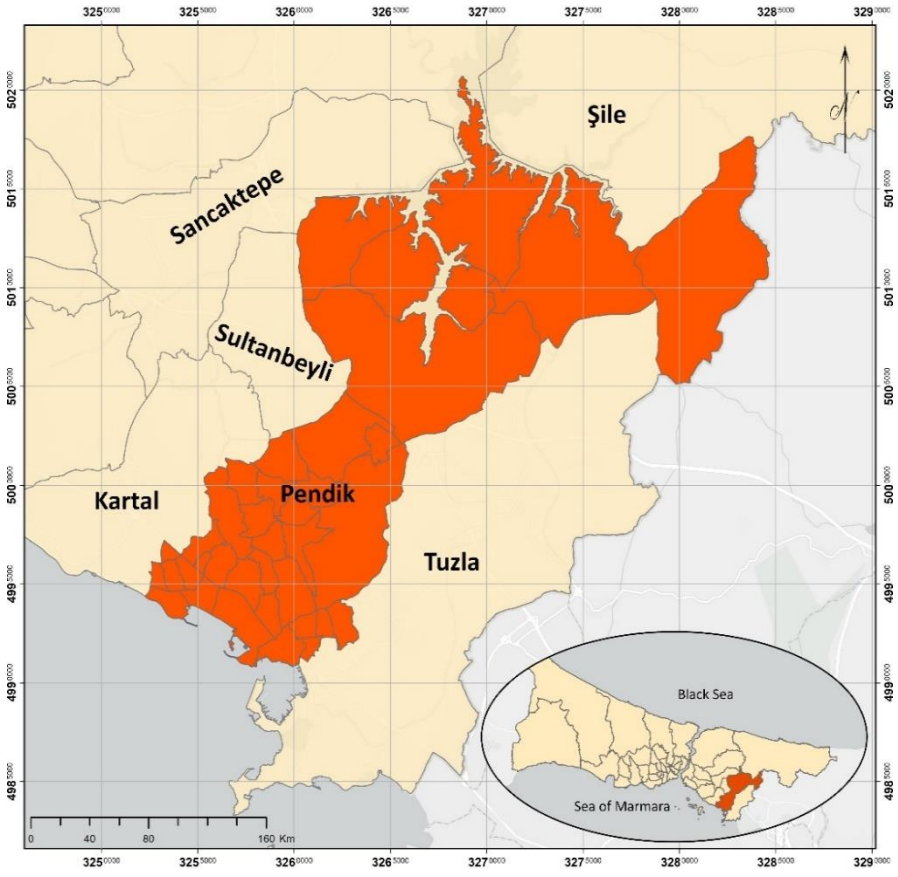

Figure 4. Location of Pendik district.

Concerning the parking suitability criteria in Figure 2, the required geographical datasets were obtained from the Istanbul Metropolitan Municipality (IMM) and Open Street Map (OSM) open data portal (OSM, 2023) and United States Geological Survey (USGS) Earth Explorer portal (USGS, 2023). Then, all datasets were imported to a geodatabase and organized for suitability analysis. Table 3 provides a detailed summary of these datasets, their corresponding sources, and the analytical

techniques employed in the study. All the adopted dat sets were referenced and registered to the ITRF 96 coordinate system. All data were provided in a vector format, except the slope of the area, which was derived from a digital elevation model (DEM) in a raster format. In this study, the cell sizes of the analysis were set to 30 m x 30 m to analyze maximum details in urban areas. The criteria maps were rasterized and scored. The scoring process was done by the reclassifying tool with the rasterized criteria being classified.

Table 3. The dataset and analysis descriptions used in the study

Data	Source	Data Type	Year	Analysis
Main Roads	OSM	Vector (Polyline)	2023	Euclidean Distance
Highways	OSM	Vector (Polyline)	2023	Euclidean Distance
Bus Stations	IMM	Vector (Point)	2023	Euclidean Distance
Metro Stations	IMM	Vector (Point)	2023	Euclidean Distance
Train Stations	IMM	Vector (Point)	2023	Euclidean Distance
Existing Parking	IMM	Vector (Point)	2023	Euclidean Distance
DEM	USGS Earth Explorer	Raster (30x30 m)	2023	Slope
Traffic Volume	IMM	Polyline	2019	Linear Density
Car Ownership	IMM	Vector (Polygon)	2019	Feature to Raster
Land Cost	IMM	Vector (Polygon)	2019	Feature to Raster
Residential & Workplace	IMM	Vector (Point)	2023	Kernel Density
Cultural Facilities	IMM	Vector (Point)	2023	Euclidean Distance
Educational Facilities	IMM	Vector (Point)	2023	Euclidean Distance
Health Facilities	IMM	Vector (Point)	2023	Euclidean Distance
Public Institutions	IMM	Vector (Point)	2023	Euclidean Distance
Sport Facilities	IMM	Vector (Point)	2023	Euclidean Distance
Shopping Malls	IMM	Vector (Point)	2023	Euclidean Distance
Green Space	IMM	Vector (Point)	2023	Euclidean Distance

According to the transportation criteria in Figure 5 and travel absorption criteria in Figure 6, a driver should walk a minimum distance from the parking areas to their destinations. The walking distance to parking areas is one of the most considerable issues. Therefore, the

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walking distance from these criteria was calculated with the Euclidean distance technique, including 5 intervals; 0-125 m, 125-250 m, 250-350 m, 350-500 m, and 500-1000 m. which implies that the minimum distance has the higher score values.

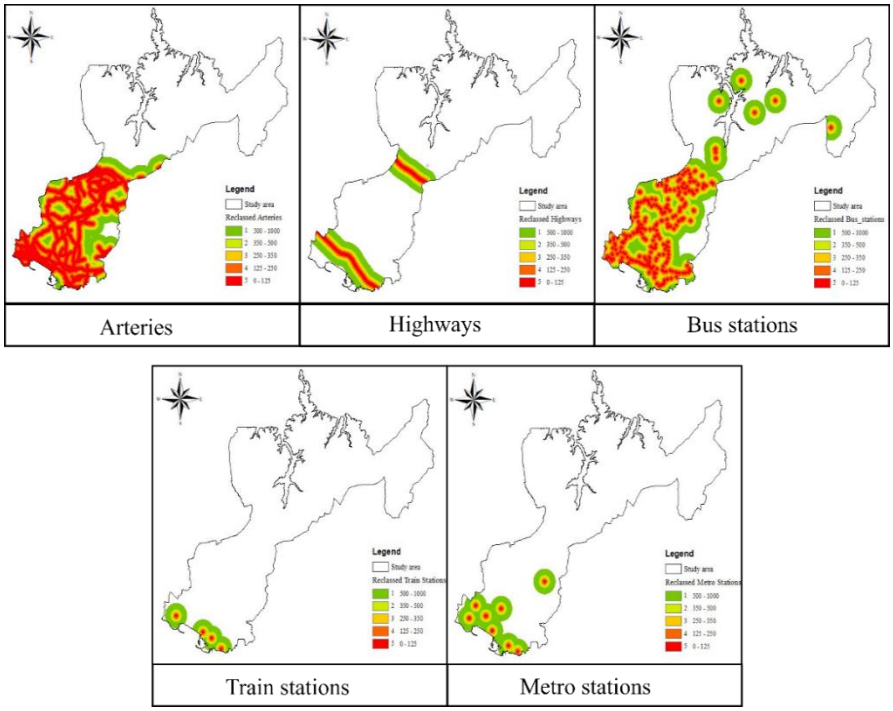

Figure 5. The classified maps of transportation criteria.

According to the parking criteria in Figure 7, it is more convenient to be far from existing parking areas. Therefore, distance to existing parking was scored with the Euclidean distance technique where the maximum distance has the higher score values.

The slope map was produced automatically with values between 0o to 39.56^{o} degrees and then the slope values were categorized according to the urban construction criterion. Land suitability is evaluated as 0^{o} - 5^{o}, 5^{o} -10^{o}, 10^{o}-15o, 15^{o}-25 ^{o} ,and >25^{o} (Xiaorui et al. 2013). The maximum values of the slope have the minimum scoring value. Steep slopes are generally not suitable for parking areas.

Land prices are high in areas with intensive transportation facilities, areas that are close to business and public services, and areas that experience modern urbanization. Considering the transportation conditions and public interest, parking investment should be supported despite the high land cost (Demir 2016). Land cost data were converted to raster data regarding their values at the neighborhood level and classified into 5 intervals.

Demand for parking areas in residential and workplaces is usually high due to increasing car ownership. This situation increases the traffic volume indirectly. Taking into account the density of residential areas and workplaces, car ownership, and traffic volume data were collected for districts and categorized into 5 intervals. Highly density places are suitable locations for selecting parking areas.

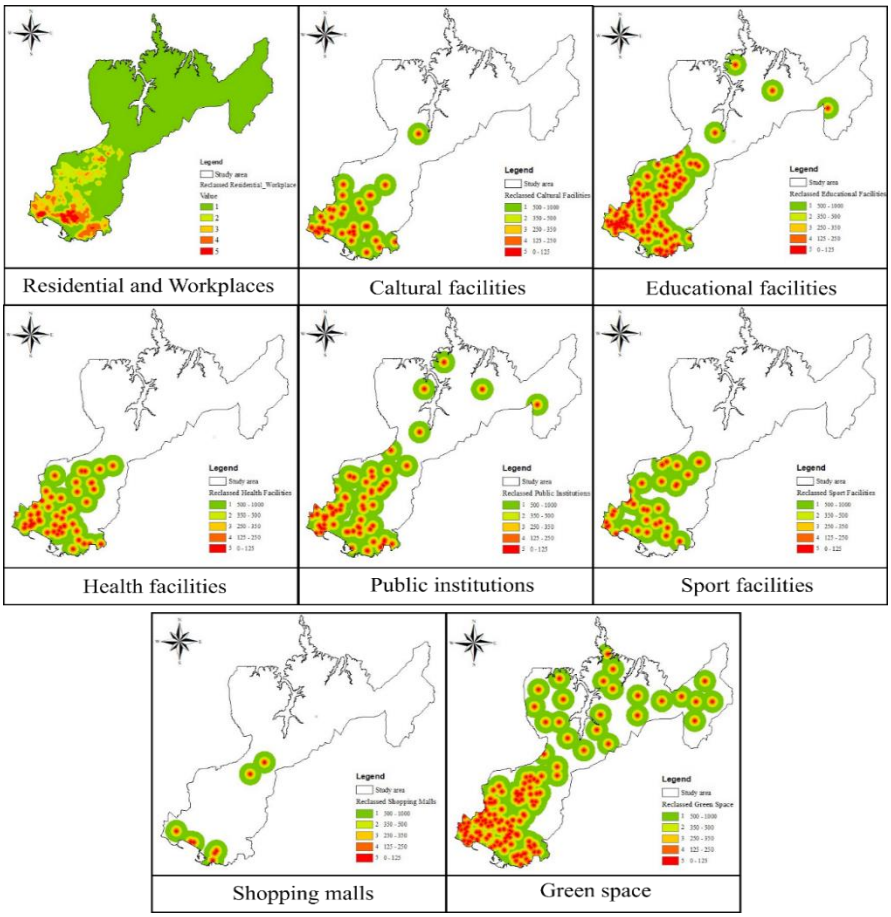

Figure 6. The classified maps of travel absorption criteria.

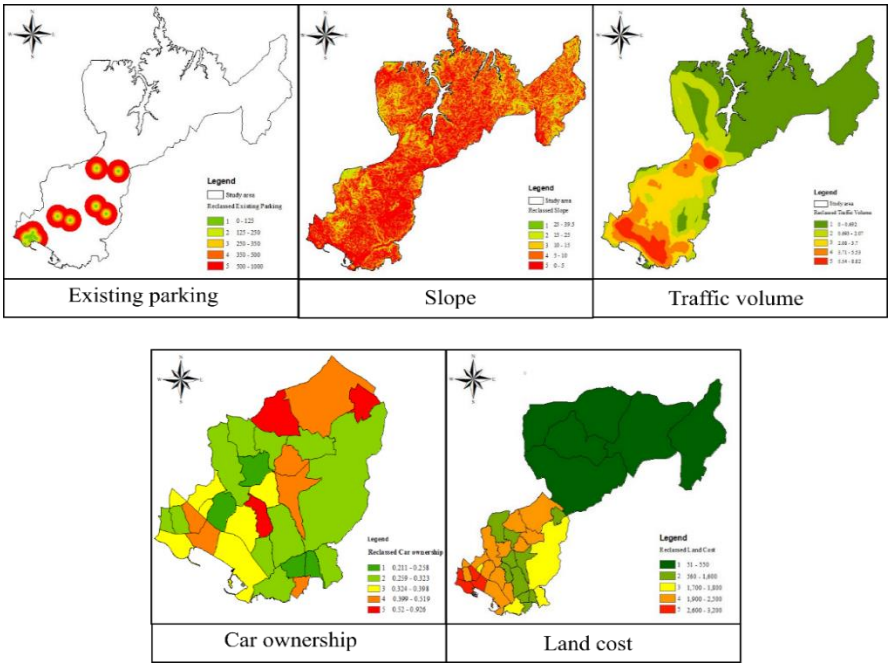

Figure 7. The classified maps of parking criteria.

Producing Parking Suitability Map with AHP

Three main criteria and 18 sub-criteria (Figure 2) were chosen as the most effective factors for developing a parking suitability map. The AHP method was used to calculate the weights of each criterion and their sub-criteria. The values were used to compare the relative importance of each criterion given in Table 1. Afterwards, the classified maps were

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integrated through the raster calculator tool in GIS where the maps were multiplied by their weights to obtain the suitable areas.

By integrating AHP with GIS in two phases, the pairwise comparison between each sub-criteria of transportation, parking criteria, and travel absorption centers was performed, and then their weights were calculated. In Tables 4, 5, and 6, the pairwise comparison matrix of sub-criteria for transportation, parking criteria, and travel absorption criteria was presented with their corresponding weights respectively.

Table 4. Pairwise comparison matrix of transportation criteria

Criteria	Arteries	highways	Bus stations	Train stations	Metro stations	Weight of criteria
Arteries	1	9	7	5	5	0.568
Highways	1/9	1	1/3	1/5	1/5	0.035
Bus stations	1/7	3	1	1/4	1/4	0.065
Train stations	1/5	5	4	1	1.00	0.166
Metro stations	1/5	5	4	1.00	1	0.166
$\lambda max = 5.268, CI = 0.067, RI = 1.12, CR = 0.06 < 0.1$						

Table 5. Pairwise comparison matrix of parking criteria

Criteria	Existing parking	Slope	Traffic volume	Car ownership	Land cost	Weight of criteria
Existing parking	1	7	5	1	3	0.347
Slope	1/7	1	1/3	1/7	1/7	0.035
Traffic volume	1/5	3	1	1/7	1/5	0.062
Car ownership	1	7	7	1	3	0.370
Land cost	1/3	7	5	1/3	1	0.186
$\lambda max = 5.273, CI = 0.07, RI = 1.12, CR = 0.061 < 0.1$						

Table 6. Pairwise comparison matrix of travel absorption criteria

Criteria	Residential and workplace	Cultural	Educational	Health	Public Institutional	Sports	Shopping malls	Green space	Weight of Criteria
Residential & Workplace	1	9	9	5	7	9	5	9	0.436
Cultural	1/9	1	1/2	1/7	1/3	1	1/9	3	0.028
Educational	1/9	2	1	1/7	1/5	3	1/7	5	0.042
Health	1/5	7	7	1	3	7	1	9	0.172
Public Institutional	1/7	3	5	1/3	1	5	1/5	5	0.084
Sports	1/9	1	1/3	1/7	1/5	1	1/7	1	0.023
Shopping malls	1/5	9	7	1	5	7	1	9	0.197
Green space	1/9	1/3	1/5	1/9	1/5	1	1/9	1	0.018
$\lambda max = 8.893, CI = 0.128, RI = 1.41, CR = 0.091 < 0.1$									

In Figures 8, 9, and 10, the overlaid maps of sub-criteria for transportation, parking criteria, and travel absorption criteria were illustrated respectively

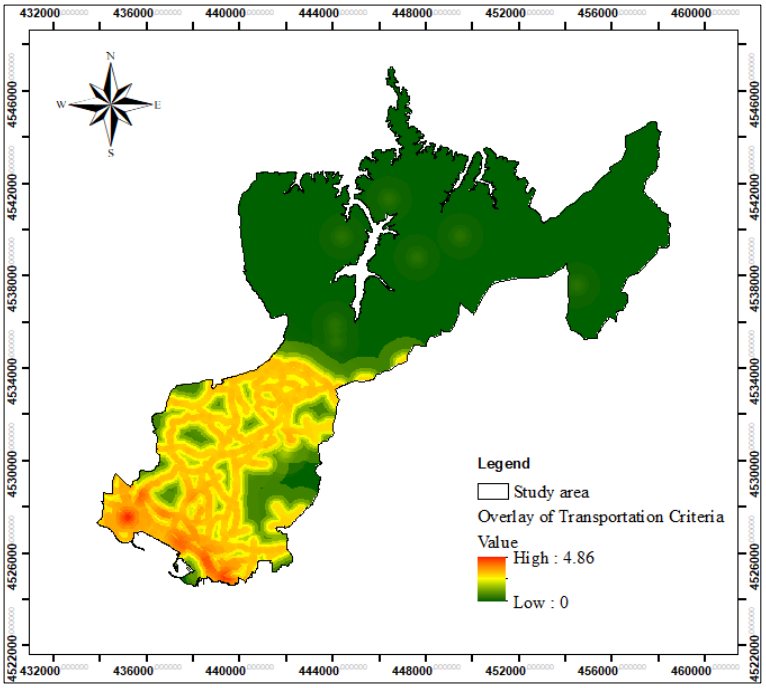

Figure 8. Overlaid map of transportation ctiteria.

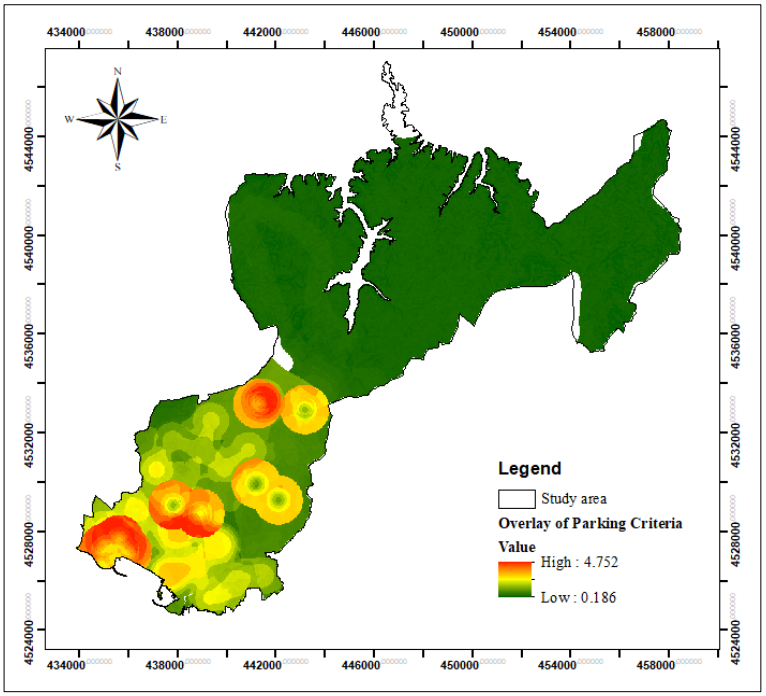

Figure 9. Overlaid map of parking. criteria.

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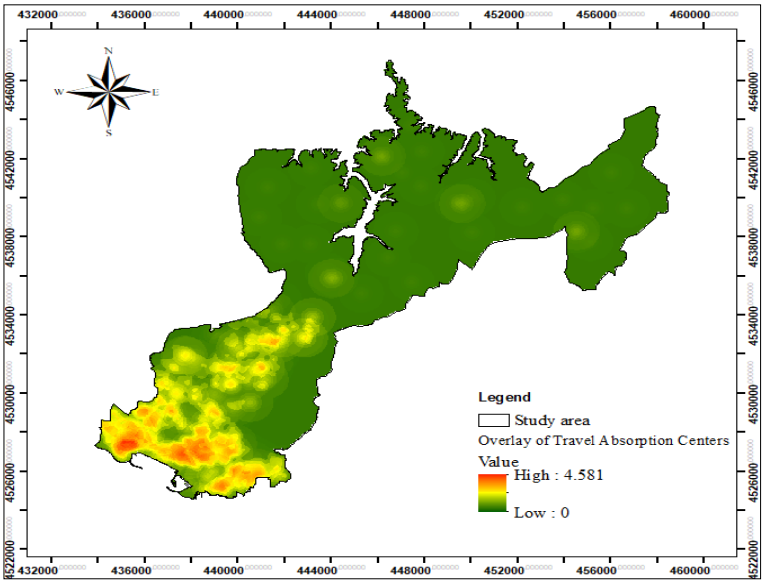

Figure 10. Overlaid map of travel absorption criteria.

To reach the final result, it's necessary to integrate the main criteria as well. The pairwise comparison between the main criteria was performed and their weights were calculated. The pairwise comparison matrix of the main criteria with their corresponding weights is presented in Table 7.

Table 7. Pairwise comparison matrix of main criteria

Criteria	Transportation	Parking criteria	TAC	Weight of Criteria
Transportation	1	5	2	0.559
Parking criteria	1/5	1	1/5	0.089
TAC	1/2	5	1	0.352
$\lambda max = 3.054, \quad CI = 0.027, RI = 0.58, \quad CR = 0.052 < 0.1$				

Next, the overlaid maps of transportation, parking criteria, and travel absorption criteria concerning their weights were combined and overlapped. As a result, the parking suitability map was produced as illustrated in Figure 11.

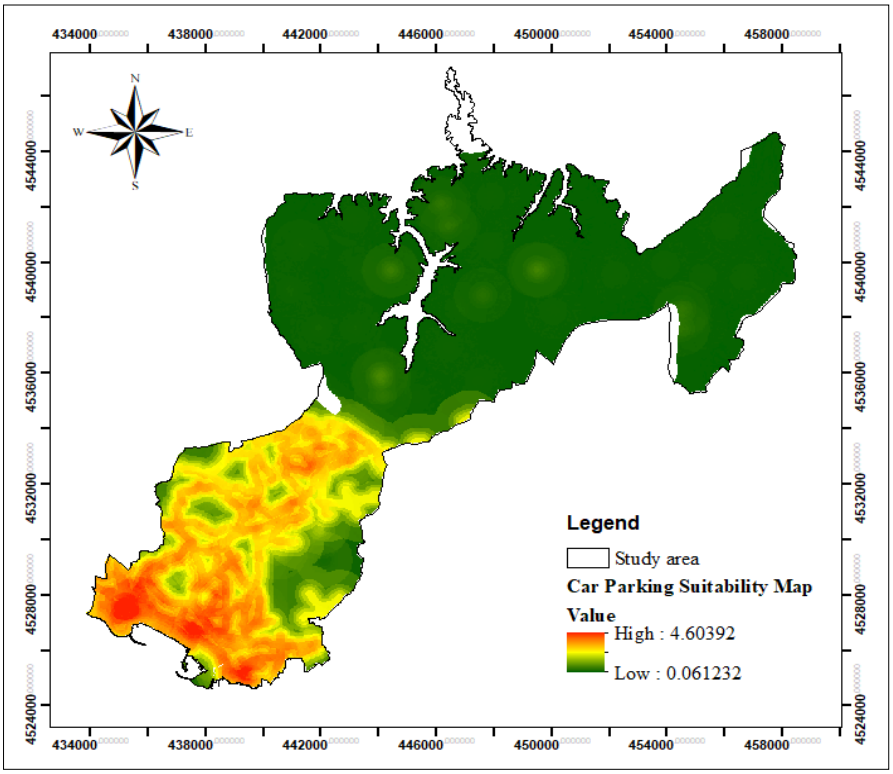

Figure 11. Parking suitability map.

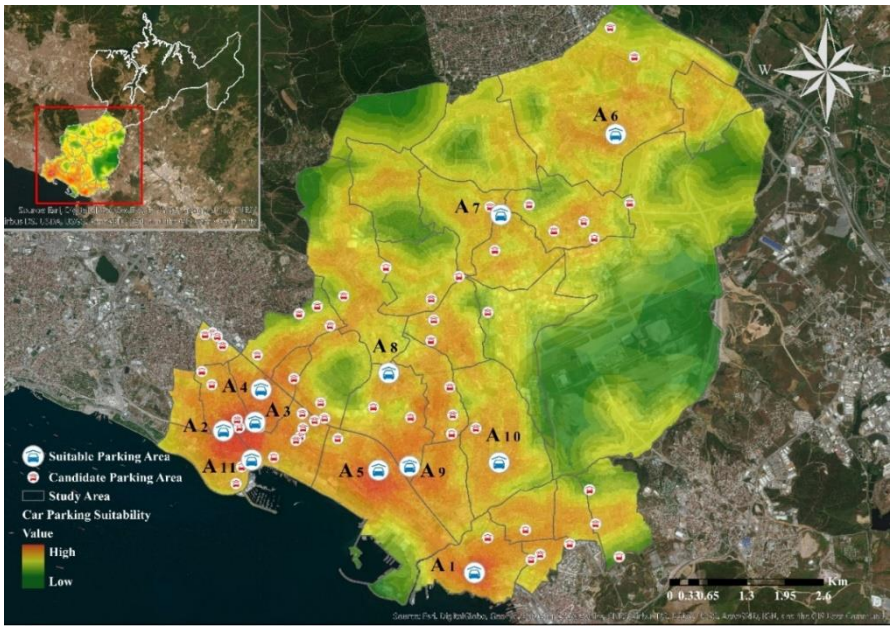

Figure 12. Locations of suitable parking and candidate parking.

The parking suitability map shows that the red-colored areas depict high numbers situated in the southeast of the study area and are the most suitable for building parking areas. Locations of suitable parking areas were determined by taking into account high suitable values in the zoning plans. Thus, 11 parking areas with high parking suitable values were determined in the study area. In Figure 12, suitable parking areas were numbered from 1 to 11 as A1, A2, ... A11.

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Parking Area Selection Analysis with TOPSIS and VIKOR

The ranking was made among 11 suitable parking areas determined in the parking suitability map. For this purpose, the ranking analysis was performed by using TOPSIS and VIKOR techniques. Comparative analysis of Criteria and Alternatives is required for both of these techniques. Regarding Alternatives, 11 suitable parking areas were used. Regarding Criteria, 18 sub-criteria determined by the AHP in 3 criteria groups were used. The weights of the sub-criteria were normalized to their main weight. In this context, normalized weight ratios of a total of 18 criteria from Transportation Criteria, Parking Criteria, and Travel Absorption Criteria groups can be seen in Table 8.

Table 8. Normalized weights of sub-criteria

Main Criteria	Sub-Criteria	Criteria Number	AHP Weights	Normalized Weights
Transportation Criteria	Main roads	K1	0.568	0.3175
	Highways	K2	0.035	0.0196
	Bus stations	K3	0.065	0.0363
	Metro stations	K4	0.166	0.0928
	Train stations	K5	0.166	0.0928
Parking Criteria	Existing parking	K6	0.347	0.0309
	Slope	K7	0.035	0.0031
	Traffic volume	K8	0.062	0.0055
	Car ownership	K9	0.370	0.0329
	Land cost	K10	0.186	0.0166
Travel Absorption Criteria	Residential & workplaces	K11	0.436	0.1535
	Cultural facilities	K12	0.028	0.0099
	Educational facilities	K13	0.042	0.0148
	Health facilities	K14	0.172	0.0605
	Public institutions	K15	0.084	0.0296
	Sport facilities	K16	0.023	0.0081
	Shopping malls	K17	0.197	0.0693
	Green space	K18	0.018	0.0063
				∑=1.0000

For a comparative analysis of 11 parking areas that are based on 18 criteria, the data sets developed for each criterion were used. Using GIS analysis, values of each criterion were calculated for alternatives representing suitable parking areas (Table 9). For example; for the K1 criteria (Distance to Main Roads), the A1 alternative is 10m away and the A2 alternative is 30m away; for the K7 (Slope) criteria, the A1 alternative is 3.71°and the A2 alternative is 1.43°.

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Table 9. Decision matrix of TOPSIS and VIKOR techniques

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18
A1	10	150	10	408.04	241.87	3615.09	3.71	0.0094	3.75	1804.00	8393.20	127.28	42.43	127.28	108.17	1404.56	692.60	108.17
A2	30	1166.92	150	189.74	212.13	256.32	1.43	0.0033	2.57	2425.49	10267.40	152.97	67.08	108.17	134.16	484.67	323.11	174.93
A3	60	700.36	67.08	375.9	375.9	108.17	1.82	0.0089	2.64	3073.22	6620.85	305.94	60.00	134.16	212.13	912.41	241.87	305.94
A4	30	212.13	120	295.47	849.06	600.75	3.11	0.0081	2.40	3073.22	4817.94	300.00	174.93	108.17	42.43	732.39	674.17	512.64
A5	67.08	308.87	120	488.37	630	1701.56	4.79	0.0037	6.42	2175.86	14703.40	234.31	90.00	30.00	10.00	400.25	800.50	10.00
A6	60	1991.11	60	2249	7549.34	666.11	4.17	0.0031	4.71	2118.28	6091.18	1517.00	582.50	161.56	512.64	690.65	324.50	174.93
A7	42.43	4218.07	94.87	2457.99	5420.79	2018.04	9.01	0.0037	2.51	2079.79	6900.96	930.00	218.40	108.17	458.91	408.04	2713.30	84.85
A8	60	1129.29	180	381.84	2317	480.00	3.93	0.0040	4.73	1995.84	1914.95	729.93	351.14	335.41	920.27	313.21	2093.13	67.08
A9	108.17	127.28	10	966.08	882.33	1934.24	1.39	0.0077	6.04	1995.84	13318.10	108.17	10.00	67.08	67.08	216.33	1266.06	212.13
A10	67.08	1398.46	90	1894.04	1803.25	1867.24	3.05	0.0005	7.04	1513.81	8556.17	603.74	120.00	120.00	84.85	254.56	1332.22	510.00
A11	30	1236.93	94.87	540.83	550.73	67.08	3.77	0.0041	3.06	3224.59	8775.17	174.93	318.90	271.66	94.87	483.74	655.21	212.13

RESULTS

Results of TOPSIS

To prioritize the suitable parking areas with the TOPSIS technique, the working steps described in the method section were implemented. Positive (A+) and negative ideal (A-) solution values created from Equations 7 and 8 are shown in Table 10. It is very important to determine the positive (A+) and negative ideal (A-) solution values appropriately.

For determining the Positive (A+) ideal solution values, it can be stated that 11 suitable parking areas should be close to Main Roads, Highways, Bus stations, Metro stations, Train stations, Residential & Workplace, Cultural facilities, Educational facilities, Health facilities, Public institutions, Sports facilities, Shopping malls, Green space; be far from Existing parking; be high for Traffic volume and Car ownership; and be low for Slope and Land Cost.

Table 10. Determination of positive ideal (A+) and negative ideal (A-) solution values

Criteria	A+	A-	Criteria	A+	A-
K1	0.01671	0.18076	K10	0.00318	0.00677
K2	0.00047	0.01545	K11	0.00993	0.07628
K3	0.00106	0.01905	K12	0.00051	0.00714
K4	0.00430	0.05577	K13	0.00018	0.01048
K5	0.00199	0.07097	K14	0.00331	0.03698
K6	0.02096	0.00039	K15	0.00025	0.02285
K7	0.00031	0.00203	K16	0.00080	0.00518
K8	0.00267	0.00013	K17	0.00402	0.04511
K9	0.01559	0.00533	K18	0.00007	0.00365

From Equations 9 and 10, the distances between the positive and negative ideal points were calculated (Table 11). Using Equation 11, the relative proximity to the ideal solution was calculated. Then, alternative points are listed by using the obtained C_i * values as given in Table 11.

Table 11. Calculation of distances to positive ideal (S+) and negative ideal (S-) points

Alternative	S+	S-	S+ + S-	Ci*	Rank
A1	0.0398	0.1951	0.2349	0.8304	1
A2	0.0627	0.1669	0.2296	0.7270	3
A3	0.0923	0.1340	0.2263	0.5920	5
A4	0.0470	0.1694	0.2164	0.7826	2
A5	0.1180	0.1189	0.2369	0.5020	8
A6	0.1249	0.1040	0.2290	0.4544	10
A7	0.1058	0.1231	0.2289	0.5377	6
A8	0.1098	0.1259	0.2357	0.5341	7
A9	0.1767	0.0891	0.2658	0.3353	11
A10	0.1132	0.1042	0.2174	0.4794	9
A11	0.0688	0.1617	0.2305	0.7016	4

Results of VIKOR

To prioritize the suitable parking areas with the VIKOR technique, we followed the working steps described in the method section. Table 12

presents the best and the worst values of all criteria that were created from Equations 13 and 14.

Table 12. Determining the best and the worst values of all criteria

Criteria	f+ (Best)	f- (Worst)	Criteria	f+ (Best)	f- (Worst)
K1	10.00	108.167	K10	1513.809	3224.593
K2	127.279	4218.070	K11	1914.950	14703.400
K3	10.00	180.0000	K12	108.167	1517.00
K4	189.737	2457.990	K13	10.0000	582.495
K5	212.132	7549.340	K14	30.00	335.410
K6	3615.090	67.082	K15	10.0000	920.272
K7	1.3918	9.0094	K16	216.333	1404.560
K8	0.0094	0.0005	K17	241.868	2713.300
K9	7.0363	2.4046	K18	10.00	512.640

S_j, R_j and Q_j values were calculated for each alternative using Equations 18, 19, and 20. Then, alternative points are listed in Table 13 by using the obtained Q_j values.

Table 13. S_j, R_j and Q_j values

Alternative	Sj	Rj	Qj	Rank (Qj)
A1	0.1597	0.0777	0.0258	1
A2	0.3009	0.1002	0.2456	3
A3	0.3585	0.1617	0.4387	5
A4	0.2557	0.0647	0.1191	2
A5	0.4322	0.1846	0.5755	8
A6	0.5362	0.1617	0.6592	10
A7	0.5321	0.1049	0.5418	6
A8	0.4466	0.1617	0.5480	7
A9	0.5625	0.3175	1.0000	11
A10	0.4625	0.1846	0.6131	9
A11	0.3442	0.0823	0.2639	4
S*, R*	0.1597	0.0647		
S-, R-	0.5625	0.3175		

The S_j, R_j and Q_j values were ranked in ascending order in Table 14. At the end of the calculations, we found that A1 has the smallest value among the Q values compared to other alternatives. For the A1 alternative to be accepted, condition 1 and condition 2 must be satisfied. Considering condition 1, 0.1191- 0.0258 = 0.09 and <0.10 (DQ), therefore condition 1 is not satisfied. According to condition 2, the alternative A1 was the column S_j in Table 13. Therefore, condition 2 is satisfied. Then, the ranking was done according to the minimum value of Q. The results of the ranking are presented in Table 15.

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Table 14. The ranking by S_j, R_j, and Q_j values

Alternative	S_j	Alternative	R_j	Alternative	Q_j
A1	0.1597	A4	0.0647	A1	0.0258
A4	0.2557	A1	0.0777	A4	0.1191
A2	0.3009	A11	0.0823	A2	0.2456
A11	0.3442	A2	0.1002	A11	0.2639
A3	0.3585	A7	0.1049	A3	0.4387
A5	0.4322	A3	0.1617	A7	0.5418
A8	0.4466	A6	0.1617	A8	0.548
A10	0.4625	A8	0.1617	A5	0.5755
A7	0.5321	A5	0.1846	A10	0.6131
A6	0.5362	A10	0.1846	A6	0.6592
A9	0.5625	A9	0.3175	A9	1.0000

When the results of the TOPSIS and VIKOR methods are compared, we note that the same results were achieved in both methods as can be seen in Table 15. These methods point to the same alternative as the best option and give the same results in the ranking of the location alternatives. Therefore, it is concluded that the TOPSIS and VIKOR methods can be successfully used for selecting vehicle-parking areas in common.

Table 15. The comparison of TOPSIS and VIKOR results

Rank	1	2	3	4	5	6	7	8	9	10	11
TOPSIS	A1	A4	A2	A11	A3	A7	A8	A5	A10	A6	A9
VIKOR	A1	A4	A2	A11	A3	A7	A8	A5	A10	A6	A9

DISCUSSION AND CONCLUSION

Allocating public services like vehicle parking areas is a complex decision-making problem that should be accomplished accurately to increase the efficiency of parking and avoid extra costs. The allocation of parking areas that have been performed using traditional methods was unsuccessful in considering all the effective parameters and therefore these gave insufficient results. This study adopted a wide range of effective parameters and developed an approach that considers all the parameters simultaneously. GIS integrated with MCDA techniques is effective in solving the complicated problem of locating parking areas. Accordingly, the MCDA methods were applied in two stages. First, the AHP technique was applied to calculate the weight of corresponding criteria and sub-criteria. Afterward, the weights were integrated with GIS to prepare the parking suitability map. Second, the TOPSIS and VIKOR techniques were implemented to prioritize the parking locations amongst suitable parking areas and to determine the best location for establishing parking areas.

Pendik district of Istanbul was selected as the study area in this research given that the district suffers from a lack of parking areas.

Rapid growth of population and urbanization, and development of transportation infrastructure investments in the city signify the need for parking areas. To tackle this complex problem, in this study, a wide range of effective parameters were considered and identified based on three criteria i.e. transportation criteria, parking criteria, and travel absorption criteria. The criteria determined within the scope of this model can also be used for determining suitable parking areas in any district outside the study area.

The integration of the GIS with MCDA techniques appears to be a highly successful method in dealing with geographic data as well as in manipulating criteria importance and in the prioritization process towards defining the optimum locations of parking areas. The AHP method was adopted to provide the weights of each decision criterion that was combined with GIS to prepare the parking suitability map. Consequently, TOPSIS and VIKOR were used to rank the alternatives. We anticipate that this novel integrative approach with its future variations will be instrumental in future works for determining efficient parking areas in highly populated cities and urban regions. In addition, as a decision-making tool, this approach using GIS-based MCDA techniques is proposed to allocate any public service by determining suitable areas and prioritizing these areas according to the criteria weights.

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Resume

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Scenario-Based Futures Research on Tourism Destination Competitiveness: An Interdisciplinary Framework Using Delphi and MICMAC

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Abstract

In recent years, tourism competitiveness has become a key factor in urban development, significantly affecting economic, social, and environmental sustainability. This study aims to identify and analyze the main drivers of tourism destination competitiveness using a futures research methodology. To address this gap, the study adopts a scenario-based futures research framework that integrates the Delphi method (for expert-driven identification of key drivers), MICMAC structural analysis (to evaluate systemic interdependencies), and Scenario Wizard (to generate internally consistent future scenarios). This methodological combination is rarely applied in tourism research and represents an interdisciplinary innovation that allows for dynamic modeling of tourism competitiveness under uncertainty. Through a systematic process, 25 initial factors were categorized into five dimensions, and 14 key drivers were extracted based on their influence. These drivers were then modeled using Scenario Wizard software, resulting in 14 plausible future scenarios. The study found that 80% of these scenarios indicate optimistic conditions for tourism development. The optimal scenario suggests strategic priorities such as fostering tourism culture, promoting inter-organizational coordination, enhancing investment and marketing, and strengthening infrastructure. These insights not only provide a practical framework for policymakers and urban planners but also contribute to the methodological advancement of interdisciplinary scenario-based tourism research.

Keywords: *Future research, Interaction analysis, Key drivers, Tourism development, Tourism destination competitiveness.*

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INTRODUCTION

In recent decades, tourism has emerged as a dynamic sector with substantial contributions to economic growth (Zhao, 2018). The concept of tourism competitiveness reflects a destination's ability to attract international visitors through quality, innovation, and sustainability (Simarmata et al., 2024; Zhang et al., 2023). Recent research has shifted from national performance to destination-level competitiveness, focusing on infrastructure, culture, governance, and innovation (Lasisi et al., 2023; Goffi et al., 2023). Unlike general urban competitiveness, tourism destination competitiveness (TDC) emphasizes attracting and retaining tourists while supporting sustainable development (de Paula Aguiar-Barbosa & Chim-Miki, 2024).

Tourism competitiveness is linked to job creation, poverty reduction, and improved living standards (Yan et al., 2022). The Travel and Tourism Competitiveness Index (TTCI) by the World Economic Forum provides a widely used benchmarking tool (Băbăț et al., 2023). However, these indices often lack foresight and fail to address uncertainty and system complexity.

This need for adaptive planning has intensified in response to global disruptions. COVID-19 revealed the fragility of tourism economies (Paul et al., 2022), while climate change, shifting behaviors, and digital transformation continue to reshape the sector (Scott, 2021; Meneghello, 2021). Addressing these dynamics requires forward-looking strategies.

Scenario-based futures research—combined with structural analysis—offers an effective approach to anticipate change and guide resilient planning (Goffi et al., 2023). Despite their relevance, such tools remain underused in tourism research.

This study adopts an interdisciplinary futures approach using the Delphi method, MICMAC analysis, and scenario planning to identify key drivers of competitiveness and provide a strategic framework for strengthening destination performance under uncertainty.

Research background

In the 21st century, tourism has evolved beyond an economic activity to become a key driver of sustainable regional development (Higgins Desbiolles, 2006). It is one of the world's largest industries, contributing around 9% of global GDP and 8% of employment (Hanandeh, 2013). Countries such as France, Japan, Spain, and the UK illustrate tourism's economic significance, with billions in annual revenue and millions of jobs supported (Ibragimova, 2024; Yanagi, 2023; Zamkova, 2024; Agarwal et al., 2024).

Recent studies emphasize that tourism competitiveness is no longer measured solely by economic performance but also depends on sustainability, innovation, and digital transformation (Lasisi et al., 2023). Investments in tourism not only boost growth but also contribute to environmental and cultural preservation. For example, Brazil's protected areas have demonstrated strong returns, both economically and

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ecologically (Souza et al., 2021). Destinations that integrate smart technologies, community empowerment, and sustainability tend to recover more quickly from global disruptions (de Paula Aguiar-Barbosa & Chim-Miki, 2024).

Empirical studies confirm tourism's long-term contribution to economic development when aligned with broader strategies such as financial development and urbanization (Kumar et al., 2015; Du et al., 2016; Ohlan, 2017). However, tourism alone is insufficient to guarantee growth and must be part of integrated planning.

Sharif et al. (2021) explored the complex relationship between globalization and tourism in the U.S., showing that while globalization enhances tourism, tourism's impact on economic and political dimensions is less predictable, especially post-crisis. These findings underscore the importance of resilience and adaptability in maintaining competitiveness.

Urban-level factors such as infrastructure, local demand, and place quality also influence destination appeal (Weng et al., 2022). Community engagement and resident empowerment are key to building local support for tourism initiatives (Ahn & Bessiere, 2022).

In digital tourism, Colabi (2021) highlighted that legal structures, organizational agility, and value creation are critical for successful e-tourism models. Community-based frameworks incorporating environmental, economic, social, and managerial factors also support sustainable tourism (Emami et al., 2021). Social acceptance and responsible tourist behavior further reinforce long-term tourism viability (Shahhoseini et al., 2021).

Overall, tourism competitiveness is shaped by intersecting economic, environmental, technological, and socio-cultural dimensions. However, few studies apply integrated, future-oriented methods to analyze competitiveness under uncertainty. This gap calls for interdisciplinary, scenario-based approaches capable of modeling the sector's complex and evolving dynamics.

Although many studies have addressed tourism competitiveness using standard indices and current condition analyses, they often lack forward-looking perspectives that account for uncertainty and complexity in long-term tourism planning. Given the increasing uncertainty in global tourism trends—driven by technological shifts, climate change, and geopolitical volatility—traditional planning tools often fall short in addressing complex, long-term challenges. Most existing literature focuses on static measurements and short-term evaluations, leaving a gap in exploring dynamic, future-oriented strategies. To fill this gap, the present study adopts a futures research methodology that integrates the Delphi method for expert consensus, MICMAC structural analysis for mapping variable influence, and scenario planning to simulate plausible development trajectories. This methodological combination is rarely applied in tourism competitiveness research and offers a systematic approach to identifying and analyzing key drivers that shape the future of tourism

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destinations. Therefore, this study not only addresses a methodological gap but also introduces a strategic framework for anticipating and managing future changes in tourism development. Based on this, the research questions are:

- What are the effective drivers for tourism development as a key factor for tourism destination competitiveness?

- What are the possible and desirable scenarios in the development of tourism as a factor of destination attractiveness and resilience?

Given the increasing complexity and uncertainty in tourism development, there is a pressing need to review existing scholarly approaches to tourism competitiveness and future planning. The following section critically examines relevant literature to identify conceptual and methodological gaps that justify the need for our integrative foresight framework.

RESEARCH LITERATURE

Destination Competitiveness

Destination competitiveness is a multidimensional concept shaped by the interaction of tourists, places, and destination management organizations (González-Rodríguez et al., 2023). It goes beyond attractiveness, encompassing a destination's ability to provide innovative, sustainable, and satisfying experiences that foster tourist loyalty (Santos et al., 2021). This complexity calls for a multidisciplinary lens, integrating insights from management, marketing, sociology, and technology (Xu & Au, 2023).

According to the World Tourism Organization (UNWTO), competitive destinations must adopt smart technologies, enhance digital access, and implement inclusive policies (Citaristi, 2022). Competitiveness also involves effective resource use, market adaptability, and distinctiveness (Ahn & Bessiere, 2022), aligning capabilities with trends like digital strategies and sustainable models (Khan et al., 2024).

Scholars emphasize the need to combine economic, technological, environmental, and behavioral dimensions in assessing competitiveness (Ferreira & Perks, 2020). As global competition intensifies, policy decisions must support balanced growth through governance, public-private partnerships, and digital integration (Woyo & Slabbert, 2021).

Crucially, competitiveness depends on stakeholder collaboration—among tourists, DMOs, investors, researchers, and businesses—to co-create adaptive strategies that match evolving demands. Such interconnected networks help maintain resilience and responsiveness in dynamic tourism environments (Wardhani & Widodo, 2020; Dwyer, 2022).

Tourism Competitiveness

Tourism competitiveness refers to the tangible and intangible attributes that enable a destination to perform effectively in the global tourism market. It involves enhancing appeal through valuable,

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innovative, and sustainable experiences (Pérez León et al., 2022), while also adapting to changing consumer preferences, technological shifts, and sustainability goals (Font et al., 2023).

Understanding these drivers is essential for evidence-based policymaking. National-level frameworks and benchmarking tools assist policymakers in monitoring and refining competitiveness strategies (de Paula Aguiar-Barbosa & Chim-Miki, 2024; Wang et al., 2022).

Beyond traditional attractions, factors such as digital transformation, smart technologies, and immersive cultural offerings are increasingly crucial (Sustacha et al., 2023). Competitiveness is shaped by both objective indicators—e.g., price levels, infrastructure, and technological readiness—and subjective factors like image, environmental quality, and service experience (Gao et al., 2021).

Resilience during crises—such as pandemics or geopolitical shocks—is now seen as a core competitiveness component (Espiner et al., 2019). Other key determinants include safety, hospitality quality, accessibility, resident attitudes, cultural depth, and political stability (Gavurova et al., 2021).

Ultimately, collaboration among governments, private sectors, and communities is essential to sustaining tourism competitiveness in a dynamic and uncertain environment (Woyo & Slabbert, 2021).

The Impact of Competitiveness Indicators on Tourism Economic Growth

Numerous studies confirm a causal link between tourism development and economic growth (Tugcu, 2014). However, the extent of these benefits depends on factors such as exchange rates, capital, governance, digitalization, and market responsiveness (Watson & Deller, 2022).

While destinations with abundant natural and cultural resources often attract long-term tourist flows, recent research emphasizes that innovation, smart tourism, and diversification can reduce dependency on such resources (Rocha, 2022). Strategic planning is essential to enhance positive outcomes and mitigate risks like resource depletion and inflation (Murayama et al., 2022).

Travel and tourism competitiveness indices offer structured tools to assess a destination's growth potential. These indices influence areas such as investment, branding, service quality, policymaking, innovation, and workforce development by revealing key strengths and gaps.

Digital tools—such as big data analytics, AI recommendations, and immersive technologies—further support competitiveness and economic resilience (Gretzel, 2022; Sustacha et al., 2023). Their integration fosters a more adaptive, efficient, and visitor-oriented tourism ecosystem.

In short, competitiveness indicators are not just evaluative tools but strategic instruments that guide sustainable growth in an increasingly complex global tourism landscape.

Selected Indicators and Conceptual Model of the Research

There is no universal set of indicators applicable to all tourism destinations (Perna et al., 2018). However, the World Economic Forum's framework serves as a robust foundation due to its comprehensive nature. Recent studies emphasize incorporating digital readiness, crisis response, and destination intelligence into competitiveness metrics (Espiner et al., 2019).

Between 2007 and 2017, the Travel and Tourism Competitiveness Reports ranked countries using multidimensional indicators. In response to evolving challenges—especially post-COVID-19—the framework was revised and relaunched as the Travel and Tourism Development Index (TTDI) in 2022 (Woyo & Slabbert, 2021).

TTDI introduced major updates, including merging natural and cultural resources under "Drivers of Travel and Tourism Demand," adding a new pillar on sustainability, and emphasizing digital infrastructure, crisis preparedness, and inclusive travel policies (Sustacha et al., 2023; Gretzel, 2022).

These changes reflect a broader shift in competitiveness measurement—from focusing solely on economic performance to assessing adaptability, technological integration, and sustainability in tourism planning (Farhadikhah et al., 2024).

Despite the growing recognition of tourism competitiveness as a strategic priority, most existing studies remain confined to descriptive or index-based assessments. Few attempts have been made to explore dynamic interactions among competitiveness variables under future uncertainty. Furthermore, while MICMAC and Delphi methods have separately appeared in tourism forecasting studies, their combined and scenario-based application remains scarce. This conceptual and methodological gap justifies the need for a futures research approach—which is detailed in the following methodology section.

RESEARCH METHOD

This study is applied in purpose and follows a mixed-methods futures research approach, combining qualitative and quantitative techniques. Qualitative data were gathered via open-ended surveys, expert interviews, and document analysis. Quantitative data were obtained through structured Delphi questionnaires, and expert inputs were processed using MICMAC software for structural analysis (Truong et al., 2023).

The methodological process—illustrated in Figure 1—involves three key stages: identifying variables, analyzing their interactions using MICMAC, and categorizing them based on influence and dependency scores. Experts evaluated pairwise interactions using a scale from 0 (no influence) to 3 (strong influence), resulting in a square matrix where MICMAC identifies systemic roles of variables within the influence–dependence map.

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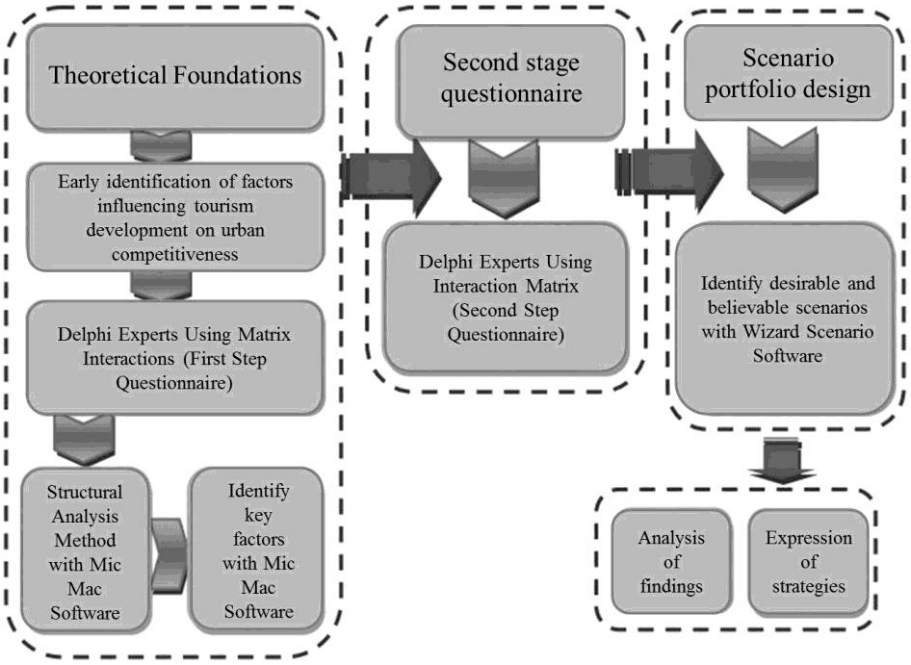

Figure 1. Conceptual framework of the research methodology, illustrating the sequential integration of Delphi and MICMAC techniques to identify and analyze key variables affecting urban tourism competitiveness
Source: Authors

The MICMAC model classifies variables into five categories based on their systemic role (Figure 2):

- Influential variables (top-left): High impact, low dependency—critical for system control.

- Relay variables (top-right): Both highly influential and dependent—unstable and sensitive, requiring constant monitoring.

- Dependent variables (bottom-right): Heavily influenced but exert little influence—outcomes rather than drivers.

- Independent variables (bottom- left): Minimal interaction with the system—generally insignificant for policy intervention.

-Adjustment variables (center): Located near the center—moderate values that may act as secondary drivers or buffers.

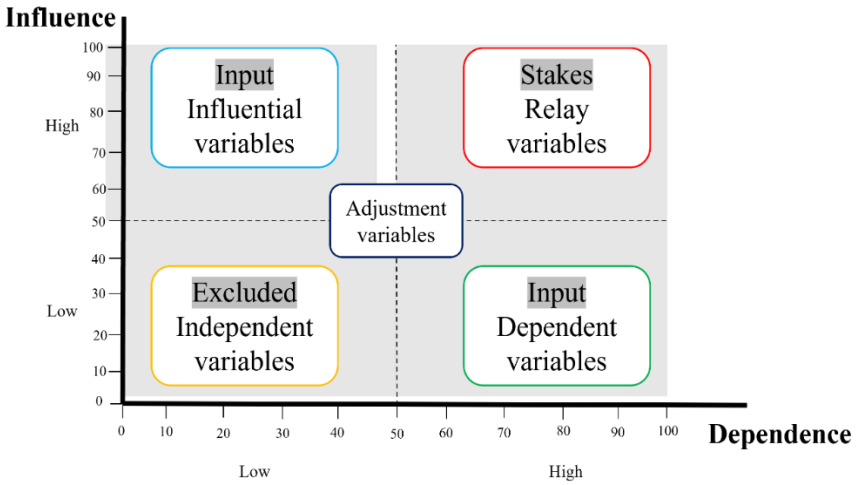

Figure 2. Distribution of key variables based on their level of influence and dependency using MICMAC analysis
Source: Chen (2018)

The Delphi method is a forecasting process and structured communication framework based on the results of multiple rounds of questionnaires sent to a panel of experts (Niederberger et al., 2021). The

Delphi technique emphasizes the expertise and relevance of participants over sheer their numbers (Naisola-Ruiter, 2022). Prior studies have demonstrated that Delphi panels of 10–15 highly qualified individuals can yield reliable and valid results in similar research contexts (Barrios et al., 2021). To implement the Delphi method, questionnaires were conducted in three stages. The first was an open-ended questionnaire identifying key factors influencing tourism's role in urban competitiveness.

In the second stage, experts evaluated these variables using pairwise weighting on a 0–3 scale to determine key drivers. The third stage involved assessing potential future scenarios based on the selected variables. This final step aimed to validate the scenario-building process and ensure their relevance for strategic planning. The Scenario Wizard software, developed by the Millennium Project (Niazi et al., 2021), was used to synthesize future scenarios based on the cross-impact matrix developed in the third round of the Delphi process. The input consisted of a 42×42 matrix representing the interactions among different states of 14 key variables. Experts rated each possible state's effect on others using a scale from -3 (strongly limiting) to +3 (strongly enabling). The software then applied a consistency algorithm to identify logically coherent combinations of states, filtering out scenarios with internal contradictions. Parameters such as consistency threshold and impact value cutoffs were calibrated based on expert input and prior studies (Cordova-Pozo and Rouwette, 2023). The final outcome included strong, moderate, and weak scenarios based on the systemic compatibility of variable states. Finally, by preparing desirable and believable scenarios, strategies have been proposed.

The statistical population of this study consisted of 12 industry professionals engaged in the tourism sector, including both private and government employees, managers specializing in geography and tourism planning, as well as professors and students within the field of tourism. A purposive sampling method was used to ensure that respondents possessed specialized expertise in tourism planning, policy, and management. The selection of the expert panel was based on clear inclusion criteria to ensure the relevance and depth of insights. Experts were required to have at least a postgraduate degree in tourism, urban planning, or related fields, along with a minimum of five years of professional or academic experience in tourism planning, policy-making, or destination development. This purposive sampling strategy ensured that each panelist possessed both theoretical knowledge and practical expertise relevant to the study's objectives. By focusing on quality rather than quantity, the research aligns with Delphi methodology standards, which prioritize the richness of expert input over statistical generalizability.

Among the participants, 67.4% were male and 32.6% female, with the majority aged 18–30 and a small proportion over 60. Approximately 37.2% held postgraduate degrees, and the highest share (33.3%) worked

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in the private tourism sector, reflecting a knowledgeable and diverse sample.

To validate the research tools, expert review confirmed the content validity of the questionnaires. Reliability was verified using Cronbach's alpha (0.818) and inter-rater consistency through Cohen's kappa (0.79), indicating substantial agreement (Vader et al., 2024). The Kolmogorov-Smirnov test showed that all variables followed a normal distribution ($p > 0.05$).

The combined use of the Delphi method and MICMAC structural analysis was selected to address the complexity and interdependence inherent in tourism development. Delphi enabled expert-driven identification and prioritization of key variables, particularly where empirical data was lacking. MICMAC provided a systematic framework to map variable interactions and distinguish influential versus dependent factors. This integration enhances both the depth and structure of analysis, supporting more nuanced and actionable scenario building.

The synergy of these methods offers a robust platform for strategic foresight in tourism planning, especially under conditions of uncertainty. It allows researchers and policymakers to identify not only which factors matter most, but also how they dynamically interact over time.

RESULTS

An open-ended survey and literature review were conducted using the Delphi method to identify key factors shaping the future of tourism as a driver of urban competitiveness. Experts were asked to list influential variables across diverse tourism categories—historical, natural, cultural, recreational, sports, artistic, religious, health, work, and educational—selected based on prior research and validated by expert consensus. This comprehensive categorization ensured coverage and conceptual overlap.

In the second stage, a structured questionnaire was distributed to the same panel, who rated the importance of each variable using a Likert scale. As a result, 25 key variables were selected for final analysis from an initial pool of 104, refined through both expert validation and statistical assessment. These were grouped into five thematic areas. Table 1 presents the initial variables identified during the first Delphi round, based on source reviews and expert input.

Concurring to the number of factors, the measurements of 25 * 25 lattice, which were set in five distinctive areas, were analyzed utilizing auxiliary investigation strategy and computer program MICMAC to extricate the most components affecting tourism improvement with the urban competitiveness approach. The number of rehashes was considered twice. The lattice filling rate is 59.80%, which speaks to a cruel coefficient that appears common due to the dissemination of the factors influencing the break advancement. Among 374 connections assessed in this lattice, 251 were zero, 205 were one, 86 were two, and 83 were three. On the other hand, the network based on measurable files with information revolution twice has 100% utility and optimization

which demonstrates tall legitimacy of the survey and its answers. Table 2 presents the output of the analysis, in which the main variables are ranked in terms of their direct and indirect impact and influence. (Table 2)

Table 1. Initial Set of Variables Influencing Urban Tourism Competitiveness, Identified in Delphi

Group	Factor
Organizational and managerial	P_1. Macro government policies; P_2. Tourism comprehensive plan; P_3. Skilled manpower; P_4. Coordination of organizations; P_5. Regulation of tourism laws and regulations.
Sociocultural	P_6. Awareness of the local community and tourists; P_7. Holding seasonal and cultural festivals; P_8. Crafts; P_9. Tourism culture; P_{10}. Security.
Economic	P_{11}. Private Sector Investments; P_{12}. Distribution of Facilities; P_{13}. Entrepreneurship; P_{14}. Funding; P_{15}. Marketing and Advertising.
Infrastructure and services	P_{16}. Urban and Regional Transport Network; P_{17}. Health Network; P_{18}. Infrastructure; P_{19}. Tours and Agencies; P_{20}. Welfare Services.
Natural	P_{21}. Water Resources; P_{22}. Climate; P_{23}. Vegetation and Animals; P_{24}. Beautifying Urban Space; P_{25}. Polluting Resources

Source: Alavi et al. (2022); Kumar & Dhir (2020); Matin (2021); Lopes et al. (2018); Rahmani & Rahnama (2020)

Table 2. Direct and Indirect Influence and Dependency Rankings of Key Variables Based on MICMAC Analysis

Rank	Title	Direct influence	Title	Direct affected	Title	Indirect influence	Title	Indirect affected
1	P_{15}	623	P_{16}	623	P_{10}	610	P_{16}	602
2	P_{10}	591	P_{21}	575	P_{22}	572	P_{21}	564
3	P_{22}	591	P_{22}	559	P_{11}	570	P_{22}	557
4	P_7	575	P_{19}	511	P_{15}	564	P_{19}	521
5	P_9	543	P_{10}	511	P_7	555	P_{13}	493
6	P_{18}	543	P_7	479	P_9	552	P_{10}	485
7	P_2	543	P_{17}	463	P_{18}	540	P_{17}	484
8	P_{11}	527	P_{13}	463	P_2	530	P_2	466
9	P_1	511	P_2	463	P_1	487	P_4	453
10	P_{20}	463	P_4	431	P_{20}	476	P_7	442
11	P_{25}	447	P_8	399	P_{25}	460	P_8	400
12	P_4	431	P_{23}	383	P_4	413	P_{23}	377
13	P_{14}	399	P_{14}	383	P_{14}	413	P_{18}	376
14	P_{21}	383	P_5	383	P_{16}	368	P_5	374
15	P_{16}	351	P_{18}	367	P_{21}	362	P_6	351
16	P_{12}	319	P_3	351	P_{19}	318	P_9	342
17	P_{19}	303	P_9	351	P_{12}	286	P_{14}	342
18	P_{17}	255	P_{12}	335	P_{23}	264	P_{15}	337
19	P_6	255	P_6	319	P_{24}	263	P_3	325
20	P_{24}	239	P_{15}	303	P_3	250	P_{12}	308
21	P_{23}	239	P_{20}	287	P_5	244	P_{11}	304
22	P_3	223	P_1	287	P_6	244	P_1	296
23	P_5	223	P_{25}	271	P_{17}	227	P_{20}	278
24	P_8	223	P_{11}	271	P_8	222	P_{25}	262
25	P_{13}	191	P_{24}	223	P_{13}	197	P_{24}	248

The output of the Interaction Analysis Model reveals the relationships between factors, and MICMAC is capable of transforming these relationships into direct and indirect influence matrices, as well as

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visually interpretable system structures, making it easier to analyze relationships and framework structures. As shown in Figure 3, the identified factors were mapped onto an Influence-Dependence Chart to provide a graphical representation of their roles in the system. (Figure 3)

According to the comes about of the investigation, Table 3 appears among 25 components which were explored in this ponder, 14 components were chosen as the most components impacting tourism improvement with an urban competitiveness approach. Table 3 also categorizes variables based on their role in the urban tourism competitiveness system. (Table 3)

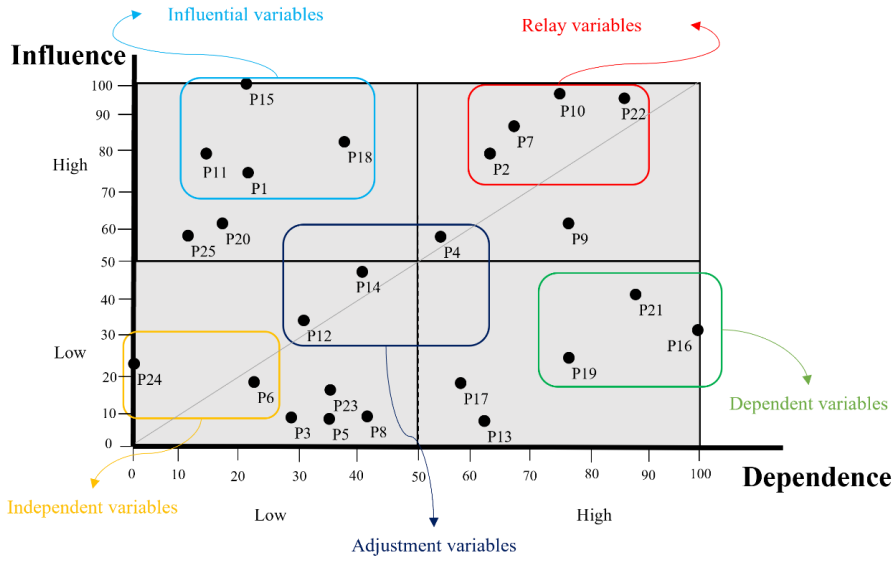

Figure 3. Distribution of key tourism competitiveness variables based on their level of influence and dependency using MICMAC analysis
Source: Authors

Table 3. Classification of Key Variables According to Their Strategic Roles in the Influence-Dependency Map (MICMAC Output)

Group	Factor
Input or Influential variables	P_1. Macro government policies; P_{11}. Private Sector Investments; P_{15}. Marketing and Advertising; P_{18}. Infrastructure.
Stakes or Relay variables	P_2. Tourism comprehensive plan; P_7. Holding seasonal and cultural festivals; P_{10}. Security; P_{22}. Climate.
Adjustment variables	P_4. Coordination of organizations; P_{12}. Distribution of Facilities; P_{14}. Funding.
Output or Dependent variables	P_{16}. Urban and Regional Transport Network; P_{19}. Tours and Agencies; P_{21}. Water Resources.

As shown in Figure 3, the MICMAC analysis reveals a highly interdependent structure within the tourism competitiveness system. Variables such as P15 (Marketing and Advertising), P11 (Private Sector Investment), and P1 (Macro Government Policies) are located in the upper-left quadrant, identifying them as Input or Influential variables. These are high-leverage points—interventions in these areas are likely to have widespread ripple effects throughout the system. For instance, improvements in marketing not only enhance destination visibility but also indirectly influence infrastructure use, investment flow, and tourist behavior.

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On the other hand, variables such as P16 (Urban and Regional Transport Network) and P21 (Water Resources) are classified as Dependent variables, meaning they are highly sensitive to changes in other parts of the system. This suggests that while these elements are crucial for tourist experience, their improvement relies on upstream decisions in governance, investment, and planning.

Interestingly, P10 (Security) and P22 (Climate) function as Relay variables, both influencing and being influenced by multiple other factors. Their dual role reflects their strategic importance: they act as amplifiers of system behavior. For example, security concerns can destabilize marketing efforts and infrastructure investment, while at the same time, they are influenced by broader socio-political and environmental dynamics.

The presence of P4 (Coordination among Organizations) and P14 (Funding) near the center of the influence-dependence map suggests they serve as Adjustment variables—factors that may not be primary drivers but are essential for balancing system behavior. These elements often determine the system's capacity to respond and adapt to external shocks.

Taken together, these findings point to a non-linear, interconnected system where targeted intervention in a few influential variables—particularly macro government policies, private sector investment, and infrastructure development—can yield system-wide benefits. This insight is essential for policymakers aiming to build a resilient, adaptive, and competitive tourism system.

A total of 42 probable states were generated for 14 key drivers, considering optimistic, pessimistic, and moderate modes. Experts evaluated these through a 42×42 cross-impact matrix, rating the effect of each state on others using a scale from -3 (limiting) to +3 (enabling). The system calculated approximately 318 million combined scenarios, though most serve statistical purposes rather than policy guidance.

Based on expert input and Scenario Wizard software analysis, the results yielded:

5 strong (high-probability) scenarios

14 high-compatibility (believable) scenarios

4111 weak or inconsistent scenarios

The software does not select scenarios based on desirability but on logical consistency among variable interactions. Thus, outputs range from fully desirable to entirely critical. Weak scenarios, being highly unstable, are unsuitable for planning. The 14 believable scenarios fall between extremes and offer viable bases for strategic planning—categorized as Desired (D), Static (S), and Crisis (C) in Table 4.

Among these, most scenarios reflect favorable conditions, indicating strong potential for tourism development within urban competitiveness frameworks. Overall, 80% were classified as desired, 11% as static, and 9% as critical. Scenario 1—considered the best-case—emerges as the strategic benchmark for tourism-driven urban competitiveness.

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Table 4. Summary of the Developed Future Scenarios Based on Variable Configurations and Strategic Assumptions (D: Desired (Green); S: Static (Gray); and C: Crisis (Red))

	Macro government policies	Tourism culture	Private Sector Investments	Marketing and Advertising	Infrastructure	Tourism comprehensive plan	Holding seasonal and cultural festivals	Security	Climate	Coordination of organizations	Distribution of Facilities	Funding	Urban and Regional Transport Network	Tours and Agencies	Water Resources
1	D	D	D	D	D	D	D	D	D	D	D	S	S	D	S
2	S	D	D	D	D	D	D	D	D	D	D	S	S	D	S
3	S	D	D	D	D	D	S	D	D	D	D	S	S	D	S
4	D	D	D	D	D	D	D	D	D	D	D	S	S	S	S
5	S	D	D	D	D	D	D	D	D	D	D	S	S	S	S
6	S	D	D	D	D	D	S	D	D	D	D	S	S	S	S
7	D	D	D	D	D	D	D	D	D	D	S	S	S	S	S
8	D	D	D	D	D	D	D	D	S	D	S	S	S	S	S
9	S	D	D	D	D	D	D	D	S	D	S	S	S	S	S
10	S	D	D	D	D	D	S	D	S	D	S	S	S	S	S
11	C	C	D	S	D	C	S	C	S	S	S	S	C	S	S
12	C	C	D	C	D	C	S	C	S	S	S	S	C	S	S
13	C	C	C	C	C	S	C	C	C	C	C	C	C	C	C
14	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

DISCUSSION

Tourism planning encompasses multiple dimensions due to its complex and dynamic nature. Planning for future development as a component of urban competitiveness has become essential, particularly given the sector's exposure to external shocks and its interdependence with urban systems. Traditional approaches often fall short in addressing such uncertainties, reinforcing the need for futures research and scenario-based methodologies to support more adaptive tourism strategies.

In this study, we adopted a future-oriented system approach, integrating Delphi and MICMAC techniques to identify critical variables and simulate plausible development trajectories. This scenario-driven framework enables planners to anticipate systemic changes and align strategies accordingly.

Three scenario groups were developed—Crisis, Intermediate, and Desired—to explore a range of possible futures. Each reflects different combinations of key variables and offers unique insights into the challenges and opportunities of urban tourism development.

- **Crisis Scenarios: Unfavorable Conditions for Tourism Development**

Crisis scenarios represent the most adverse trajectories, where systemic vulnerabilities dominate. These are characterized by weak

governance, low investment, poor branding, environmental degradation, and fragmented institutional coordination. Neglecting city branding, ineffective legal frameworks, and unsustainable tourism practices collectively erode competitiveness and reduce a destination's ability to adapt or recover.

From a policy standpoint, these scenarios serve as early warnings, highlighting the need for capacity building and strategic interventions. Key measures include strengthening governance through integrated policies, incentivizing long-term investment in infrastructure and human capital, and leveraging smart tourism technologies to build adaptive capacity.

• **Intermediate Scenarios: Static Conditions and Limited Progress**

Intermediate or "status quo" scenarios reflect slow, fragmented progress, often resulting from institutional inertia or lack of consensus. Variables like transportation infrastructure and water management frequently appear as stable, indicating resistance to short-term changes. These scenarios point to a need for sustained investment in infrastructure and human resource development.

Characteristics include limited urban branding, insufficient stakeholder coordination, and underdeveloped tourism promotion. Recommended actions include:

Expanding public-private partnerships,

Enhancing tourism education and skills training,

Strengthening regional collaboration.

These efforts aim to address systemic fragmentation and foster gradual, consistent improvement in competitiveness.

• **Desired Scenarios: Favorable Conditions for Urban Tourism Development**

Desired scenarios depict optimal conditions, shaped by effective governance, integrated policies, smart infrastructure, and coordinated investment. These scenarios demonstrate the power of collective vision and strategic alignment among stakeholders in creating high-impact tourism systems.

Recurring variables in these scenarios—such as smart technologies, sustainable policies, and advanced marketing—reflect a shared expert consensus on their centrality to tourism competitiveness. Their consistent presence suggests that these factors are both achievable and instrumental in fostering growth.

Strategic recommendations to realize these scenarios include:

Advancing smart tourism infrastructure (IoT, AI, big data),

Implementing sustainable tourism policies,

Enhancing destination branding and market research.

These measures are supported by previous research (Ferreira & Perks, 2020; Woyo & Slabbert, 2021) that underscore the importance of aligning economic, environmental, and social indicators in tourism development.

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Our findings validate earlier studies identifying governance, infrastructure, and marketing as key drivers of competitiveness (Goffi et al., 2023; Ferreira and Perks, 2020). Additionally, the emergence of "climate" and "security" as influential relay variables underscores the increasing relevance of environmental and geopolitical uncertainties.

While Espiner et al. (2019) highlight the primacy of resilience and sustainability, our results suggest that without strategic coordination and investment, these values may not translate into effective action in uncertain contexts. This distinction points to the importance of integrated and adaptive planning that combines sustainability goals with operational pragmatism.

Tourism competitiveness is influenced by a spectrum of variables across physical, climatic, demographic, institutional, and economic dimensions. Cities aiming to enhance their competitive edge should prioritize strategies that address:

Geographic and natural advantages,

Seasonal climate dynamics,

Demographic shifts and tourist behavior,

Policy frameworks and investment incentives,

Employment generation and financing models,

Cultural heritage and community engagement.

By systematically addressing these areas, cities can build resilient, inclusive, and future-ready tourism ecosystems.

Moreover, this study's methodological framework provides transferable insights. In culturally rich regions, promoting local participation and tourism culture is essential for community-based tourism. In emerging economies, investment in branding and infrastructure aligned with regional goals can create a competitive edge. In environmentally vulnerable zones, resilience-focused planning and sustainability integration are key. The scenario-based approach offers a scalable tool that allows policymakers to tailor strategies based on their unique risk and resource profiles.

For instance, coastal destinations facing climate change may focus on adaptive infrastructure and conservation, while post-conflict regions may prioritize safety, perception management, and trust-building.

The designed scenarios also implicitly account for current global dynamics such as the aftermath of the COVID-19 pandemic, climate change, and digital transformation. For instance, scenarios that emphasize infrastructure resilience, inter-agency coordination, and smart tourism technologies reflect a direct response to vulnerabilities exposed during the pandemic. In the plausible scenarios, climate appears as a critical uncertainty—where favorable scenarios (e.g., Scenario 1 and 4) assume climate stability and environmental resilience, while pessimistic scenarios (e.g., Scenario 13 and 14) reflect climate disruption and its adverse effects on tourism seasonality and attractiveness. Likewise, although not explicitly labeled as "digital infrastructure," variables such as "marketing and advertising" (P15) and "coordination of

organizations" (P4) indirectly capture the role of digital transformation. In desirable scenarios, digital tools are assumed to enhance inter-agency coordination and promote smart tourism systems, while in static or crisis scenarios, lack of integration results in inefficiency and reduced competitiveness. These elements collectively ensure that the scenario framework remains responsive to evolving global challenges, enabling adaptive capacity for policymakers to address future shocks proactively.

While the findings of this study provide actionable insights for urban tourism development, their applicability in diverse tourism economies must be considered with caution. In low-income or politically unstable regions, for example, the successful implementation of strategic drivers such as inter-organizational coordination or infrastructure investment may be limited by institutional weaknesses or funding constraints. Similarly, in regions with informal tourism economies or limited data infrastructure, methods like Delphi or MICMAC may face feasibility challenges due to lack of structured expert networks or consistent indicators.

These constraints suggest that while the methodological approach is robust, its application requires contextual adaptation. Policymakers and planners should calibrate the tools and strategies identified here to local institutional capacities, stakeholder dynamics, and governance models. This critical reflection also opens the door for future research on adapting futures research methods to fit a broader range of socio-economic and political contexts in tourism planning, guided by local realities but supported by a flexible and future-oriented planning model.

CONCLUSION

This study sought to identify effective, future-oriented strategies to strengthen the role of tourism in urban competitiveness using a combination of Delphi and MICMAC methods. Through expert consultation and structural analysis, 14 key variables were identified as critical to tourism development. These variables formed the basis for constructing three scenarios—desired, intermediate, and crisis—to explore potential development paths. Among them, the desired scenario was found to be the most feasible and aligned with global trends in sustainable tourism and digital transformation.

Key elements of the desired scenario include expanding tourism culture, enhancing inter-organizational collaboration, increasing investment, improving the business environment, and fostering innovation and entrepreneurship. These priorities reflect the sector's need for strategic coordination, smart infrastructure, and targeted marketing to boost competitiveness.

To operationalize these insights, Table 5 presents strategic priorities across five key domains:

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Table 5. Core Features and Strategic Priorities of the Optimal Scenario for Tourism Destination Competitiveness

Group	Strategy
Organizational and managerial	Coordinating the preparation of a comprehensive tourism plan by preserving and promoting urban, environmental and tourism values; Applying efficient and effective management for tourism planning attracts and coordinating all key infrastructure factors in a collaborative workgroup on tourism, cultural heritage, sustainable development, and tourism growth.
Sociocultural	Ensuring security at the regional level; Educating and training local communities to engage effectively with tourists; Promoting and developing traditional handicrafts and cultural industries
Economic	Increasing the share of tourism development budgets; Introducing tourism investment opportunities to investors; Encouraging private sector participation through supportive policies such as tax exemptions and incentives for establishing and expanding cultural, artistic, and tourism service centers; Enhancing marketing and awareness initiatives to highlight tourism benefits.
Infrastructure and services	Improving the performance of attractions, transportation, and accommodation facilities in terms of accessibility and affordability for diverse social groups; Ensuring that available facilities meet international tourism standards; Expanding infrastructure development in alignment with tourism potential; Increasing financial allocations for upgrading and expanding urban and regional transport networks
Natural	Protecting and conserving natural diversity; Utilizing environmental and climatic advantages of the region to enhance tourism appeal; Modernizing and integrating eco-tourism initiatives with broader tourism strategies.

Achieving long-term success depends on aligning strategies with uncertainty-aware planning, ensuring adaptive capacity in the face of climate change, technological disruptions, and market volatility. Scenario-based approaches offer a flexible framework for translating theoretical models into actionable policy tools.

The study's findings align with earlier literature emphasizing governance, sustainability, and infrastructure as key to tourism growth. Notably, variables like climate and security emerged as influential relay factors, signaling an increased sensitivity to external risks. While previous studies (e.g., Espiner et al., 2019) stressed resilience and sustainability, our results suggest that these values alone are insufficient without strategic investment and inter-agency coordination.

Some limitations of the study include the time-intensive Delphi process, limited expert panel size, and context-specific nature of the findings. Additionally, the integration of qualitative insights with quantitative models posed technical and methodological challenges. The subjectivity of scenario construction also limits generalizability to some extent.

Future research could explore emerging trends and variables beyond those examined here. Comparative studies across different cities or countries would enhance external validity. Furthermore, the integration of real-time data, AI-based foresight tools, and smart tourism analytics

could refine the scenario development process and improve policy responsiveness.

Beyond policymaking, the study provides a methodological framework for understanding the mental models of tourism planners, supporting participatory approaches, and enhancing collaboration between governments, businesses, and communities.

Beyond policymaking, the study provides a methodological framework for understanding the mental models of tourism planners, supporting participatory approaches, and enhancing collaboration between governments, businesses, and communities.

From an urban design perspective, the identified drivers—such as infrastructure quality, sustainability, and governance—directly influence spatial development, mobility networks, and public space design. The scenarios can inform urban planners and architects in creating flexible, tourism-oriented environments that promote resilience and cultural identity. Embedding futures thinking into design processes enables cities to build spaces that are not only competitive but also adaptive and sustainable.

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Resume

Mohammad Hossein SAMAR, a graduate of Islamic Azad University, Central Tehran Branch, he has been passionate about traditional Iranian architecture and historic buildings since his teenage years, which led him to work in restoration and

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Azadeh ABDOLLAHI has received a Master's degree in Architecture. She is an architectural designer, passionate about the design process and drawing inspiration from traditional architectural styles. Her work integrates these rich historical elements with modern approaches, such as computational design and environmental strategies. She strives to create innovative architectural solutions that honor the past while addressing contemporary challenges. Her research is Energy in Architecture, Renewable Energy, Artificial Intelligence and Algorithms, Parametric Architecture.

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Mahya GHOUCHANI is lecture of university, researcher and inventor in Architectural Engineering. She is inventor and passionate about creativity and innovation. Moreover, she is an INV member of the International Federation of Inventors' Associations - IFIA. Her unique combination of research expertise, practical innovation, and academic mentorship allows me to provide valuable insights and solutions to businesses and organizations. She is particularly interested in collaborating with companies that seek to innovate and stay ahead of the curve by leveraging cutting-edge research and technological advancements. Her research interests span the Theory and Philosophy of Architecture, Architectural Design, Space and Culture, Intelligent Decision in Architecture, Energy in Buildings, Energy in Architecture, Energy Optimization, Renewable Energy, Artificial Intelligence and Algorithms, Artificial Intelligence in Architecture, Parametric Architecture.

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Preserving and Rehabilitating the Historic Urban Landscape of Istanbul: A Case Study of the Büyükdere District

Özge Ilık Saltık*

Abstract

Büyükdere has been a settlement since the Byzantine period and was a popular summer destination for ambassadors and foreigners due to its natural beauty in the 18th and 19th centuries. Nevertheless, while the urban sprawl of Büyükdere continued during the Republican period, the settlement began to lose its cosmopolitan structure. The problematic legal processes of Bosporus caused deterioration in the historical fabric of Büyükdere, even though it was declared a "historical urban site" in 1983.

As a unique part of Bosporus' urban morphology, Büyükdere has not received enough attention, which can support the preservation of its urban fabric, from scholars and local authorities so far. Therefore, this study aims to fill the knowledge gap on Büyükdere by highlighting its preservation problems and thus, developing rehabilitation proposals for its historical urban fabric.

The settlement was documented via various analyses, and through them: legal, physical, and socio-economic preservation problems were determined at the building and urban scales. In 2023, 10,2% of the buildings were determined unoccupied, whilst 10% of the buildings were observed as structurally in bad condition. While 50,9% of the existing building stock was determined as new buildings, 6,4% of the buildings on the site were newly constructed on listed parcels. When the numbers of listed buildings were compared in 1978, 1983, 2004, and 2022, it was determined that 167 heritage buildings were lost during the last decades. The primary cause of this heritage loss has been identified as legal procedures, which significantly impact the site's preservation status. In parallel with these, due to the decrease in the local population, abandonment and neglect were observed to impact the deterioration level of remaining heritage buildings.

Consequently, new urban designs and interventions were proposed to revitalize the fabric and create a sustainable preservation environment.

Keywords:
Historical urban site, Preservation, Rehabilitation, Urban revitalization.

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INTRODUCTION

The settlements on the shores of Bosporus have a fragmented typology that consists of separated dwelling units called “villages”. The term “village” (*köy* in Turkish) has become an indicator of Bosporus’ unique morphology by existing in the names of many Bosporus districts (such as Ortaköy, Kadıköy, Arnavutköy, etc.). These separated historical urban cores of Bosporus, expanded unevenly over time. However, despite having regional differences, these villages developed their own lifestyle that can be traced over architectural and natural assets, as well as daily life activities that can be spotted on the site (Kuban, 1976).

As a Bosporus village, Büyükdere was defining a cosmopolitan structure through its demography and architecture, along with its unique natural assets during the 18th-19th centuries. However, even though it was declared as a historical urban site in 1983 according to the Turkish Law of Conservation of Cultural and Natural Assets (no. 2863), the settlement had lost most of its natural and cultural heritage assets before the enactment of the related laws. Furthermore, while other Bosporus villages drew the interest of scholars and local authorities more in terms of conservation, Büyükdere has not been studied mostly due to its remote location from the city’s urban focal points. Therefore, the respectable amount of its lost cultural, natural, and intangible heritage have been never documented in detail. Yet, the traces of some tangible and intangible heritage that are lost in time, in addition to the present ones, are still detectable.

In this context, this study aims to document and assess the heritage assets of Büyükdere to define their preservation problems, and thus, develop rehabilitation proposals both in the building and urban scales by utilizing a combination of data sources and analyses of the historical characteristics of the area. In order to achieve this, study zone was first selected based on factors such as the historical urban site boundaries, aerial photographs, old maps, and the preservation status of the built fabric. The tangible heritage structures were then analyzed in terms of occupation rates, number of stories, construction materials, and techniques to assess their current preservation status and associated challenges. These analyses were conducted at both the building and urban scales to provide a comprehensive yet detailed understanding of the site.

The findings from the physical analyses were interpreted alongside the socio-economic history and legal transformations (including laws and regulations) that have shaped the area to further explore the underlying causes of Büyükdere’s preservation challenges. Based on these insights, rehabilitation proposals were developed to safeguard Büyükdere’s urban heritage while promoting its distinctive local practices. These proposals focus on key focal points or designated recreation zones that integrate both the tangible and intangible heritage of the site.

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HISTORY OF BÜYÜKDERE

The earliest reference to Büyükdere was made by Greek geographer Dionysios during the 2nd century BCE, where it was mentioned as *Bathykolpos*, meaning 'deep bay' (Dionysios, 2020). The first significant mention of Büyükdere as a settlement came in the 4th century CE by Deleon (1999), who described it as a small fishing village called *Vathys Kolpos* (Figure 1). The village was built around the stream called *Büyükdere*, which flows into the deepest bay (Büyükdere Bay) in Bosporus. Büyükdere was renowned for its natural beauty, including meadows, plane trees, and spring waters (Eyice, 2021).

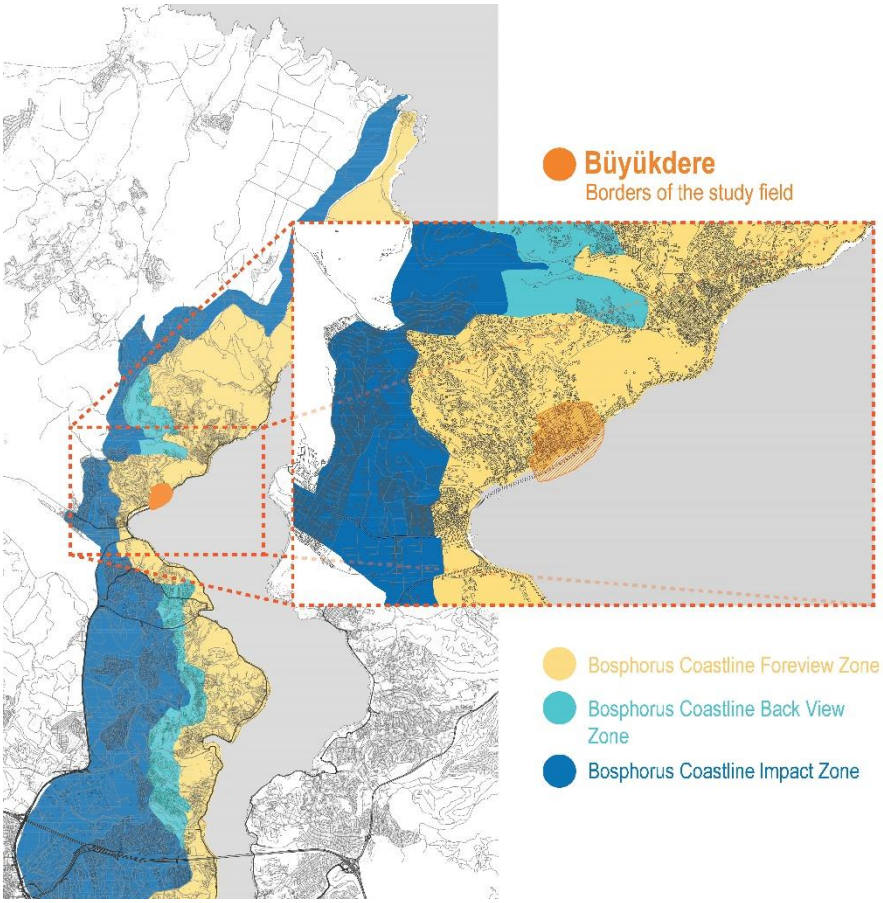

Figure 1. Location of the study area in Bosporus Natural and Historical site (Ilık Saltık, 2023)

During the Ottoman Period, Büyükdere gained prominence as a preferred destination for the sultans in the 16th -17th centuries, offering them a picturesque retreat within a day's reach. It was regarded as a natural extension of the nearby Belgrad Forest (Aysu, 1994). As the sultans and their families began to show more interest in settling in Bosporus rather than the historical peninsula during the 18th century, Büyükdere started to expand.

During the 19th century, Büyükdere became a cosmopolitan settlement, attracting both Muslim and non-Muslim populations, including Levantines and foreign soldiers. The presence of ambassadors who chose to reside in Büyükdere during the summer further contributed to its popularity among foreigners (Kuban, 1996). Life in

Büyükdere during the summer was considered an extension of life in Pera, a vibrant neighbourhood of Istanbul (Gülenaz, 1998). As a result, numerous restaurants, taverns, hotels, markets, and various shops were established in Büyükdere, along with a ferry port, in the second half of the 19th century (Aysu, 1994).

Büyükdere also became a preferred summer residence for many individuals seeking to escape the frequent epidemics and fires that plagued the historical peninsula (Yağan, 2015). However, Büyükdere itself suffered significant damage from fires in the late 19th century. The 1898 fire destroyed more than 400 buildings, resulting in a transformation of the settlement's urban morphology (Figure 2). It is believed that the grid axes seen in Büyükdere today were planned after this fire, at the beginning of the 20th century (Figure 4) (Ercan, 2019).

Figure 2. Maps of The German Blue, Büyükdere, 1913-1914 (IBB Atatürk Library, 1926)

In the late 19th century, the cosmopolitan nature of Büyükdere began to decline, and this declination process was further accelerated with the establishment of the Republic of Türkiye. During the 1920s-1930s, Büyükdere remained a quiet place primarily visited by residents and was still regarded as a summer resort. However, significant changes occurred in the following decades with the construction of new land roads in the 1940s -1950s. These roads connected Büyükdere to other parts of Istanbul, leading to an increase in construction activities in and around the historic urban core (Aysu, 1994).

According to the Turkish Statistical Institute (TÜİK), the population of Büyükdere continued to increase until 2007. To alleviate the growing traffic congestion, a new coastal road, locally known as the *kazıklı yol* ('causeway' in Turkish), was constructed in the late 1980s. This road, Demokrasi Şehitleri Street, created a barrier between the land and the sea, rendering the workshops of boat builders, seaside mansions, and restaurants obsolete (Aysu, 1994). As a result of economic fluctuations and urban development, the size of parcels decreased, meadows disappeared, and Büyükdere transformed into a densely populated residential area (Erkılınç, 1982).

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Neither the declarations in 1975 and 1983 (which include and acknowledge Büyükdere as a natural and cultural site worth preservation) nor the laws were sufficient and effective enough to protect the historical core of Büyükdere (Salman and Kuban, 2006). Consequently, many civil architectural heritage buildings were replaced with new and incompatible structures between 1950-2025.

DEFINITION OF THE STUDY AREA AND ITS PRESENT PHYSICAL STATUS

To evaluate the historic fabric of Büyükdere, a specific study zone was selected. Figure 3 displays the borders of the historical urban site and the selected study zone. While determining the study area, various inputs were considered: including aerial photos, old maps, and the present preservation status of the fabric. Natural features such as hills and the coastline, as well as urban elements like streets, were considered to establish the boundaries. The study area encompasses Boylu Blind Alley in the northeast, Kalfa and Çavuşoğlu Streets in the north, Dede Korkut Street in the northwest, Ekserci and Cami Streets in the west, and Uzun Fıstık and a portion of Demokrasi Şehitleri Streets in the southwest).

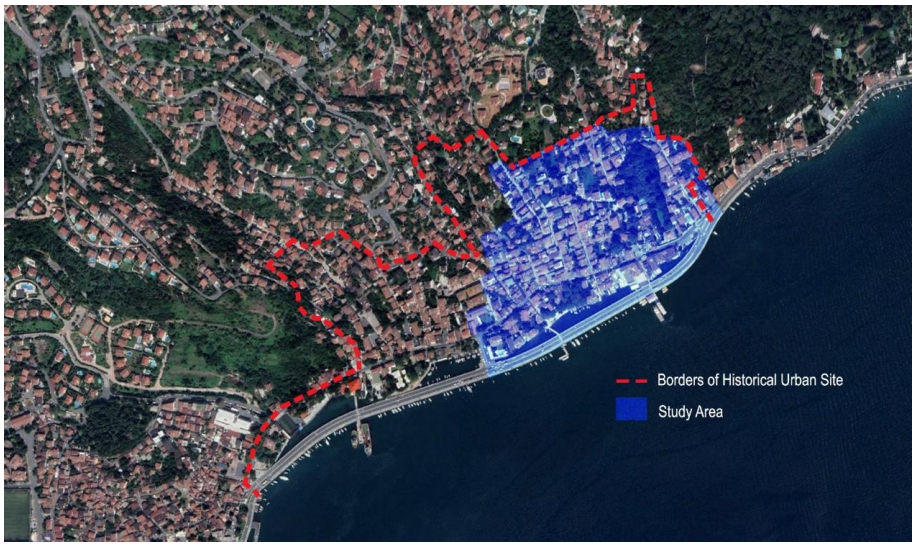

Figure 3. Borders of the study area within the historical urban site borders dated 1983 (Google Earth, 2023)

The selected study zone in Büyükdere comprises 53 lots, 529 parcels, and 499 structures. Within this zone, there are eight listed monumental heritage buildings, namely Kara Mehmet Kethüda (Büyükdere) Mosque, Hagia Paraskevi Greek Church, Surp Boğos Armenian Catholic Church, Italian Santa Maria Catholic Church, Topçu Police Station, Spanish Embassy's Summer Resort, Old Büyükdere Ferry Port, and Fuad Pasha Mansion. Additionally, numerous civil architectural heritage buildings from various periods can be spotted within the zone.

The historic fabric of Büyükdere exhibits a combination of partially organic and regular building blocks and streets. The oldest structure in the area dates to the 18th century, while the majority of the building stock originates from the late 19th century to the early 20th century.

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Çayırbaşı Street, as the main axis of Büyükdere (even after the construction of the causeway), defines a unique urban formation in the study zone. This uniqueness comes from the two-sided nature of Çayırbaşı Street which refers to the orange building island in Figure 4. It is known that most of the Bosporus villages' coastlines consist of a line of building blocks (purple blocks) and a road in front of them. Given the fact that these roads which are located between the building blocks and Bosporus are usually the main axis, the ground floors of these first-row buildings are frequently used for commercial functions. Accumulation of commercial functions in one axis or zone is usually addressed as a bazaar or marketplace (or '*çarşı*' in Turkish). Therefore, in Büyükdere, both sides of Çayırbaşı Street can be and are used as '*çarşı',* which promotes local business opportunities and commercial activities.

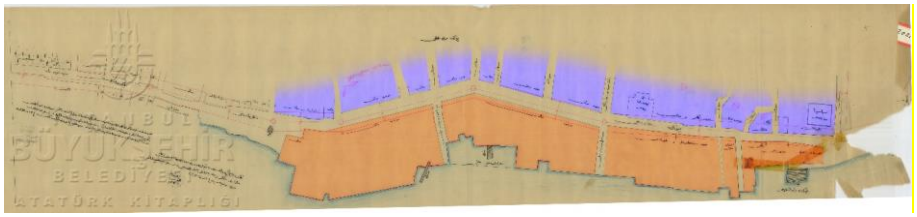

Figure 4. New route map for the coastal road (Çayırbaşı Street) due to the fire in 1898, dated 1913-1914 (IBB Atatürk Library, 1913)

In parallel with this unique formation, commercial buildings were observed to be concentrated on Çayırbaşı Street in the function analysis of the site. However, various other functions including residential, residential+commercial, accommodation, administrative+public, religious, education, and storage were also observed in the area. Moreover, the most prominent function was determined as residential, constituting 67.1% of the buildings. While commercial function was determined as 8% and residential+commercial as 10.5%, it is important to note that the ratio of vacant buildings in the area was determined as 9.6%, indicating a significant number of unoccupied structures. Many of these vacant structures are located on Çayırbaşı Street (Ilık Saltık, 2023). Moreover, in addition to vacant status, ruin-like half-demolished structures on this axis also address building scale problems that require various conservation actions.

It was observed that 47.1% of the buildings have at least one basement story. The number of basement stories was observed to reach up to four due to the hilly terrain of the Bosporus. However, the most common building height in the area is Ground (G) + 2 Stories (S), accounting for 35.9% of the buildings. Buildings with heights exceeding G+3S are mostly newly constructed.

The rich fabric of Büyükdere is reflected in the diverse construction techniques and materials used in the buildings. 58.3% of the buildings were constructed with a reinforced concrete frame, combined with various facade materials such as timber cladding, cement plaster, rough cement plaster, mosaic tiles, vinyl siding, and stone cladding. Timber-frame buildings account for 16.9% of the structures, while masonry construction represents 13.6%. This indicates that over half of the

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building stock in the historical core consists of newly built structures. Nevertheless, the ratio of compatible new structures to incompatible structures is almost 1 to 7 (Figure 16) which addresses a significant loss in tangible heritage (on building scale) and historic urban fabric (on urban scale).

Following these, out of the 499 structures in the area, 40.3% are listed as heritage buildings. However, it should be noted that 16 of these listed buildings were determined as reconstructions. Additionally, 6.4% of the listed buildings are newly constructed within listed parcels, and 50.9% are new buildings in non-listed parcels. Nonetheless, 2.4% of the buildings constructed with a reinforced concrete frame could potentially be considered for listing as modern heritage buildings.

While 27.7% of the buildings that were constructed after 1970 are considered new, the remaining buildings have different preservation conditions in terms of their building masses: 2.8% are in bad condition, 17.7% are in fair condition, and 51.8% are in good condition. Buildings in good condition generally retain their original volumes or have undergone simple and reversible changes, such as the enclosure of balconies. Buildings in fair condition may have undergone volumetric changes, such as additional stories. Buildings in bad condition can be stated as having unidentifiable original volumes.

When examining the preservation statuses of the facades in the study area, it was observed that 11.4% are in bad condition, 19.9% are in fair condition, and 41% are in good condition. Facades in good condition generally preserve their original appearance or have undergone simple and reversible changes, such as the addition of signboards or new claddings. Facades in fair condition may have experienced volumetric changes and alterations in the facade openings. Facades in bad condition are those where the original appearance is no longer recognizable.

One of the significant challenges faced by the existing building stock in Büyükdere is the addition of new stories to the buildings. This common practice gave path to the structural instability. Around 10% of the 499 structures in the study area have heavily damaged building elements and/or severe material problems, indicating a bad preservation condition. Unoccupied buildings and those with new or altered facade openings also contribute to the preservation problems in the area.

PRESERVATION PROBLEMS

Legal Problems

Conservation of historical fabrics usually contravenes the daily priorities of the public. Despite the existence of laws and conservation master plans, the lack of cultural motivation among the local population can lead to unlawful actions and opposition to conservation policies (Kuban, 2000). The laws established during the late Ottoman era, which were passed to the Republic, were not comprehensive enough to prevent the destruction of heritage structures effectively (Mumcu,

1969). Furthermore, complications arose due to the allocation of buildings with different functions to various institutions responsible for their conservation and preservation (Madran, 1996).

One of the major legal problems concerning the Bosporus region emerged with the enactment of Law No. 775, also known as the *Gecekondu* Law, enacted on July 20, 1966. This law was a milestone for the zoning activities along Bosporus, as it allowed and registered many unauthorized structures in and around the historical cores of Bosporus villages (*Gecekondu Yasası,* 1996). Subsequently, further enactments of laws and the foundation of related institutions led to cumulative preservation problems. In Table 1, important events and laws were summarized chronically to frame the whole process. The major problems that can be determined from Table 1 are conflicting and inconsistent decisions along with the confusion of authority.

Preservation of the industrial complexes in the Bosphorus can be given as an example of conflicted decisions. While the existing industrial buildings in Bosporus were stated to be preserved and only new constructions were forbidden in the Istanbul Industrial Land Use Plan (1966), they were decided to be removed gradually according to the Conservation Decisions on the Natural and Historical Sites of the Bosphorus (1975). However, with the report of the Land Use Preservation Plan of Bosphorus (1977), the existing industrial buildings were again decided to be preserved (Salman, 2004).

The confusion of authority, however, was used as an excuse to make unsuitable decisions in terms of preservation practices, for the sake of political interests.

It can be argued that due to administrative ambiguities and the political climate of the period, decisions conducive to preservation were not effectively implemented. As follows, from Table 1, Conservation Decisions on the Natural and Historical Sites of Bosporus in 1975 declared the High Council of Immovable Antiquities and Monument (GEEAYK) as the sole authority responsible for decision-making concerning the Bosporus. Nevertheless, the Land Use Preservation Plan of Bosporus (1977) expanded the list of authorized institutions and included the Ministry of Zoning and Housing, and the Ministry of Culture, which were granted the power to make decisions alongside GEEAYK.

Consequently, although laws and decisions concerning the Bosporus were theoretically intended to preserve its natural and cultural assets, they have ultimately led to the destruction of heritage assets in practice(Ilık Saltık, 2023).

Table 1. Legal Processes of Zoning and Conservation in Bosporus (Ilık Saltık, 2023)

YEAR	INSTITUTION	STATEMENT
1960	Directorate of Zoning and Planning	In order to decentralize the city, 1/10.000 scaled master plan and 1/5000 scaled Regional Plan of the Bosphorus have been prepared.

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1966	Grand National Assembly of Türkiye (*TBMM*)	Law no.775, titled *Gecekondu* Law, has been introduced.
1966	*TBMM*	"Istanbul Industrial Master Plan" (*İstanbul Sanayi Nazım Planı*) has been accepted.
1968	*GEEAYK*	*GEEAYK* (High Council of Immovable Antiquities and Monuments) decision dated 11.05.1968 and numbered 3967 has been introduced.
1970	*GEEAYK*	*GEEAYK* decision dated 11.09.1970 and numbered 5505 has been introduced.
1971	*GEEAYK*	*GEEAYK* decision dated 10.07.1971 and numbered 5948 has been introduced.
1972	*GEEAYK*	*GEEAYK* decision dated 19.07.1972 and numbered 6555 has been introduced.
1973	Ministry of Culture	Law no.1710 titled "Law of Antiquities" (*Eski Eserler Yasası*) (06.05.1973 / official gazette: 14527) has been introduced.
1974	*GEEAYK*	*GEEAYK* decision dated 13.09.1974 and numbered 7955 has been introduced.
1974	General Planning Bureau of Istanbul	1/5000 scaled "Seaside Mansions and Coast Line" plan (*Yalılar ve Sahil Şeridi*) has been introduced.
1974	*GEEAYK*	*GEEAYK* decision dated 14.12.1974 and numbered 8172, 1/5000 scaled "Regarding the Preservation of the Bosphorus Groves and Forests, Conservation Decisions on the Natural and Historical Sites of the Bosphorus" (*Boğaziçi Korularının ve Ormanlarının Korunmasına İlişkin Boğaziçi Doğal ve Tarihi Sit Alanı Koruma Kararları*) has been introduced.
1975	*GEEAYK*	*GEEAYK* decision dated 12.04.1975 and numbered 8036, 1/5000 scaled "Conservation Decisions on the Natural and Historical Sites of the Bosphorus" (*Boğaziçi Doğal ve Tarihi Sit Alanı Koruma Kararları*) has been introduced.
1975	Ministry of Culture	Bosphorus has officially been announced as "natural and historical site area"
1977	*GEEAYK*	*GEEAYK* decision dated 10.06.1977 and numbered 9868 and 9872 has been

		introduced.
1977	*GEEAYK*	*GEEAYK* decision dated 12.11.1977 and numbered 10170 has been introduced.
1977	Ministry of Culture	1/5000 scaled Report of the Master Preservation Plan of the Bosphorus (*Boğaziçi Nazım Koruma Planı Raporu*) has been introduced.
1977	Ministry of Culture	The Report of the Master Development Plan (*Nazım İmar Planı Raporu*) has been introduced.
1978	*GEEAYK*	*GEEAYK* decision dated 25.03.1978 and numbered 10290 has been introduced.
1978	Ministry of Culture	Revisions have been made in 1977 dated "Master Development Plan"
1979	Ministry of Culture	Revisions have been made in 1977 dated "Master Development Plan"
1980	*GEEAYK*	New regulations have been requested by *GEEAYK* for the 1978-1979 revisions that have been made on the "Master Development Plan".
1982	Ministry of Culture	The regulations that were requested in 1980 by *GEEAYK* have been introduced.
1983	Council of Ministers	Restrictions dated 29.01.1983 have been announced for the "Master Development Plan" of the Bosphorus.
1983	*TBMM*	*GEEAYK* has been dismantled with the decision 21.06.1983 dated and 2863 numbered "Law on the Conservation of Cultural and Natural Assets". High Councils of Conservation of Cultural and Natural Assets (KTVKYK), under the governance of the Ministry of Culture, have been founded.
1983	Istanbul Metropolitan Municipality / General Planning Bureau of Istanbul / Provincial Bank	1/5000 scaled "Master Plan" (*Nazım Planı*) and 1/1000 scaled "Conservation Plan" (*Koruma Geliştirme Planı*) which were requested by the Council of Ministers, have been prepared.
1983	*TBMM*	"The Bosphorus Law" (*Boğaziçi Kanunu*) dated 22.11.1983 and numbered 2960 has been introduced.
1985	Ministry of Culture	The Bosphorus has been accepted as a part of the Istanbul Metropolitan zone.
1994	*TBMM*	In accordance with Law No.2863, reconstructions of the buildings that have completed their physical lifespan

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		have been allowed in the Bosphorus.
1999	*KTVKYK*	*KTVKYK* resolution dated 05.11.1999 and numbered 665 has been introduced.
2009	*KTVKYK*	*KTVKYK* resolution dated 23.09.2009 and numbered 751 has been introduced.
2010	*KTVKYK*	*KTVKYK* resolution dated 19.01.2010 and numbered 762 has been introduced.
2010	*KTVKYK*	*KTVKYK* resolution dated 14.09.2010 and numbered 773 has been introduced.
2010	*KTVKYK*	*KTVKYK* resolution dated 25.02.2016 and numbered 536 has been introduced.
2017	*KTVKYK*	*KTVKYK* resolution dated 18.10.2017 and numbered 837 has been introduced.

Physical Problems

The authentic urban morphology of the Bosporus consisted of distinct settlement units or villages, which were situated at a walking distance of approximately an hour from each other. These villages were characterized by linear building blocks, primarily represented by seaside mansions. They were often connected through water transportation. Land roads were often built behind the first row of seaside mansions, which cut the direct connection between the main buildings and their annexes most of the time (Figure 5).

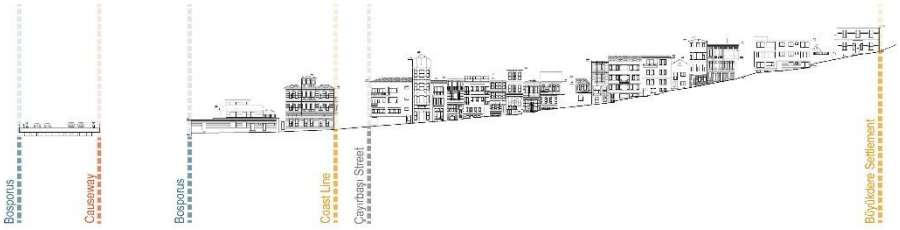

Figure 5. Causeway's location in Büyükdere, about the coastline (Ilık Saltık, 2023)

However, with the rapid urbanization movement that occurred in the second half of the 20th century, Bosporus villages underwent significant changes. New construction zones filled the gap between the villages and led to the demolition of many coastal heritage buildings. The construction of the coastal road further transformed the coastline, turning it into a central refuge between two land roads (Demokrasi Şehitleri and Çayırbaşı Streets). To visualize the lost coastal heritage of Büyükdere, a superimposed map was created using a base map from 2022 and a map drawn by Sedat Hakkı Eldem (Figure 6). This map

serves as a visual representation of the changes that have occurred over time, highlighting the loss of coastal heritage due to urbanization as well as the transformation of Çayırbaşı Street and its distinctive two-sided commercial çarşı units, following their decline in significance due to the construction of the causeway.

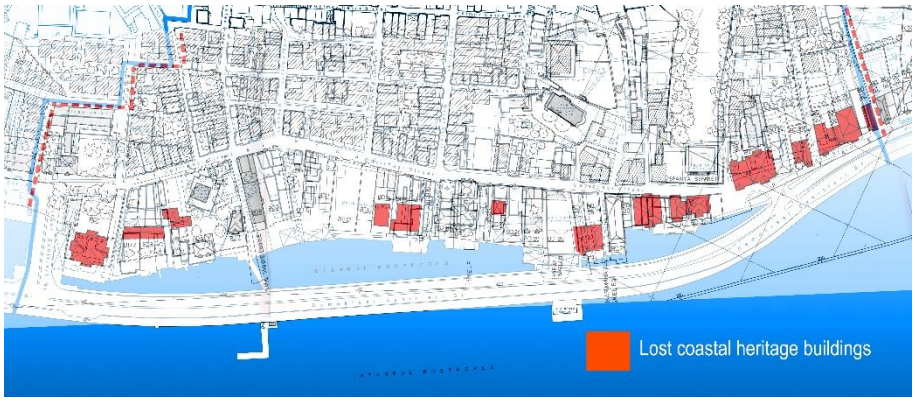

Figure 6. Lost coastal heritage buildings (seaside mansions) of Büyükdere (Eldem, 1993 & Ilık Saltık, 2023)

According to Kuban (1976), the physical problems of Bosporus settlements can be summarized into four main subjects: changing characteristics of transportation, expansion in building volumes, increasing density in settlements, and deterioration in green areas. These problems continue to be effective in 2025, and they have had a significant impact on the historical fabric of Büyükdere. Nevertheless, some additions to these problems can be made both for the case of Büyükdere and for the Bosporus villages in general.

In contrast to the increase in building volumes and settlement density, Büyükdere embodies many vacant buildings, lots, as well as ruin-like demolished heritage structures. While these structures threaten the physical safety of the site, they also address heritage buildings that require extensive conservation or comprehensive restoration programs. Therefore, in addition to urban rehabilitation, a need for individual buildings' rehabilitation in different scopes also exists in the area. In favour of settlement density, however, annex-like unqualified structures in open spaces such as parks, gardens, or urban public zones define a physical problem that leads to the misperception of the historic fabric. Moreover, urban furniture in Büyükdere, as in other Bosporus villages, is observed to be not compatible with the historic fabric. Variations of the same type of furniture (such as benches) can even be seen within the same park or street.

To assess the physical changes and deterioration in the historical fabric, the building stocks from different periods (1978, 1983, 2004, and 2022) were compared (Figure 7). 1983 is considered a critical threshold due to the enactment of new legal regulations, including Law No. 2863 and No. 2960 (Table 1).

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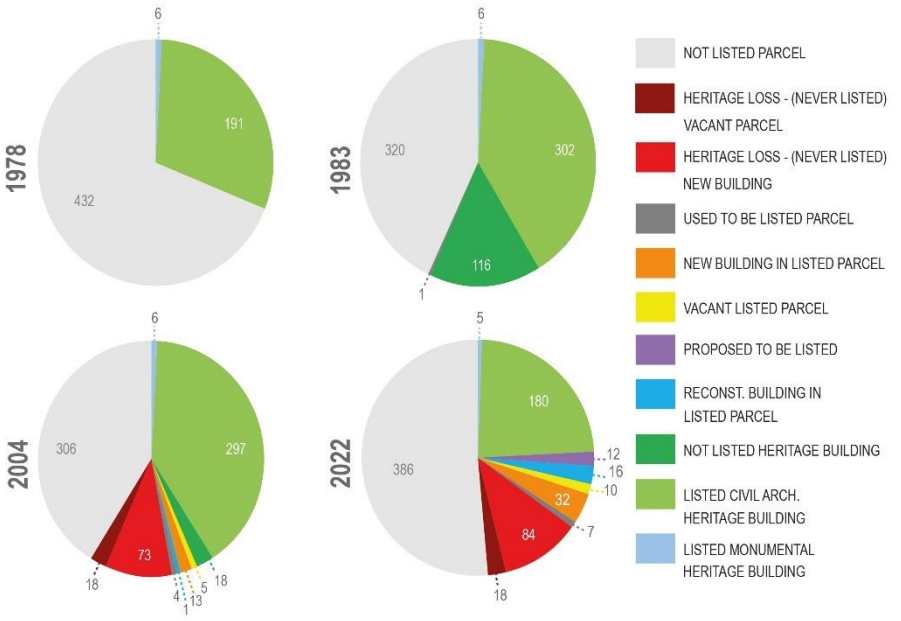

Figure 7. Pie charts of physical preservation statuses of Büyükdere (Ilık Saltık, 2023)

In 1978, there were 197 listed buildings in Büyükdere. With the enactment of the new laws, the number of listed buildings increased to 309. An additional 116 buildings that had heritage qualifications yet were not listed were identified from historical documents (Salman, 2004). With this addition, the total number of heritage potential rises to 424. However, by 2004, the number of listed buildings decreased to 305, and the number of non-listed heritage buildings decreased to 18. A total of 113 heritage buildings were determined to be lost between 1983-2004. In 2022, the number of heritage losses further increased to 167, resulting in a decrease in the number of listed buildings to 185 (Figure 8).

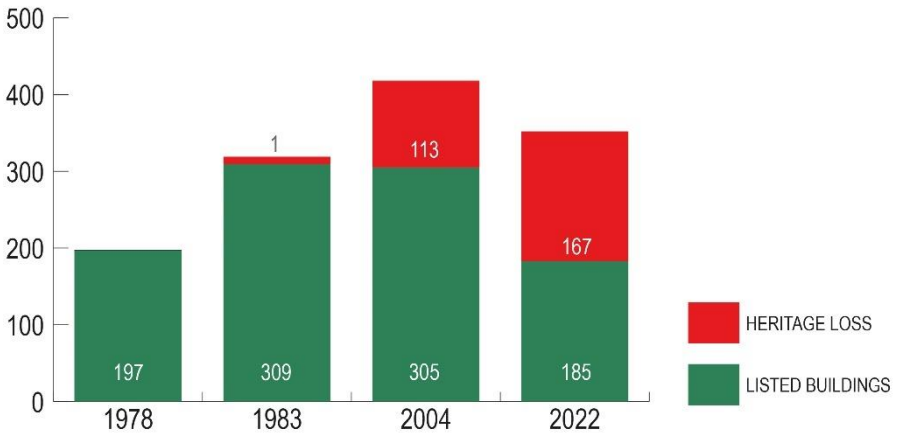

Figure 8. Numbers and ratios of listed buildings and heritage losses by year (Ilık Saltık, 2023)

In terms of parcels, out of the total 629 parcels in the study site, there were 197 listed parcels in 1978. This number increased to 309 in 1983 and 323 in 2004. However, by 2022, the number of listed parcels decreased dramatically to 243 (Figure 9).

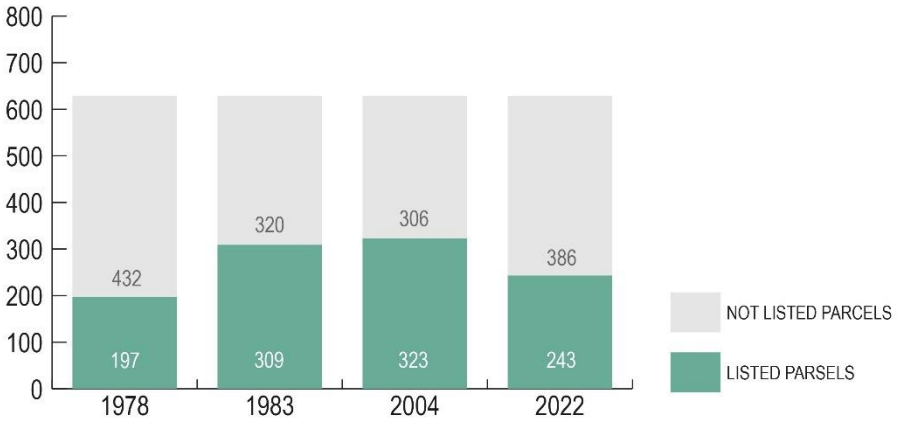

Figure 9. Numbers and ratios of listed and not listed parcels by year (Ilık Saltık, 2023)

These findings indicate that neither the laws and regulations nor the cultural values associated with preservation have been sufficient to effectively protect and preserve the existing fabric of Büyükdere. The loss of heritage buildings and the decrease in the number of listed parcels reflect the challenges and shortcomings in preserving the historical fabric of the area.

Socio-Economic Problems

During the first half of the 19th century, Büyükdere was a relatively small town. However, it always had a commercial zone with various functions, unlike many other villages along Bosporus.

Table 2 provides records of the *bostancıbaşı*s from the first half of the 19th century, allowing us to compare the past with the present and determine the variety of functions and preservation status of economic activities along the coastline.

Table 2. Different functions by year on the coastline (Ilık Saltık, 2023)

	1815	1822-1823	2023
Religious	1	1	1
Fountain	1	1	1
Bakery	1	1	1
Butcher	1	1	2
Dock	2	3	0
Coffee House	1	1	0
Market	0	0	3
Food & Beverage	0	0	13
Accommodation	0	0	4
Bank	0	0	1
Association	0	0	1
Office	0	0	4
Dry Cleaning	0	0	1
Hairdresser	0	0	3
Stationer	0	0	1
Jewelry	0	0	1

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Telco	0	0	1
TOTAL	**7**	**8**	**38**

In the second half of the 19th century, Büyükdere became known for its cosmopolitan population. This diverse population led to the development of different commercial functions, making Büyükdere a vibrant place with restaurants, taverns, casinos, and beaches. The local people even created a term, '*piyasa yapmak*' or '*piyasaya çıkmak*', which referred to evening walks on the coastline between Büyükdere and Sarıyer as a socializing event. This evening walk route is known as Piyasa Street at present.

Even after losing its cosmopolitan character, Büyükdere maintained its functions until the 1990s. However, with the construction of the coastal road, the seaside restaurants, casinos, and taverns in Büyükdere lost their appeal and gradually closed (Aysu, 1994). The relocation of public enterprises, such as the courthouse of Sarıyer Municipality, also contributed to these closures. These decisions had an impact on the population, which has been decreasing since 2007. It is worth noting that many vacant lots in Büyükdere are located around the old municipality facilities and public enterprises on the shores of Büyükdere (Ilık Saltık, 2003).

REHABILITATION PROPOSALS FOR BÜYÜKDERE

Interventions on The Urban Scale

To revitalize the urban fabric of Büyükdere, three primary urban interventions were proposed: (1) traffic re-regulation, (2) redesigning urban focal points, and (3) reimagining urban furniture (Figure 10).

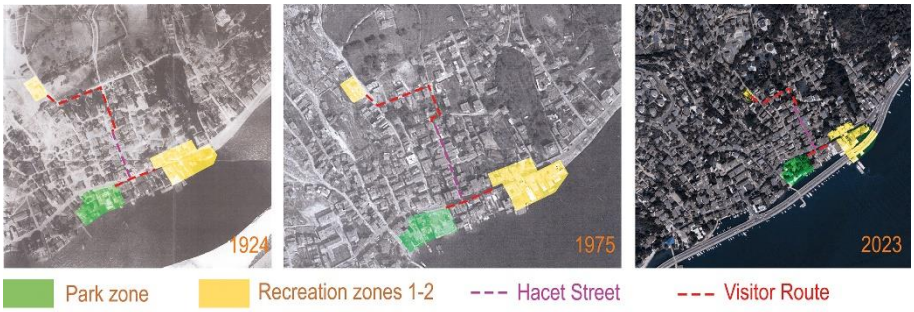

Figure 10. Selected recreation zones in Büyükdere over time (Salman, 2004; Google Earth, 2023)

While the ideal solution for traffic re-regulation would involve the deconstruction of the coastal road, this approach necessitates a comprehensive master transportation plan encompassing all the villages along Bosporus. Therefore, a more integrated approach was adopted: instead of demolishing the coastal road, it was regarded as an extension of Piyasa Street, incorporating its cultural significance. To offer visitors an optimal Büyükdere experience and stimulate local job opportunities, a designated visitor route was proposed, with Hacet Street being pedestrianized as part of this route (Figure 10).

Three urban focal points were defined in Büyükdere: the zone between the Spanish Embassy's Summer Mansion and the Old Büyükdere Ferry Port (recreation zone-1), Çelik Gülersoy Park (recreation zone-2), and the Old Topçu Police Station (recreation zone-3). While Çelik Gülersoy Park is already utilized as a recreational space, the other two zones predominantly consist of abandoned heritage buildings and vacant parcels, offering the potential for revitalization and repurposing.

Recreation zone-1 encompasses several lots, including 603, 599, 608, and partially 593 and 592 (Figure 11). Despite its present vacant status, this zone holds significant heritage buildings, such as the Old Büyükdere Ferry Port[1] in lot 593, parcel 9. The building in lot 603 parcels 1-8, which served as a courthouse before its relocation (*Sarıyer Posta,* 2021), stands out due to its relatively monumental architectural style. The buildings within lots 593, 597, and 599 are either completely or partially abandoned, resulting in their deteriorated structural condition.

[1] During the review process of this paper, Old Büyükdere Ferry Port is re-functioned as a café of a well-known Turkish brand. Since it is referred to as Istanbul's new culture & living attraction point (Espressolabtr, 2023), it supports the decisions that are discussed for Recreation Zone-1.)

Figure 11. Interventions and Proposals for Recreation Zone-1 (Ilık Saltık, 2023)

To rehabilitate and revitalize the area, these factors were carefully considered. The proposed interventions for the zone are summarized in Figure 10. Buildings marked with a dark blue colour are recommended for demolition due to their deteriorated structural condition. Although these buildings are not listed, their parcels have been identified as listed properties. Initially, the ideal approach would have been to reconstruct the old heritage buildings. However, as the Directorate of Regional Council of Conservation of Cultural Assets in Istanbul (No. 3) declined to provide information about these parcels, new infill designs were proposed instead. These designs predominantly encompass commercial functions, such as cafes, pubs, and restaurants. Additionally, any remaining buildings that were proposed for restoration were suggested

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to be repurposed as commercial units if they were not already being used for such purposes. The old courthouse building was suggested to function as a cultural centre (Figure 12).

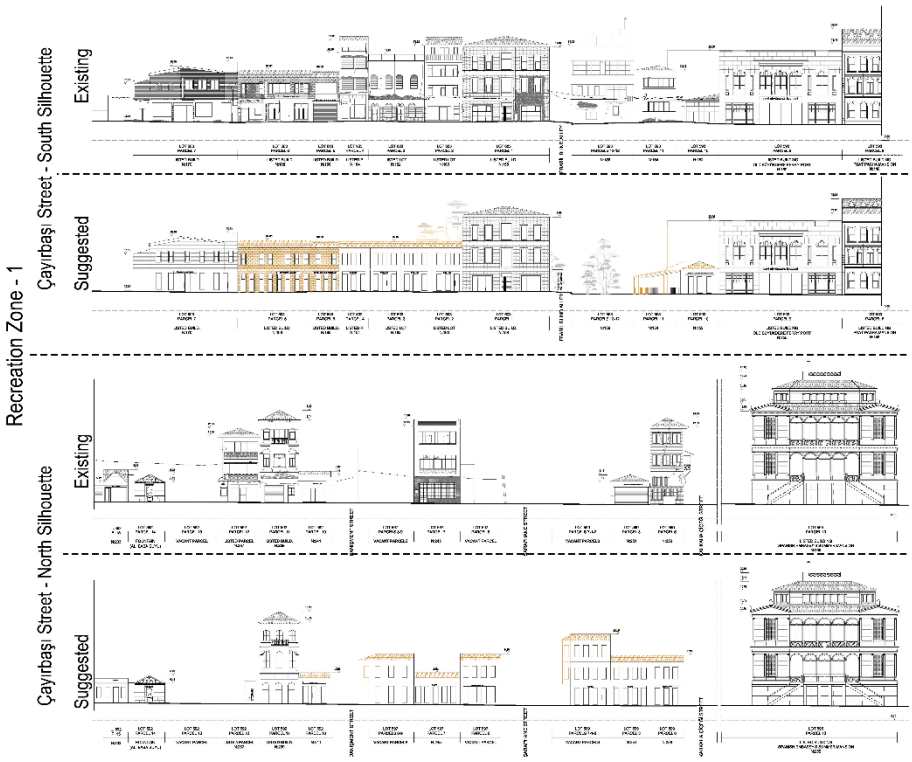

Figure 12. Silhouettes of Recreation Zone-1 (*yellow; new infill design suggestions*) (Ilık Saltık, 2023)

The proposed redesign focuses on Çelik Gülersoy Park and its immediate surroundings, encompassing lots 568, 581, 582, and 583 (Figure 13). Currently, the park is occupied by annex-like commercial units and features randomly placed urban furniture. The visual appeal of the park is significantly diminished from both land and sea perspectives. Furthermore, the presence of ruins surrounded by barriers in lot 583 obstructs the view of the park and the adjacent Merdiven Blind Alley (Figure 14). Additionally, the absence of clearly defined pedestrian routes and the disorganized arrangement of tables and chairs around the commercial units contribute to the park's unattractiveness to visitors.

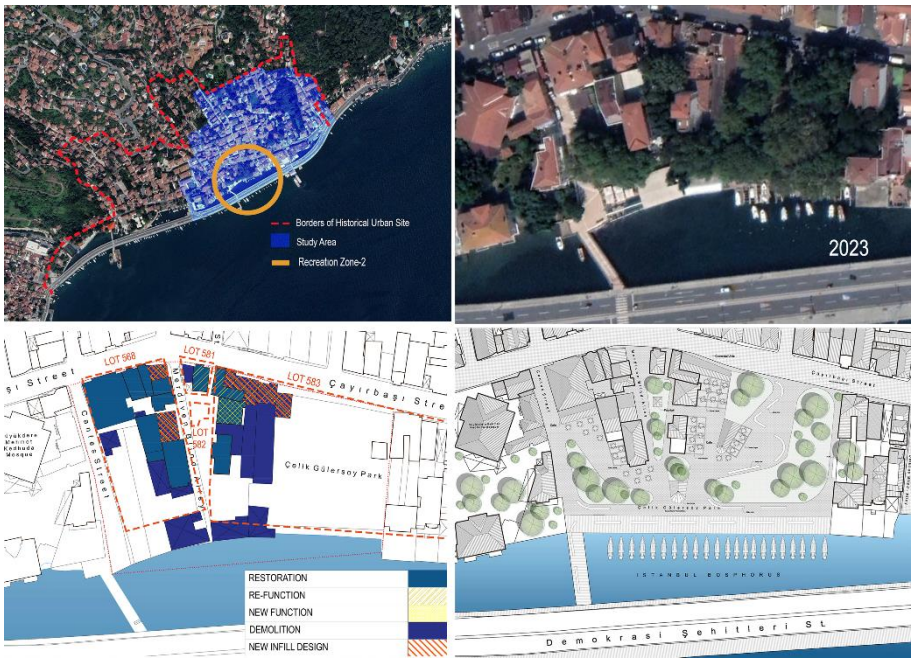

Figure 13. Interventions and Proposals for Çelik Gülersoy Park, Recreation Zone-2 (Ilık Saltık, 2023)

Figure 14. Silhouettes of Çelik Gülersoy Park (*yellow; new infill design suggestions*) (Ilık Saltık, 2023)

To address these challenges, demolishing the annex-like commercial units occupying the park and focusing on restoring and conserving the structures that contribute to the historical fabric of the area are suggested. Furthermore, the vacant heritage buildings were proposed to be re-functioned. New pedestrian axes are planned, considering the existing trees and their locations.

Büyükdere Bay has long been renowned for its safe waters and docking opportunities within the Bosporus. However, with the construction of the coastal road, larger vessels are no longer able to dock at the shores of Büyükdere. Nonetheless, smaller boats can still utilize this area. To reinforce the connection between land and sea and support water transportation, a new small-scale dock was proposed along the shores of Çelik Gülersoy Park (Figure 13).

Semi-open timber pergolas and better-oriented commercial units were proposed to replace the present structures. The restoration of existing heritage buildings is a vital part of the proposed plan. These heritage buildings were suggested to be restored and repurposed as commercial units such as cafes, preserving their authenticity while enhancing their functionality.

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By implementing these proposed interventions, Büyükdere can foster a stronger relationship between its coastal and inland areas, revitalize its historical assets, and provide enhanced amenities and attractions for both locals and visitors.

The third focal point of the urban intervention is the Topçu Police Station located in lot 563 parcel 10, along with its immediate surroundings. Despite its status as a monumental heritage building, the Topçu Police Station has suffered extensive damage over the years due to its abandonment. The building also developed a negative reputation among the local community, primarily because it has become a gathering place for drug addicts (*Sözcü Gazetesi,* 2021). Given the historical significance of the building and its potential for restoration, it is crucial to address its current state and rehabilitate it in a way that serves the community.

Extensive research conducted during the literature review revealed that there is only one institution, the *Institut du Bosphore* focused on Bosporus studies at present, and no Turkish institution specifically dedicated to the studies of the Bosporus and its historic villages.

To address this gap and provide a dedicated space for researchers interested in Bosporus and its surroundings, Topçu Police Station was proposed to be re-functioned as a Bosporus Studies Research Centre (Figure 15).

Figure 15. Interventions and Proposals for Recreation Zone-3 (Ilık Saltık, 2023)

To establish connectivity between all the focal points and enhance visitor engagement, a designated visitor route was proposed. This route aims to attract visitors to the site while also encouraging residents to value and preserve their properties. Several streets were selected considering their preservation status and strategic locations such as Çayırbaşı Street, Hacet Street, Sefaret Yanı Street, and Topçu Karakol Street.

Çayırbaşı Street, with its historical significance and well-preserved character, offers an ideal starting point. It sets the tone for the experience, showcasing the authentic charm of Büyükdere. Hacet Street, with its fairly preserved heritage buildings, provides an opportunity for visitors to explore and appreciate the cultural heritage of the region. Sefaret Yanı Street, located near the proposed Bosporus Studies Research Centre, serves as a connection between the academic and cultural aspects of the visitor route. Topçu Karakol Street, which includes the Topçu Police Station, defines an arrival point in the visitor route. The repurposed police station as the Bosporus Studies Research Centre adds depth and significance to the visitor experience with its observation terrace.

By strategically selecting these streets for the visitor route, it is anticipated that visitors will be able to immerse themselves in the cultural and historical fabric of Büyükdere, fostering a deeper connection between the local community, visitors, and the preservation of the area's properties.

As the final urban intervention, re-designing (re-imagining) urban furniture is proposed to enhance the overall aesthetic and functional quality of Büyükdere. It is recognized that various national and international competitions have been organized to promote the development of well-designed local urban elements, such as the Istanbul Metropolitan Municipality's competition of *Istanbul Senin – Kent Mobilyaları ve Oyun-Rekreasyon Ürünleri Tasarımı Yarışması* in 2020 (*Arkitera,* 2020).

When designing urban furniture, it is essential to consider the context and location of the design. By considering the unique characteristics and specificities of Büyükdere, the aim is to create furniture that harmoniously blends with the surroundings. Instead of relying solely on pre-designed furniture, it was proposed to encourage adaptable solutions and local competition.

By promoting local design competitions and encouraging innovative and adaptable solutions, Büyükdere can benefit from unique and contextually appropriate urban furniture that enhances the overall visual appeal and functionality of the area.

Interventions on the Building Scale

Approximately 20% of the buildings were identified as “do not require any interventions” due to their preservation status (11,8%) or compatible features (8%) (Figure 16).

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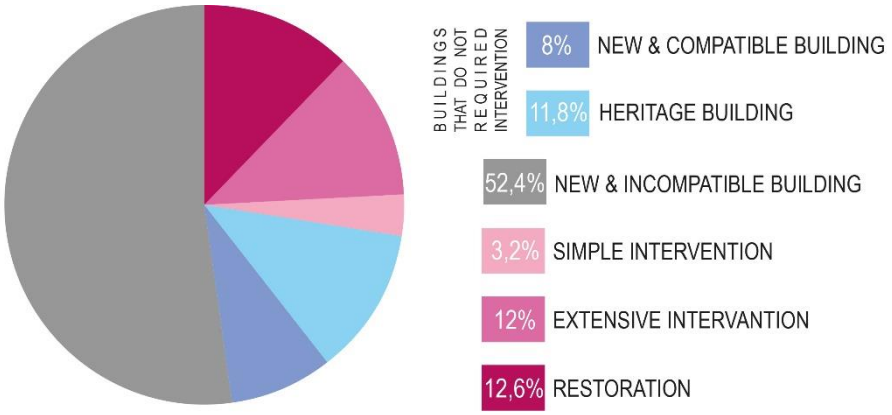

Figure 16. Pie chart of the rehabilitation interventions on the building scale (Ilık Saltık, 2023)

A significant number of buildings, 261 out of the total 499, were identified as newly built and incompatible, with a ratio of 52.4% (Figure 16). These buildings exhibited architectural features, such as materials, structure, volume, facade, and height, that did not align with the historical urban fabric. As an ideal solution, it was proposed that these newly built incompatible buildings should be demolished upon the completion of their lifespan. Heritage structures with high reliability information, such as the Cultural Heritage Protection Regional Board archives and written sources, must be rebuilt in parcels registered as cultural assets/ However, due to the lack of information, facade rehabilitations were suggested as an alternative approach to making them more compatible with the historical fabric.

The heritage buildings that require interventions were categorized into three main groups: simple intervention, extensive intervention, and restoration. Simple interventions refer to practices that do not require significant changes in building elements, such as basic maintenance practices (surface cleaning, etc.) and/or the removal of additions (air conditioning units, signboards, etc.). A total of 16 buildings, accounting for 3.2%, were identified as requiring simple interventions. Extensive interventions involve changes in building elements, facade coverings, alterations in perforations, removal of additional stories and annexes, and small-scale structural interventions. 60 heritage buildings, corresponding to a ratio of 12%, were determined to require extensive interventions. Restoration refers to comprehensive structural interventions, changes, and renovations in building elements, completion of volumes or surfaces, etc. 63 buildings (12.6%) were identified as requiring restoration. Among these heavily damaged buildings, four were partially collapsed (in lot 583 parcels 16-24, lot 560 parcel 3, lot 605 parcel 137), and two were inclined toward other buildings or streets (in lot 560 parcel 21 and lot 563 parcel 22).

CONCLUSIONS AND RECOMMENDATIONS

Based on the analyses, it can be inferred that additional stories pose a significant conservation challenge in Büyükdere. Even buildings from recent decades feature these extra stories, leading to severe structural problems, facade deterioration, and disruption of the urban fabric's

visual balance. The examination of legal status reveals that less than half of the buildings in the study area are listed. In 2022, 185 buildings were listed; however, it was discovered that, according to data collected for the years 1978, 1983, and 2004, 167 heritage structures were demolished during the process of formulating and implementing an effective conservation policy, along with regionally focused, detailed master plans that are still lacking in the Bosporus region. Despite the implementation of regional master plans and conservation laws, it can be argued that they were not adequately planned and executed. Consequently, many cultural and natural assets in Büyükdere have been lost. This loss has been accompanied by a process of abandonment, driven by socio-economic factors within Büyükdere.

Within the scope of this study, some interventions were proposed to revitalize and rehabilitate Büyükdere's historical urban fabric. These interventions can be summarized into two main scales: urban and building. Urban-scale interventions were examined under three main categories: (1) traffic re-regulation, (2) redesigning urban focal points, and (3) reimagining urban furniture.

(1) By adopting an integrated approach, the proposed interventions seek to improve traffic flow, enhance water transportation, and create a more compatible transportation system in the Büyükdere region. Better traffic regulation is thought to be helpful in terms of gaining more attraction to the region to create a sustainable preservation environment for Büyükdere.

(2) The proposed intervention aims to preserve the urban fabric by creating attractive public spaces and visitor routes. Revitalization of the area is thought to be helpful in terms of drawing the interest of scholars and local authorities to encourage further studies that would include the Büyükdere region. Additionally, the rehabilitated environment with more employment opportunities is thought to solve the socio-economic problems, and thus, encourage locals to preserve their properties.

(3) By promoting local design competitions and adaptable solutions, the proposed interventions seek to create aesthetically pleasing and functional urban furniture that reflects the local identity, enhances the visual appeal of the area, and improves the overall urban experience for residents and visitors. And thus, local events such as competitions are thought to be helpful in terms of increasing awareness among the locals and recognition of Büyükdere.

The building-scale interventions focus on the preservation and rehabilitation of the buildings in Büyükdere. The proposed interventions aim to preserve heritage buildings, ensure structural stability, and maintain the historical fabric of the area.

Overall, the proposed interventions in Büyükdere aim to preserve and rehabilitate the urban fabric, which has been neglected so far. It is

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important the note that these interventions are not just focused on the present conditions but they also suggest sustainable improvements by increasing awareness, encouraging local authorities and visitors, and promoting further studies of scholars by following the recommendations of various international texts (ICOMOS, 1987, 1994, 1999, 2011; UNESCO, 1976). To address and affect the legal regulation to be more effective and efficient, the interest of the scholars, locals, and visitors is thought to be crucial. Ultimately, these interventions not only aim to restore Büyükdere's historic fabric but also ensure its sustainable preservation, fostering a thriving and resilient community for future generations.

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Resume

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Investigation of Konya Musalla Cemetery in terms of Landscape Design Principles

Ruhugul Özge Gemici *

Abstract

Grave and cemetery culture is shaped according to the lifestyles, cultures and religious beliefs of societies and is remarkable because it represents life after death. Cemeteries represent the oldest structures in human history that carry and illuminate information about cultural identity such as religion, history, social, economic, customs and crafts to the present day. As a basic function, cemeteries are storage areas that allow dead bodies to mix with the soil without endangering public health. In addition, they are places of remembrance, visitation and symbolic meaning for the living.

The main material of the research is the Musalla Cemetery, located in the Selçuklu district of Konya province, with an area of 191,875 m^2. Musalla Cemetery was used during the Seljuk, Principalities, Ottoman and Republican periods and is the largest cemetery in Konya that has survived to the present day. The purpose of this study is to examine the current situation of Konya Musalla Cemetery in terms of landscape design principles. In this context, firstly, cemetery structural and vegetative design principles were researched, and then Musalla Cemetery was examined and evaluated in line with the mentioned principles. As a result, it has been determined that the vegetative design principles are not fully fulfilled in the area that is generally found to be suitable for structural design principles. While the lack of parking in or near the area puts visitors in a difficult situation, insufficient lighting elements threaten human safety in the evening hours.

Keywords: *Konya, Landscape architecture, Landscape design, Landscape planning, Musalla Cemetery*

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INTRODUCTION

With rapidly increasing urbanisation, open-green areas in urban areas are gradually decreasing. Cemeteries, which are a part of cultural history, constitute a large part of urban open-green space systems. Therefore, cemeteries are becoming increasingly important in urban areas with their green texture. Urban open-green areas also provide many ecosystem services such as supporting urban biodiversity, improving urban climate and contributing to urban aesthetics (Tırnakçı, 2021).

Grave literally means grave, the area where dead bodies are buried (Uslu, 1997). Cemeteries, they are cultural landscape areas with identifiable visual characteristics based on unique structures such as tombstones, trees and fences, and a specific spatial arrangement created by these structures (Francaviglia, 1971).

As a result of the rules and beliefs brought by religions, the dead are buried in different ways. In particular, the belief that life continues after death has been effective in shaping the burial methods and structures of the graves (Özarslan, 2007). In the formation of cemeteries, the conditions of the geography where the societies lived have been limiting factors, just like religious beliefs and traditions. For these reasons, many burial styles, cemeteries and cemetery area types have emerged (Özkartal, 2016).

Cemeteries have also been used for various events throughout history (Deering, 2016). Cemeteries in countries that have completed their socio-economic development; It serves as green areas where residents can benefit from the green texture, calm and peaceful environments, where they can rest and think, and the passive recreation opportunities provided by city parks (Harvey, 2006; Franck and Stevens 2007; Skar et al, 2018; Lai et al, 2020). The birth, formation and development of cemeteries took place in line with the beliefs, traditions and habits, population growth, hygiene and social needs of the societies. Societies' beliefs and fears about death have been the most important factors shaping graves and cemetery traditions. The most effective rule maker is undoubtedly religious belief (Uslu, 1997).

Cemeteries in Turkish culture

Cemetery culture among Turks has manifested itself in different ways. The most important reason for this is the influence of culture and religious beliefs at different times. Therefore, Turkish grave culture can be examined under two headings: pre-Islamic and post-Islamic (Özarslan, 2007).

As historians state, the pre-Islamic Turkish civilizations are the Huns, Gokturks and Uyghurs. Their cemetery cultures were influenced by Shamanic, Upanish, Buddhist and Hindu doctrines (Özarslan, 2007). The first known tomb structure used by the Turks is Kurgan. Later, different types of graves and tombstones were used. For example, Gokturks would arrange various stones called balbal around the graves (Şeker, 1999).

The Uyghurs accepted Buddhism, but they buried their dead in places like hills, just like the Gokturks and Kyrgyz. The dead were buried in pits

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under the mound. The heads were placed towards the East or North (Saraçoğlu,1950). The most important stage in the burial tradition of the Turks manifests itself with the acceptance of Islam (Tunçel, 2004). Karakhanid Turks are the first Turks to accept Islam. Later, other Turks widely accepted Islam in the tenth century. However, the custom of building enormous cemeteries did not disappear after Islam. In fact, it has survived to this day in different forms and applications (Yazar, 1999). Although the positioning of the cemetery area can be directed towards the east or north depending on the topographic structure of the area, there is generally no clear orientation in Turkish graves. After Islam, the main adaptations were made regarding the orientation of the grave, body placement and burial methods, grave commemoration ceremony, and the grave itself and its location. Muslim Turks accepted a single burial method as prescribed by Islam (Özarslan, 2007). From past to present, cemetery areas have been socially valued areas in Turkish society. Therefore, cemeteries are reserved area that will continue to exist in the future, where damage is avoided, changes and transformations are carried out with caution. As a matter of respect, not even a single plant is removed from cemeteries, which increases the sustainability of these valuable green areas. Because of this feature, cemeteries come to mind when unspoilt urban green areas are mentioned (Özhancı and Aklıbaşında, 2017).

Importance of Cemeteries in the Open and Green Space System

From ancient times to today, cemeteries have been of great importance in all civilizations. People left cemeteries as a sign of their lives to future generations. Cemeteries are places that show the socio-cultural situations, economic assets and urban expansion patterns of civilizations and societies. Some societies, due to religious requirements or philosophical thoughts, used flashy materials in their cemeteries, left special items and statues to accompany and serve the dead, and built ornate works on a pile of soil. Some people have designed their graves and cemetery areas with distinctive elements in favor of simplicity and left them to future generations (Gönen, 1992).

The concepts of death and eternity and the burial tradition have been perceived differently according to societies and times. Natural caves were used as cemeteries in prehistoric times. Later, rock cemeteries emerged. In medieval Europe, church gardens were used as cemeteries, and since the 19th century, larger areas were needed as these became insufficient. In pre-Islamic Turkish states, tombs were large, domed structures created as monuments. With the acceptance of Islam, the understanding of graves partially changed. In Roman and Byzantine cities, cemeteries were located outside the city walls. However, in Ottoman cities, cemeteries were areas that were like urban parks within the residential area. It is not possible to find the artistic and literary structure of the cemeteries used in the past in today's cemeteries. Today, cemeteries are perceived as places that are rarely visited by urban people and generally contain burial grounds (Odabaş et al, 1994).

Cemeteries are a type of land-use within the city. Therefore, it should be considered as an important physical planning issue (Aktan, 1999). Both the planning and design phases of cemeteries should be the product of a multidisciplinary study (Cömertler, 2001).

Although cemeteries today can be described as "cities of the dead", this is insufficient. Contrary to traditional thought, cemeteries are living spaces. Cemeteries not only contain those who have passed away, but also are physically important urban green areas, apart from their deep philosophical and religious aspects. Due to religious beliefs and prohibitions, the green tissue in the cemetery has immunity compared to other urban green areas. While other green areas can easily be transformed into structures in a short time, cemeteries resist different uses for a long time (Uslu, 1997). Thus, cemeteries within the city were no longer viewed as unnecessary areas that consumed precious land, and serious progress was made in preserving old cemeteries. Many countries in Europe have banned the burial of the dead in the cemeteries located within the city limits and have opened these areas as parks, devoting them to public recreation with their well-kept greenery (Gönen, 1992).

Almost all cemeteries are green areas that differ from their surroundings with their dense vegetation and whose importance is increasing in cities where functional green areas cannot be increased or even decrease proportionally. In addition to its hygienic and religious functions, it has many ecological, cultural and recreational functions. Developed country planners, who realized these features of cemeteries years ago, have reorganized these spaces and turned them into areas that offer passive and even active recreation opportunities in addition to their main functions (Karaoğlu, 2007).

In the 60s and 70s, there was a desire to design cemeteries like a natural park that would create a less gloomy feeling, and to prevent cemeteries from becoming distressing places. The number of burial areas decreased and were hidden to form a dense green belt. Thus, cemeteries became easily visible signs in the urban landscape and the concept of "park cemetery" emerged (Kienast, 1990).

The concept of cemetery in the compilation of cemeteries master plan, decree and handbook prepared by the Christchurch City Council in 2013; They are defined as functional open spaces where people can go to pray and remember those they have lost. Large open cemeteries can be social places. For example, the Barbadoes Street cemetery hosts social events, meetings or public tours, such as free weekend concerts. In contrast to according to some religions and cultures, cemetery areas are seen as places where visitors are supposed to be silent out of respect (Akten and Özkartal, 2016).

It is observed that in British cemeteries, attention is paid to the use of three shaping elements which are stones, trees and grass areas, with their unique characters. In France, it has become a tradition to establish cemeteries in places overlooking the landscape. Additionally, the

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surrounding wall around the cemetery is gradually being removed (Aktan, 1999).

The idea of relaxing with nature, which started with park cemeteries, has developed into forest cemeteries, where cemeteries are positioned in the forest and the proportion of burial areas is reduced considerably and designed to look like a forest (Aktan, 1999). Forest cemeteries are a very good example of the changing social outlook and also show the ecological interest and concern of the new generation. These areas form quiet, peaceful and respected commemorative places within the urban landscape, with a new forest and habitat (Akten and Özkartal, 2016).

With the changes in centuries-old traditions in Europe, today cemeteries are designed as "memorial parks" where graves are freely located in large green areas outside residential areas. For example, Pere Lachaise Cemetery in Paris is a cemetery decorated with flowers, like a garden or a park, with works of art and sculptures, creating the atmosphere of an open-air museum (Akten and Özkartal, 2016).

CEMETERY DESIGN PRINCIPLES

The design process of cemeteries is based on two main principles. These principles; social and physical principles (Cooper, 2012). Physical principles are divided into two: structural and vegetative design principles.

Structural Design Principles

Cemetery islands and grave plots

Cemeteries are divided into islands by main axis and second-degree roads. The islands are divided into parcels, and the parcels are divided into burial places with numbers. The size of islands and parcels may vary depending on the size and topographic structure of the land (Özkardaş, 2010).

Cemetery entrance and walls

Gates should be built in proportion to the width of the entrance roads to cemeteries and the surrounding wall, in accordance with the identity of the cemetery, in an aesthetic structure, in a style that will provide ease of passage for pedestrians, and resistant to vandalism and bumps. A sign with the name of the cemetery should be placed at the entrance (Özkardaş, 2010).

Multiple entrance and exit points should be determined by taking into account the size of the cemeteries, their access roads and their density. The entrance must be at least 4.5 m. Aesthetic and artistic elements should be included at the entrance to emphasize the cemetery. The name of the cemetery should be highlighted, and the entrance should be illuminated in the evening (Özkardaş, 2010).

According to Article 3 of the Law on the Protection of Cemeteries, municipalities and village headmen are obliged to protect the cemeteries by surrounding them with walls, afforesting and flowering them, and performing all necessary maintenance and repairs (Anonymus 1, 2024).

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Cemetery parking lot

It is located close to the entrance points of the cemetery, has separate entrances and exits so as not to disrupt the vehicle and pedestrian circulation within the cemetery, is of sufficient size, taking into account the intense use of the cemeteries on holidays, religious holidays and special days, and is available where people can reach their funerals on the islands in the cemetery within a maximum of 10-15 minutes walking distance. One or, if possible, more than one car park of a size appropriate to the topography should be planned (Özkardaş, 2010).

Roads inside the cemetery

In the municipal cemeteries regulations, the following articles require appropriate planning for roads within cemeteries (Anonymus 2, 2024):

• Depending on the situation in the cemetery, there will be a wide path starting from the gate.

• Again, a path will be left to go around the inner side of the cemetery wall, starting from the gate.

• The cemetery will be divided into neat islands with small roads.

• One or more squares of the required width will be built in suitable places.

• Drainage channels will be built to prevent snow and rainwater from accumulating in cemeteries.

• The graves will be lined up in islands in the cemeteries and the graves will have a consecutive sequence number.

• The widest road to be opened within the cemetery will be wide enough for hearse cars and trucks to enter and maneuver freely.

• The road connecting the cemetery to the city will always be maintained in good condition.

Stairs: Stair treads should be wide and flat on the sole of the foot (1-2 percent slope should be given to the surface for drainage), and the step height should not be too high. Height + Width = 53 cm. The step height should not be more than 17.5 cm (Seçkin, 1996).

Ramps: Ramp slopes are between 5% and 10%. For a height difference of up to 10 centimetres, the maximum ramp slope is 10%; The maximum ramp slope for a height difference of up to 25 centimetres is 8.25%; The maximum ramp slope for a height difference of up to 50 centimetres is 6%; In cases where a height difference of more than 50 centimetres must be overcome, the maximum ramp slope should be 5%. The slope of very short ramps may be 12% in necessary cases (Sürmen, 2015).

Cemetery service building

A building should be established in all cemetery areas where the burial information of the dead and the book records of the grave site constructions will be kept, visitors will be assisted with information and guidance, and the protection and security of the cemetery area will be ensured (Özkardaş, 2010).

Religious facility

Especially in large and busy cemeteries, it will be useful to build a mosque or masjid where noon and afternoon prayers can be performed

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followed by funeral prayers, to ease urban traffic and to make optimum use of public resources. However, if there is a mosque or masjid in areas very close to the cemeteries, there will be no need to build a mosque in that cemetery (Moda, 2019).

Dead washing area and morgue

A structure with morgue units where male and female corpses can be washed and where the corpses can be kept should be established next to the mosque or administrative building to be built in cemeteries with suitable area and need (Özkardaş, 2010).

Toilet and ablution room

Toilets should be installed depending on the visitor density and the size of the cemetery area. In large-scale cemeteries, toilets should be built at certain distances, and care should be taken regarding hygiene (Moda, 2019).

An ablution area should be built near the mosque to be built, taking into account the density of the mosque and the number of visitors to the cemetery. These ablution areas should be built as closed areas due to seasonal conditions. (Moda, 2019).

Squares or gathering centers

In particular, more than one place, appropriate to the size and intensive use of the cemetery, should be provided where relatives of the deceased who attend the funeral and do not know the cemetery or the place of burial can easily see each other, meet and gather when they enter from different entrances of the cemetery (Özkardaş, 2010).

Maps and information boards should be placed in these places, showing citizens their location and the islands and roads in the cemetery. In addition, it is useful to place symbolic objects so that the place can be easily perceived (Özkardaş, 2010).

Reinforcement elements

Floor covering: The road must be levelled with stabilized materials and work must be done on compacted ground. The curb level of the road must be lower than the grave parcel elevation so that vehicles do not leave the road or enter the grave plots. The steep slope of the road must be well adjusted due to superficial drainage. Otherwise, rainwater will not be able to transfer over the ground at a sufficient level (Özkardaş, 2010).

Among the cemetery parcels, materials such as andesite cube stone, slate, parquet or concrete may be preferred, depending on the municipality's situation. Asphalt should not be applied on plots between graves (Özkardaş, 2010).

Water elements: Fountains are among the equipment elements in cemeteries that have infrastructure such as lighting and sound systems. Fountains for each island should be built in cemeteries, because fountains are the most used equipment by visitors who come to visit the cemetery (Moda, 2019).

In order to support the ecological functions of cemeteries and to provide a living environment for birds, insects, butterflies and fish,

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cemeteries should include water features and houses for birds. Still water elements create a relaxing effect on cemetery visitors and will also serve to collect rainwater (Badeja, 1998).

Garbage bins: Other waste that can fit into garbage bins should be at a frequency proportional to the rate of use, especially on pedestrian paths. In the cemetery design, garbage bins should be placed in areas frequently used by people. Garbage bins should be designed specifically for the cemetery; they should be easy to place, empty and clean, resistant to impacts and fire, static enough to carry the material placed inside, impermeable to the garbage water, and designed in a way that cats, dogs and birds wandering around the cemetery cannot remove the garbage (Özkardaş, 2010).

Seating units: Seating units are the most frequently missing equipment element in cemeteries, as cemeteries in our country are not used as recreation areas or visitors to the cemetery do not spend much time there (Moda, 2019).

Seating units should be placed less frequently on main roads and more frequently on secondary roads than on the main road (Moda, 2019).

Lighting elements: Illumination of cemeteries is an issue that should not be forgotten. By illuminating cemeteries like parks, the feeling of eeriness that cemeteries may cause in people at night will be prevented (Aktaş, 2009).

Lighting in cemeteries; It should be in a hierarchical order with different spacing, heights and densities. For this purpose, intense and high lighting with a height of 6-15 m should be provided on the main axis and entrances, and moderate lighting with a height of 3-5 m should be provided on secondary roads. (Uslu, 1997).

Sound systems: The sound systems to be applied in the cemetery are generally made to announce any announcement (Moda, 2019).

Information signs: People's fixed gaze angle of vision is approximately 30 degrees in the vertical direction and 60 degrees in the horizontal direction. This is especially important in the placement of pedestrian signs (Seçkin, 1996).

Vegetative Design Principles

Before starting the plant arrangement, it should be decided how much of the cemetery area will be planted. At least 50% of the cemetery should be vegetated (Özkardaş, 2010).

If the desired park is a cemetery, 30 per cent of the total size of the cemetery should include grave plots, and the remaining 70 per cent should be designed to create a park-like feeling (Taner, 1988).

When making vegetative designs in cemeteries, landscape planning and design should be done by considering the future sizes of the plant species in the cemetery (Özkardaş, 2010).

When plant species are selected from natural vegetation in accordance with the purpose of use in the cemetery; It is least affected by the negativities in land and maintenance conditions. In addition, the root

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structure of the selected plant species; In order not to negatively affect the excavation work or cause problems in the graves in the provinces, it should be stake or heart-rooted, not broad-rooted (Aktan,1999).

Balance and Repetition: When afforesting roads throughout the cemetery, leafy species should be chosen first from the natural vegetation. In order to facilitate the orientation of visitors on the main axes throughout the cemetery, a single type of plant or two types of plants, one of which is deciduous, and the other is evergreen, should be used at intervals (Özkardaş, 2010).

Emphasis: Special attention should be paid to the entrance area of cemeteries due to the symbolic content of the entrance gate, and more flowering plant species and roses should be used, provided that they are compatible with the entire composition of the cemetery. The entrance area with its decorative door should be emphasized with plants (Richter, 1998).

Contrast: It is possible to create different areas in cemeteries by using solitary plants, but for this purpose, only conical shaped conifers should not be chosen (Etienne, 1998), flexible areas should be created by using circular and pendulous shaped plants such as *Sophora japonica 'Pendula'* (Özkardaş, 2010).

Proportion-Variety: Coniferous plants are often used in cemeteries because they are evergreen; However, since the constant use of coniferous plants tires the eyes and leaves a very serious effect, broad-leaved plants that have a decorative and peaceful effect with their different autumn colors and create a park feeling should be used in abundance in cemeteries alongside coniferous plants (Özkardaş, 2010).

Plants in cemeteries; In addition to surrounding, shading, orientation and emphasis, it should create an inviting effect on visitors with the play of light created by the movement of its leaves (Born, 1998).

The environmental limitation of the cemetery area should not be set too high. However, densely textured and tall plants should be used for protection from noise and dust in cemeteries located on or near the highway, or for screening in cemeteries established in areas with wind problems (Özkardaş, 2010).

Throughout the cemetery; species selection should be made for road afforestation, surrounding the cemetery area, screening unwanted images or noise, providing shade in sitting and resting corners, emphasizing the entrance area and parking lot planting (Aktan, 1999).

In order to provide shading in sitting-resting areas of cemeteries and parking lots, plants with large crown diameters, tall plants with broad leaves that are crowned from above should be preferred (Uslu, 1997).

In addition, grass areas are areas that should be included in cemeteries due to their space-expanding and relaxing effect on visitors. Including large grass surfaces, especially in gathering and dispersing areas and in the entrance area, helps to provide the desired calm and peaceful environment in the cemetery area (Özkardaş, 2010).

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The purpose of this study is to examine the current situation of Konya Musalla Cemetery in terms of landscape design principles. In this context, firstly, cemetery structural and vegetative design principles were researched, and then Musalla Cemetery was examined and evaluated in line with the mentioned principles.

RESEARCH METHOD

Materials

The main material of the study is Musalla Cemetery located in Selçuklu district of Konya province. Musalla Cemetery has an area of 191,875 m^2 (Figure 1).

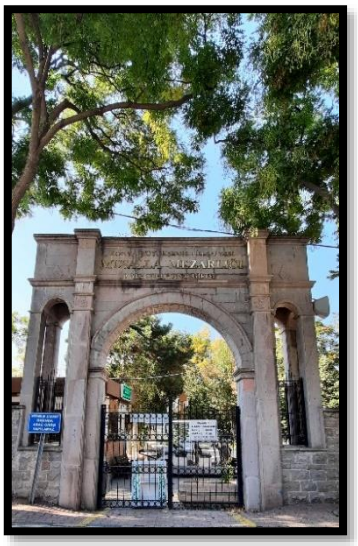

Figure 1. Musalla Cemetery (Original, 2023).

Musalla Cemetery

Musalla Cemetery, located on Ankara Street in the central Selçuklu district of Konya, was used during the Seljuk, Principalities, Ottoman and Republican periods and is the largest cemetery in Konya that has survived to the present day (Kuşdoğan, 2023). The maintenance and protection of the cemetery is provided by cemetery staff. Burial procedures at the cemetery continue.

Martyrs' Cemeteries in Musalla Cemetery

Konya military cemetery: It is located in the northeast of Musalla Cemetery and was organized in 1955 (Kuşdoğan, 2023). There are a total of 194 martyrs' graves in the area. The cemetery has 2 entrances, 1 service building and 1 monument.

Konya police cemetery: Located in the northwest of Musalla Cemetery, it was organized in 2011 (Kuşdoğan, 2023). There are 9 police martyrs graves in the area.

Non-Muslim cemeteries in Musalla Cemetery

Christian cemetery: The entrance of the small triangular Christian cemetery, which is a separate section of the cemetery, is on Nalçacı street and there is no direct entrance connection with the cemetery.

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Other places in Musalla Cemetery

There are places of historical and cultural importance within the cemetery. There are four tombs in total, three from the Seljuk period and one from the Ottoman period. In addition, the Namazgah, Paradise Pit, Zamzam infusion well and Governor's graves are also located within the cemetery.

Tombs: Inside Musalla Cemetery, there are Gömeç Hatun Tomb, Evhad'üd-din Kirmani Tomb, Şeyh Halili Tomb and Şeyh Şucae'd-din Uğurlu Tomb.

Paradise Pit: This place, which is considered the first mass grave martyrdom of Central Anatolian Turks, is located on island number 141. This is the place where the pioneer troops sent by Sultan Alparslan to Konya before the conquest of Anatolia were martyred and thrown away by the Byzantines (Kuşdoğan, 2023). This part is under protection today and no burials are made in it (Figure 2).

Zamzam Infusion Well: In ancient times, pilgrims returning from their pilgrimage would pour some of the Zamzam water they brought with them into this well, so that people who could not go on pilgrimage could get Zamzam water from this well. This well was destroyed over time and lost its function as a well. In 2016, the location of the well in the Heaven Pit was determined and it was reconstructed in accordance with the original by Konya Metropolitan Municipality Cemeteries Branch Directorate (Kuşdoğan, 2023). (Figure 3).

Figure 2. Paradise Pit (Original, 2023).

Figure 3. Zamzam Infusion Well (Original, 2023).

Namazgah: Namazgah, which used to be a kind of open-air meeting and worship place, is located in front of the Sheikh Halili tomb in Musalla Cemetery (Kuşdoğan, 2023). (Figure 4).

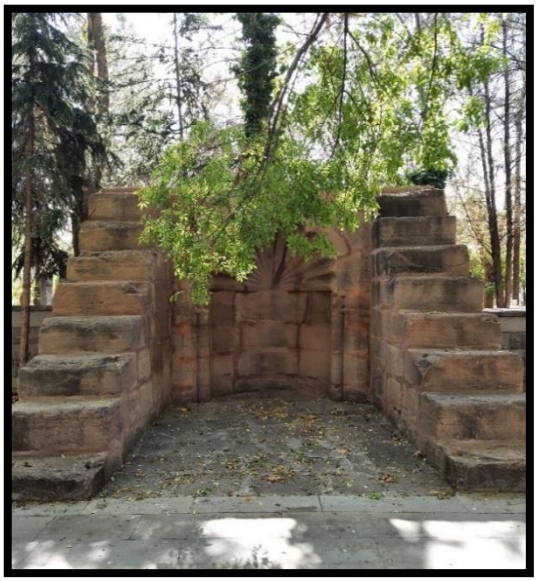

Figure 4. Namazgah (Original, 2023).

Governor's Tombs: In a special area designed as governor's tombs, there are the tombs of Konya governors İzzet Bey, Fuat Tuksal and Rıfat Özpar.

Method

Firstly, the purpose of the study was determined, and the research area was selected. The reason why Musalla Cemetery was chosen as the research area is that it is one of the largest and oldest cemeteries in Konya and also has historical importance. In the second stage, a literature review was conducted on the concepts that form the basis of the research. In the third stage, Musalla Cemetery was visited, and the area was examined, information about the area was obtained from the authorised

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persons working in the cemetery and photographs were obtained from the area. In the fourth stage, interviews were conducted with experts in the field of landscape design of cemeteries. The expert group consists of five people, and they are landscape architects. All photographs of Musalla Cemetery were shown to the experts and all information about the area was shared with the experts. The experts were asked to evaluate Musalla Cemetery between 1-5 points in accordance with structural and vegetative landscape design principles. 1 point is not suitable at all, 2 points is not suitable, 3 points is neither suitable nor suitable, 4 points is suitable, 5 points is very suitable (Likert Scale). In the last stage, conclusions and recommendations were developed.

RESULTS AND DISCUSSION

Examination of Musalla Cemetery in Terms of Structural Design Principles

Cemetery islands and grave plots

The cemetery, which has a regular road and afforestation system, is divided into islands and numbered by main and secondary roads. Musalla Cemetery consists of 50 islands in total. Cemetery islands are divided into parcels. There are island and parcel signs.

Cemetery entrance and walls

There are 3 main entrances in Musalla Cemetery. Nalçacı, Parsana and Kalenderhane gates are important main entrances. The Kalenderhane entrance is located on Ankara Street, on the east side of the cemetery. In this area, which is considered the main entrance, there is the officer's hut, camellia, hospital rooms and the morgue. The Parsana entrance is located in the southern part of the cemetery. There is also an officer's hut and a camellia on the side of the Parsana entrance. The Nalçacı entrance is located on Nalçacı street, to the west of the cemetery. The Nalçacı entrance gate of the cemetery is shown in Figure 5. Apart from these, the cemetery has four more entrance gates.

The surrounding walls of the cemetery made of rubble stone are covered with andesite. These walls are surrounded by iron railings. The wall surrounding the tomb is shown in Figure 6.

Figure 5. Musalla Cemetery Nalçacı entrance (Original, 2023).

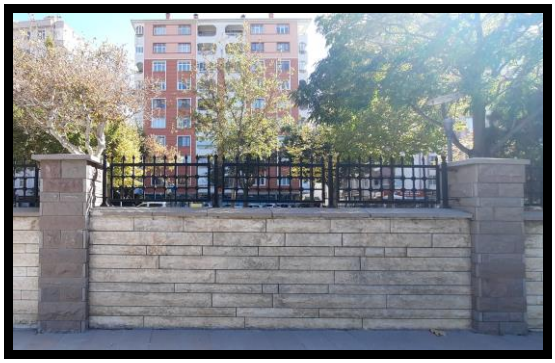

Figure 6. Musalla Cemetery wall (Original, 2023).

Cemetery parking lot

Musalla Cemetery has a reserved parking area only for hearse vehicles and golf carts used within the cemetery. Guests who come to visit the cemetery do their visits by parking their vehicles in the streets around the cemetery or on the sides of the streets (Figure 7).

Figure 7. Vehicles parked near Musalla Cemetery (Original, 2023).

Roads inside the cemetery

There are 3 main entrances in the cemetery and there are main and secondary roads connecting these entrances.

Stairs: Stairs were not generally used in Musalla Cemetery due to the low slope. There are stairs in the Christian cemetery and at several pedestrian entrances within the cemetery.

Ramps: There is little space in the cemetery that will need a ramp. For this reason, ramps were used only in a few places.

Cemetery service building

There is a security and cemetery service building at the Kalenderhane entrance of the cemetery.

Religious facility

There are three religious facilities in and around Musalla Cemetery. These are the Musalla Halkabi Köşk Mosque, located near the Kalenderhane entrance on the east side of Musalla Cemetery, Mürşit Pınar Mosque, located next to the Police Martyrs' Cemetery on the northwest side of the cemetery, and Parsana Grand Mosque, located at the Parsana entrance on the southern part of the cemetery.

Dead washing area and morgue

There are two Islamic mortuary washing room (male and female), in the building between the Kalenderhane entrance of Musalla Cemetery and Musalla Halkabi Köşk Mosque. There are three morgues in the same

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building, next to the hospital. One mobile morgue was used during the Covid-19 pandemic period.

Toilet and ablution room

There are two toilets, male and female, next to the glass-fronted waiting area at the Kalenderhane entrance of Konya Musalla Cemetery. There is an ablution room in the cemetery.

Squares or gathering centers

People coming to the cemetery use the front of the cemetery entrances as a gathering area. There is no separate square or gathering center within the cemetery.

Reinforcement elements

Floor covering: Asphalt material was used as vehicles pass through the main roads of Musalla Cemetery. Cobblestones were generally used on pedestrian paths.

Fountains: The most common accessory elements in Musalla Cemetery are fountains. There are 187 fountains in Musalla Cemetery.

Fountains were built by citizens in line with their own financial means and preferences. These fountains do not have any concept and are made with different materials and workmanship, in different sizes and styles.

Musalla Cemetery fountain is located at the entrance of Kalenderhane. There is no inscription on the fountain, which is made of marble. Although it is not known when it was built, the façade form comes to us from the 20th century. It provides information that it was built in the beginning. The fountain, which is 220 cm high, 106 cm wide and 47 cm deep, has an independent single facade (Kuşdoğan, 2023). The Musalla Cemetery fountain is seen in Figure 8.

Figure 8. Musalla Cemetery fountain (Original, 2023).

Garbage bins: There are a total of 76 garbage bins in Musalla Cemetery.

Seating units: Inside Musalla Cemetery, there are waiting areas with covered glass windows that provide shade in summer and protect from the cold in winter for people coming to the cemetery. Benches are used as seating units in these waiting areas. One of these waiting areas is at the Kalenderhane entrance of Musalla Cemetery and the other is at the Parsana entrance.

There are a total of 20 benches on the main roads of the cemetery, which are also used by vehicles. There are no benches on the side roads within the cemetery. There are 10 benches in the Military Martyrs' Cemetery.

Lighting elements: There are not enough lighting elements in the cemetery.

Sound system: The sound system in Musalla Cemetery is located next to the Kalenderhane entrance gate and is provided through speakers placed on the poles. There is a portable sound system facility in the cemetery when needed. Figure 9 shows the sound system.

Information signs: There are 50 signs showing island and street numbers in Musalla Cemetery. Additionally, there are 4 signs in the cemetery for promotional or informational purposes (Figure 10). These plaques are located in the Heaven Pit, Gömeç Hatun Tomb, Cemetery Entrance and Namazgah. There are also signs in the cemetery with hadiths and verses written on them.

Figure 9. Sound system (Original, 2023).

Figure 10. Information sign (Original, 2023).

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Examination of Musalla Cemetery in Terms of Vegetative Design Principles

Balance

Both evergreen and broad-leaved plants were used on both sides of the pedestrian paths created in Musalla Cemetery. For this reason, it has been observed that the principle of balance is generally followed in the vegetative designs in the area (Figure 11).

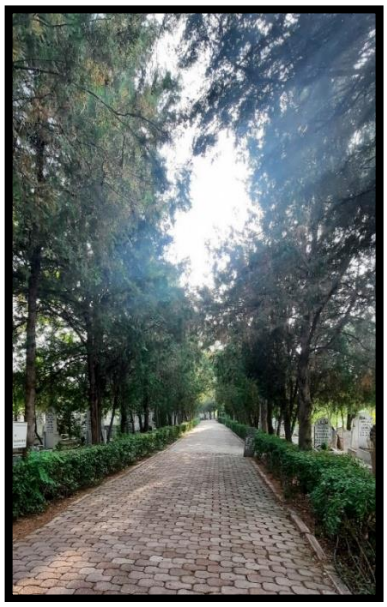

Figure 11. Example of balance principle in Musalla Cemetery (Original, 2023).

Repetition

It was also observed that repetitive plants were used on both sides of the pedestrian paths created in Musalla Cemetery. In Figure 12, *Cupressus arizonica* and *Thuja orientalis* plants were created in line with the principle of repetition.

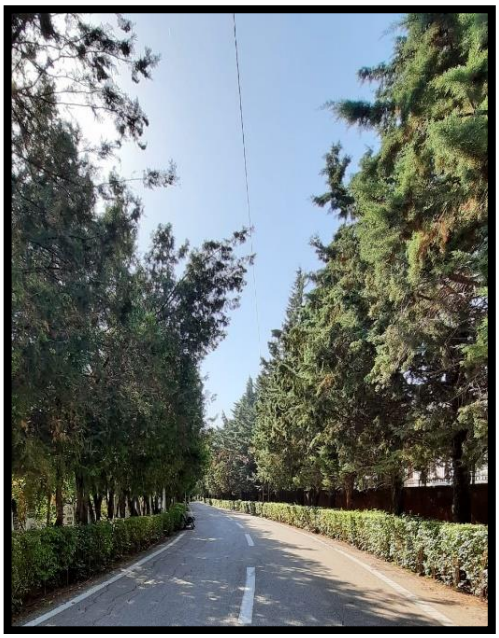

Figure 12. Example of repetition principle in Musalla Cemetery (Original, 2023).

Emphasis

In Musalla Cemetery, especially the entrances should be emphasized with plants, but the entrances were designed without complying with this principle. Plants were not used for emphasis, not only at the entrances but also throughout the cemetery.

Contrast

Plants in different forms were used very little in Musalla Cemetery. It has been determined that generally evergreen plants, occasionally broad-leaved plants and sometimes shrubs are used in the area. Since these plants do not have dominant forms that create contrast, it can be said that the area does not comply with the principle of contrast.

Proportion

The proportion of evergreen plants in the cemetery is very high compared to other plants. For this reason, it is not possible to say that a proportionate vegetative design was made in the cemetery. Examples of evergreen plants are *Pinus sp., Cupressus sp., Thuja sp., Cedrus sp., Picea sp.* can be given.

Variety

There are evergreen plant species, deciduous tree and shrub species, and seasonal flower species in Musalla Cemetery. Therefore, it is possible to talk about plant diversity. Examples of these species are *Gleditsia triacanthos, Robinia pseudo acacia, Rosa sp., Aesculus hippocastanum, Picea pungens "Glauca", Cedrus libani, Quercus robur, Juniperus sabina, Tagates erecta, Begonia semperflorens.*

Plants can also be used functionally in botanical design. The plants in the Musalla Cemetery were also used for purposes such as screening (Figure 13), shading (Figure 14) and orientation (Figure 15).

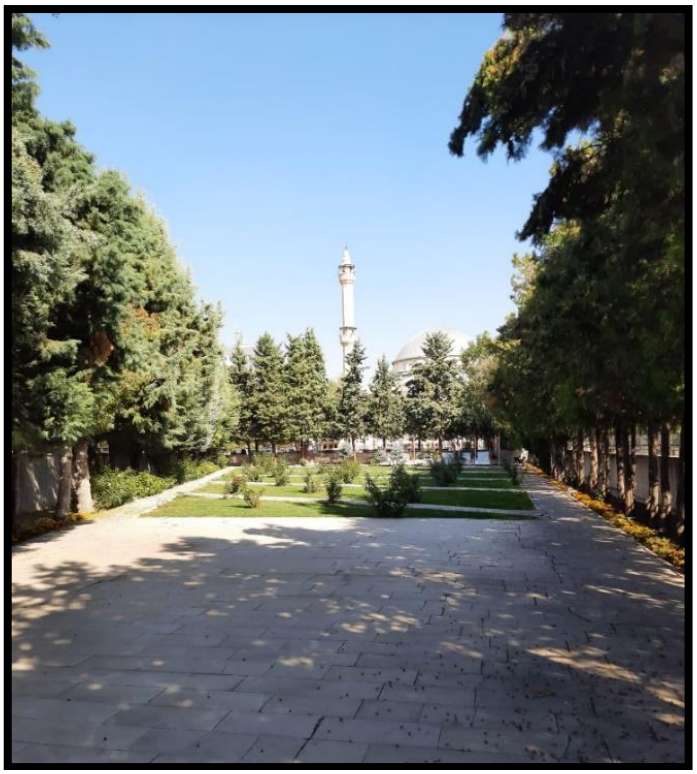

Figure 13. Example of screening Musalla Cemetery with plants (Original, 2023).

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Figure 14. Example of shading Musalla Cemetery with plants (Original, 2023).

Figure 15. Example of orientation Musalla Cemetery with plants (Original, 2023).

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The evaluation of Musalla Cemetery by the experts in line with the structural design principles is given in Table 1.

Table 1. Evaluation of the structural design principles of Musalla Cemetery by experts

Structural Design Principles	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Total Point
1- Cemetery islands and grave plots	3	4	3	3	4	**17**
2- Cemetery entrance and walls	4	5	3	4	4	**20**
3- Cemetery parking lot	1	2	1	1	2	**7**
4- Roads within the cemetery	4	5	5	4	4	**22**
5- Cemetery service building	3	4	4	5	3	**19**
6- Religious facility	5	5	4	4	5	**23**
7- Dead washing area and morgue	4	3	5	5	5	**22**
8- Toilet and ablution room	4	4	3	5	4	**20**
9- Squares or gathering centers	1	2	3	2	2	**10**
10- Reinforcement elements						
10.1- Floor covering	3	4	3	4	4	**18**
10.2- Water elements	5	5	4	5	4	**23**
10.3- Garbage bins	5	4	3	4	4	**20**
10.4- Seating units	3	5	5	4	4	**21**
10.5- Lighting elements	1	2	1	1	1	**6**
10.6- Sound systems	3	4	4	4	3	**18**
10.7- Information signs	5	4	3	3	3	**18**

Structural design principles in landscape design state that all structural elements in the landscape should be designed in an aesthetic and functional way and should be placed in the area in that way, and that these elements should be present in sufficient number in the area (Bayrak, 2019; Moda, 2019).

Table 1 shows the total number of points each structural design principle received from the experts. According to this table, Cemetery parking lot, square/gathering areas and lighting elements received the lowest scores.

There is no parking area within the cemetery area to serve visitors. Visitors park their vehicles on the roads around the cemetery area or in empty spaces. Additionally, there are no squares or gathering centers in the cemetery.

The reinforcement elements in the area are sufficient. However, the number of lighting elements among the reinforcement elements is almost non-existent. For this reason, lighting elements are insufficient in the area.

The evaluation of Musalla Cemetery by the experts in line with the vegetative design principles is given in Table 2.

Table 2. Evaluation of the vegetative design principles of Musalla Cemetery by experts

Vegetative Design Principles	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Total Point
1- Balance	5	5	4	5	4	**23**
2- Repetition	4	5	5	4	4	**22**
3- Emphasis	1	2	1	2	2	**8**
4- Contrast	2	3	1	1	1	**8**
5- Proportion	1	1	2	2	2	**8**
6- Variety	3	4	5	4	3	**19**

Vegetative design principles in landscape design are realised by planting the plant elements in the landscape area in an aesthetic and functional way. This plantation is realised in accordance with the principles of balance, repetition, emphasis, contrast, proportion and variety (Bayrak, 2019; Moda, 2019).

Table 2 shows the total number of points each vegetative design principle received from the experts. According to this table, emphasis, contrast, proportion principles received the lowest scores.

When Musalla Cemetery was evaluated in terms of vegetative design principles, it was determined that the principles of balance, repetition and variability-diversity were present in the area, while other vegetative design principles were not included in the area. It has also been determined that plants were used functionally in the cemetery area. These functions are screening, shading and directing functions.

Recommendations

Cemeteries, which can be considered as one of the least used places among the different land uses in urban areas, are places where urbanites

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can gather at the same time, in the same place and with similar feelings. Cemeteries reflect historical, religious and cultural identity, understanding of art, traditions and customs. Planning and design of urban cemeteries, which are a part of the urban green texture, is therefore a very important issue.

Cemetery areas have become disorganised over the years because they are not arranged through a specific design and arrangement and users are not guided within the framework of rules. The possibility of a clear perception for the visitor disappears, and these valuable urban open green areas give an impression far from the perception of trust. Since each cemetery has been in operation for many years, the faulty work done at the beginning cannot be easily changed. In the future, studies should be carried out with a modern understanding, and principled, environmentalist designs and applications should be realised in cemeteries as they should be in all urban open green areas.

In this direction, the suggestions about Musalla Cemetery, which is the study area, are given below.

The lack of parking in the cemetery creates parking problems for cemetery visitors. This is why it is important to establish a new car park near the cemetery. In addition, the lack of centers where visitors can gather in the area makes it difficult for people coming to the area to find each other. Such areas should be included in the cemetery.

It has been determined that the most common accessory element in the cemetery is the fountain. It has been observed that there is no distance between the fountains and that they are randomly positioned. It was determined that some of the fountains were broken and neglected. It is important to repair broken and unused fountains and make them usable, and to plan and position the fountains to be built in the future. The fact that there are almost no lighting elements in the cemetery threatens human safety, especially in the evening hours. A sufficient number of lighting elements should be placed in the area.

The number of directional signs indicating the tombs, martyrdoms, etc. in the cemetery should be increased to make it easier for people to reach the cemetery. In addition to the directional signs, the number of Cemetery Information System devices in the cemetery should be increased in order to technologically support the orientation of visitors in the cemetery. Sketch signs showing the entire cemetery (with the information 'you are here now') can be placed in many different areas in the cemetery.

Although the plant diversity in the study area contributes to the urban ecosystem, the area should be re-evaluated in terms of vegetative design principles and the vegetative design of the cemetery should be redesigned accordingly.

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Transitioning from Artichoke Fields to a Peri-Urban Settlement: The Role of İzmir Katip Çelebi University

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Abstract

The rapid urbanisation experienced in Türkiye since the mid-20th century has dramatically reshaped the urban landscape. This transformation has been particularly evident through the phenomenon of peri-urbanisation, a process marked by the expansion of urban spaces without cohesive spatial development planning at various government levels. A notable misalignment exists between the decisions made at higher levels of governance, such as the siting of new university campuses, and the master plans implemented at local levels. This disconnect often results in urban environments that are unbalanced and fail to meet their intended purposes.

The present research focuses on the Balatçık neighbourhood in the Çiğli District of İzmir, where İzmir Katip Çelebi University has been established. This area exemplifies the socio-spatial changes induced by the integration of significant educational infrastructure into its peri-urban context. Initially a peripheral settlement, Balatçık has evolved into a complex urban area that straddles the identities of both a residential community and a university town. This case study aims to dissect the spatial transformations prompted by this development, exploring how the neighbourhood's composition, demographic characteristics, and housing market dynamics have been altered with the following research question, what key factors have influenced the spatial transformation of Balatçık Neighbourhood from a rural settlement to a peri-urban area, particularly in relation to the development of a new university campus?

Utilising a mixed-methods approach, the study integrates statistical analysis, document review, semi-structured interviews, and field observations. Quantitative data was obtained from open-access sources, while qualitative insights were gathered through interviews (n=21) with residents, business owners, real estate agents, and local administrators. Thematic coding was employed for analysing collected data, revealing key socio-spatial patterns. Employing both quantitative and qualitative data, this study provides a comprehensive analysis of the impacts of policy misalignment on Balatçık. By investigating these changes, the research seeks to offer insights into the broader implications of urban planning decisions in Türkiye. The findings are intended to inform future urban development strategies, emphasizing the need for coordinated planning across different governmental levels to foster balanced and purposeful urban growth.

Keywords:
Izmir, Peri-urbanisation, Rural-urban dynamics, Spatial change, University impact.

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INTRODUCTION

Kindly read this note carefully. This document serves as a template as well as an instruction to authors in preparing full paper submission. Authors are fully responsible for their papers, including references and proper credit for use of the work of others. Papers are accepted with the understanding that they have not been published elsewhere. All papers are to be electronically submitted in Microsoft Word document format.

Urbanisation is a dynamic and complex process that has unfolded across the globe at various times and speeds. This transformative movement, driven by forces such as industrialization, population growth, and migration, has reshaped the spatial and social landscapes of cities worldwide. Urban centres, with their robust employment opportunities in burgeoning industries, have historically drawn individuals from rural settings. This migration into cities fuels further industrial growth, establishing a symbiotic relationship whereby urban environments become critical hubs for economic transformation and demographic shifts. As noted by Lewis in 1954, this interdependence is fundamental to understanding urban dynamics.

However, the pace of urbanisation is not uniform across the globe. As Davis (2006) highlights, some regions experience swift and broad urban expansion, while others undergo a slower, more regulated development. This variability can be attributed to different socio-economic conditions, governmental policies, and historical contexts, which together shape the urbanisation trajectory of each region.

Echoing this global pattern, Türkiye has been undergoing significant urbanisation since the mid-20th century. Major Turkish cities like Istanbul, Ankara, and Izmir have become magnets for the rural population, driven by the promise of better economic prospects and living conditions. This rapid influx of people has spurred a surge in demand for housing, compelling these cities to expand at unprecedented rates.

The rapid urban expansion often occurs without sufficient planning, leading to the gradual erosion of the traditional boundaries between cities and the countryside. This phenomenon is particularly pronounced in developing countries where urban planning may not keep pace with growth demands. According to Ahani and Dadashpoor (2021), such unplanned urban sprawls are evident in the expanding metropolitan areas of Türkiye, where the delineation between urban and rural areas becomes increasingly blurred.

A case in point is the city of Izmir in Türkiye, where the case study area reflects a significant transition from rural characteristics to those of a peri-urban settlement. This transformation is part of a broader trend observed in many developing nations where rapid urbanisation is challenging the existing paradigms of city planning and development. The consequences of these changes are multifaceted, impacting not only the physical layout of cities but also the socio-economic dynamics within them.

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Peri-urbanisation refers to the process by which rural or semi-rural areas at the outskirts of cities undergo transformation due to urban expansion. As urban areas expand, they encapsulate nearby villages and agricultural lands, transforming them into suburban or peri-urban districts that blend urban and rural features. These newly formed peri-urban areas often struggle with both the benefits and the challenges of rapid urbanisation. They benefit from closer proximity to urban amenities and employment opportunities but grapple with issues such as inadequate infrastructure, housing shortages, and social displacement.

Furthermore, the demographic shifts associated with urbanisation bring about profound changes in community composition and social structures. Newcomers, often younger and from diverse backgrounds, inject vibrancy into the urban fabric but also introduce challenges such as social stratification and cultural integration. These shifts necessitate thoughtful urban governance and policy-making that can harness the benefits of urban growth while mitigating its adverse effects.

The significance of this research lies in its exploration of the socio-spatial transformations occurring in Balatçık as a result of the integration of İzmir Katip Çelebi University within a peri-urban context. By examining the neighbourhood's evolution from a rural settlement to a dynamic urban area, the study highlights the complex interplay between the higher education sector and urban development. The research question, 'what key factors have influenced the spatial transformation of Balatçık Neighbourhood from a rural settlement to a peri-urban area, particularly in relation to the development of a new university campus?' directly addresses the core of this transformation. The originality of this case lies in the unique interaction between the rapid growth of a university town and the socio-spatial changes occurring in a previously rural settlement. The selection of Balatçık as a case study is driven by the significant changes the neighbourhood has undergone due to its proximity to İzmir Katip Çelebi University, which has profoundly influenced local demographics, housing patterns, and urban identity. This research offers new insights into the phenomenon of peri-urbanisation, particularly in the context of Türkiye, where urban expansion often occurs without coordinated planning. The study aims to uncover how these transformations have shaped the neighbourhood, offering a deeper understanding of peri-urbanisation and its implications for urban planning, while providing valuable lessons for similar contexts.

Based on this existing body of literature, this study employs a mixed-methods approach, integrating statistical analysis, document review, semi-structured interviews, and field observations to examine socio-spatial dynamics. Quantitative data is drawn from open-access sources, while qualitative insights are based on 21 interviews with residents, business owners, real estate agents, and local officials.

FROM RURAL TO URBAN AREA VS. FROM RURAL TO UNIVERSITY TOWN

The transformation of a rural settlement into an urban dwelling is a complex process influenced by various economic, social, and environmental forces. Economic factors play a significant role in driving this transformation, with urbanisation often seen as a response to increased economic opportunities in urban areas (Hinderink & Titus, 2002). The attraction of better employment opportunities and improved living standards can motivate individuals and families to migrate from rural settlements to urban environments (Tacoli, 2003; Satterthwaite, 2016). Urban areas often offer better access to educational and healthcare facilities, cultural amenities, and a more diverse social environment (Champion, 2001; Storper & Manville, 2006; Buzar et al., 2007). The desire for improved education and healthcare services, as well as exposure to a broader range of social opportunities, can act as compelling factors driving individuals and families to relocate from rural settlements to urban centres. Social networks and migration patterns within communities can further amplify the influence of social forces on the transformation, as individuals may be motivated to move based on the decisions and experiences of others in their social circles (Stockdale, 2002; Savage et al., 2005).

Additionally, the shift from agrarian economies to more diverse and service-oriented industries in rural areas as well as urban areas accelerates the transformation of rural settlements into urban dwellings (Losch et al., 2012). Therefore, a combination of economic and social forces interplays to shape the transformation of rural settlements into urban dwellings, reflecting the dynamic nature of urbanisation processes.

The flows of people into an area with better employment opportunities and life standards result not only in the transformation of rural villages/small towns to urban areas but also in the expansion of existing urban centres into surrounding regions, giving rise to urban sprawl. As cities expand, they often extend beyond their initial administrative boundaries, resulting in the conversion of agricultural landscapes into suburban or exurban developments. This spatial transformation has implications for environmental sustainability, transportation infrastructure, and social dynamics of the urban centres and their surrounding areas (Lang, 2003; Ewing et al., 2017).

In addition to population growth, migration patterns and economic development, policy ambiguities and flexible regulations might contribute to urban sprawl (Silva, 2018). When regulations lack clarity or flexibility, it can create an environment that fosters haphazard and unplanned urban expansion. Inadequate land-use planning and zoning regulations may lead to unchecked suburban growth, inefficient land utilization, and increased dependency on private vehicles, ultimately contributing to the sprawling nature of urban landscapes (Ewing & Hamidi, 2015). Also, peri-urbanisation might cause leapfrog

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development in metropolitan cities (Colsaet et al., 2018) due to the restrictions or policies in the development direction. Many developments and changes in spatial structure are affected by the urbanisation process. For instance, a political decision such as opening a large-scale industrial facility or university might play a major role in initiating this process (Sargin, 2017).

As well as industries and service sector, higher education institutions serve as catalysts for urban development, influencing the socio-economic landscape, cultural vibrancy, and overall dynamism of cities. The presence of universities attracts a diverse and educated population, fostering innovation, entrepreneurship, and a skilled workforce (Castells, 2004). Additionally, universities often contribute to the physical expansion of cities through campus development and associated infrastructure projects. The impact of universities on urbanisation extends beyond economic considerations, encompassing cultural enrichment, social diversity, and the creation of vibrant intellectual communities (Florida, 2002; LeGates & Stout, 2018).

The literature on the spatial transformation of small settlements into university towns is relatively limited but is gaining attention as universities increasingly become anchors for regional development (Revington et al., 2020; Livingstone et al., 2023). Existing research often emphasizes the transformative effects on land use, infrastructure, and social dynamics. It also highlights that the establishment of a university in a settlement not only brings changes to the physical environment, such as the construction of academic buildings and student housing, but also triggers a shift in the socio-economic fabric, with implications for local businesses, housing markets, and community interactions (Hubbard, 2008; Sage et al., 2013). Understanding these spatial transformations is crucial for both academics and policymakers seeking to harness the potential benefits and manage the challenges associated with the growth of university towns.

The literature also underscores the impacts of increased population, altered traffic patterns, and the emergence of new cultural and recreational spaces are all crucial elements that contribute to the evolving spatial character of the region (Fabula et al., 2017; Ackermann & Visser, 2016; Grabkowska & Frankowski, 2016; Woldoff & Weiss, 2018). Through case studies and theoretical frameworks, researchers delve into the complexities of this transformation, shedding light on how the presence of a university can catalyze economic development and shape the physical and social fabric of the surrounding landscape (Smith & Holt, 2007; Smith et al., 2014). Although the major part of this literature focuses on the countries of the Global North, the number of publications examining the process in the developing world is also growing (He, 2015; Dewi et al., 2019; Ackermann & Visser, 2016; Situmorang et al., 2019; Fabula et al., 2017; Grabkowska & Frankowski, 2016).

In the Turkish context, establishing new universities in Anatolian cities in the 1990s generated widespread economic, socio-cultural, and spatial changes in their cities (Akçakanat et al., 2010; Atik, 1999; Görkemli, 2009; Öztürk et al., 2011; Savaş Yavuzçehre, 2016, Yilmaz, 2011). As a second wave, many new public universities have been established since 2006 targeting to have at least one higher education institution in every province (Karataş Acer & Güçlü, 2017). As a result of this goal, there are 113 higher education institutions in Türkiye as of 2023 (YOK, 2023). Most of these universities are established in small Anatolian cities. However, this research focuses on how an urbanisation process has been shaped by establishing a university in rural areas on the outskirts of one of the metropolitan cities of Türkiye, Izmir in 2011.

METHODOLOGY

This study examines the spatial transformation of the Balatçık Neighbourhood, tracking its evolution from a modest rural settlement into a burgeoning urban neighbourhood characterized by a significant influx of unusually small housing units. The period from 2011 to 2023 serves as the focus for this analysis, capturing 12 years of developmental changes within the area. The research framework is structured around three primary themes: the alteration of land usage patterns, demographic shifts, and variations in the local housing market. Before delving into these specific areas, the subsequent section will present detailed data and introduce the case study area, setting the stage for a comprehensive understanding of the transformative processes that have reshaped Balatçık.

Data and Methodology

The research was designed with the mixed method. The data comprised open-access statistical data from the Turkish Statistical Institution and interviews with local residents, business owners/employees and local administrative representatives in 2022. In addition, the observations were conducted twice in March 2022 and May 2022. The illustration of the methodology can be seen in Figure 1.

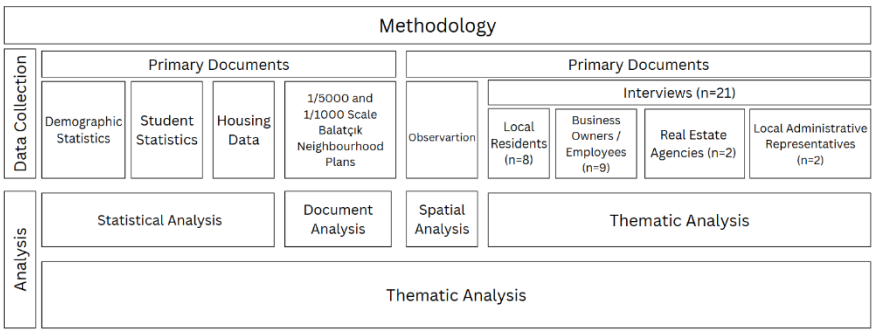

Figure 1. Research methodology diagram (Source: Authors, 2023)

Before initiating the fieldwork for this study, a thorough analysis of primary documents was conducted to establish a foundational

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understanding of the research context. The documents reviewed included a range of sources: demographic statistics provided by the Turkish Statistical Office, student enrolment and demographic figures from the IKCU database, housing data from the General Directorate of Land Registry & Cadastre, and local urban planning documents such as the Balatçık Neighbourhood Plan sourced from Çiğli Municipality. These varied documents were subjected to a dual-method analysis approach. Firstly, a statistical analysis was employed using descriptive techniques to quantify and outline the data trends observed. Secondly, a document analysis was performed, which involved a detailed examination of the texts to extract thematic codes. This methodological approach allowed for a comprehensive assessment of the available information, ensuring a robust analytical framework to support the subsequent stages of the research. These preparatory steps were critical in framing the conditions and characteristics of the study area, providing essential insights into the social, demographic, and infrastructural dynamics at play.

The primary data was gathered through semi-structured interviews during the fieldwork. The ethical approval for the fieldwork was obtained by the Social Research Ethics Committee of Izmir Katip Çelebi University (No. 2021/20-11). The interviews aimed to obtain the local residents (n=8), business owners/employees (n=9), real estate agencies (n=2) and local administrative representatives' (n=2) points of view on the recent developments taking place in the neighbourhood. Each interviewee had different standpoints regarding the change in the Balatçık Neighbourhood. The interviews were conducted face-to-face and they took a minimum of 45 and a maximum of 90 minutes.

The research and data analyses were conducted via a non-linear process. The primary documents and data and their analysis not only led but also fed each other during the project. Initial codes of the thematic coding system arose from the literature review and primary document analysis. Afterwards, the thematic coding system was finalised with analysis and interpretation of all collected data.

The Timeline of Balatçık Neighbourhood

The changing characters of the case study area; Balatçık neighbourhood has internal and external forces that are leading the change. The graph below indicates that the macro-level and micro-level events have impacts on the spatial change of the Balatçık neighbourhood. Figure 2 shows the external forces in the upper section and internal forces in the lower section of the illustration. All of these events in Figure 2 have been impacting the transition of the Balatçık neighbourhood over the last 40 years. However, the research, as mentioned earlier, focuses on the 2011-2023 period which starts with the foundation of the university in the neighbourhood.

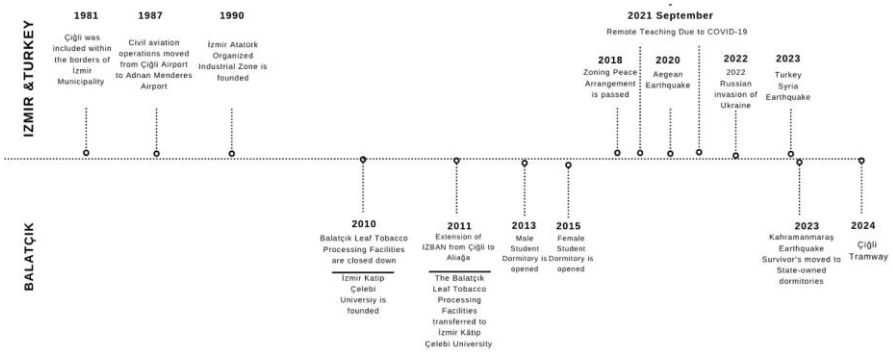

Figure 2. The timeline of Balatçık Neighbourhood (Source: Authors, 2023)

The site selection of the university was made by the Central Government and the Council of Higher Education in 2011 (IKCU, 2019). Without a site evaluation and involvement of any other local or mezzo-level governmental bodies in the selection process means that how the university in this particular location might have impacted the neighbourhood and the wider city has not been evaluated thoroughly in terms of development planning. This conflict between the upper-level decision (site selection of IKCU) and lower-level results triggers an unsolicited and ungoverned spatial change in the neighbourhood. Therefore, the site selection of the main campus in Balatçık might be claimed as the breaking point of the spatial change of the neighbourhood. As can be predicted, not all events have the same weight on the change. Their impact will be investigated in detail later in the discussion part of this research. However, as with many aspects of daily life, specifically, remote working and online education during the COVID-19 pandemic has changed the understanding and the traditional use of the built environment. Turkish higher education institutions moved to remote teaching from March 2020 until September 2021 due to the increasing COVID-19 cases (YÖK, 2020b). When face-to-face teaching resumed in September 2021, students encountered a student housing crisis. In 18 months, housing prices increased all over Türkiye and students struggled to find affordable accommodation near their universities (see housing market section). It needs to be highlighted again that rising housing prices are observed not only by students but also by all the citizens in Türkiye as mentioned earlier.

The Case Study: Balatçık Neighbourhood

Land use transformation plays a critical role in the evolution of urban environments, particularly in rapidly expanding metropolitan regions. The Balatçık Neighbourhood in İzmir serves as a significant case study of this process, where former agricultural land has been converted into a peri-urban area following the establishment of a university campus. This section provides a comprehensive analysis of the neighbourhood's existing conditions, focusing on its spatial structure, land use dynamics, and the underlying factors driving its transformation.

Balatçık is located in Çiğli District which is in the northern part of Izmir. As can be seen in Figure 3, Road D550 and IZBAN line cut through

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the neighbourhood and the main campus of IKCU is located in the western part of the neighbourhood. The Egekent station of IZBAN connects the neighbourhood and the university to the rest of Izmir. The university is surrounded by Çiğli Air Base in the west, the Ege Industrial Zone in the north, and the Izmir Atatürk Organized Industrial Zone in the south. Therefore, the most suitable and accessible area for further development to accommodate students and staff of the university was the Balatçık Neighbourhood. Therefore, private real estate investors and construction companies took the initiative rapidly and started to build on the former agricultural land which was converted to residential land with a 1/5000 scale master plan by the local government.

Figure 3. Balatçık in Izmir and Balatçık Neighbourhood Administrative Area

Figure 4 shows the conversion of the neighbourhood land from cultivated agricultural land over 20 years. The light green represents the 2002 period while almost half of the neighbourhood was agricultural land. The dark green demonstrates the agricultural land in 2023. As can be seen in Figure 4, the agricultural land has decreased to almost one-tenth due to a significant increase in residential development in the neighbourhood by 2023 with lower-level planning decisions.

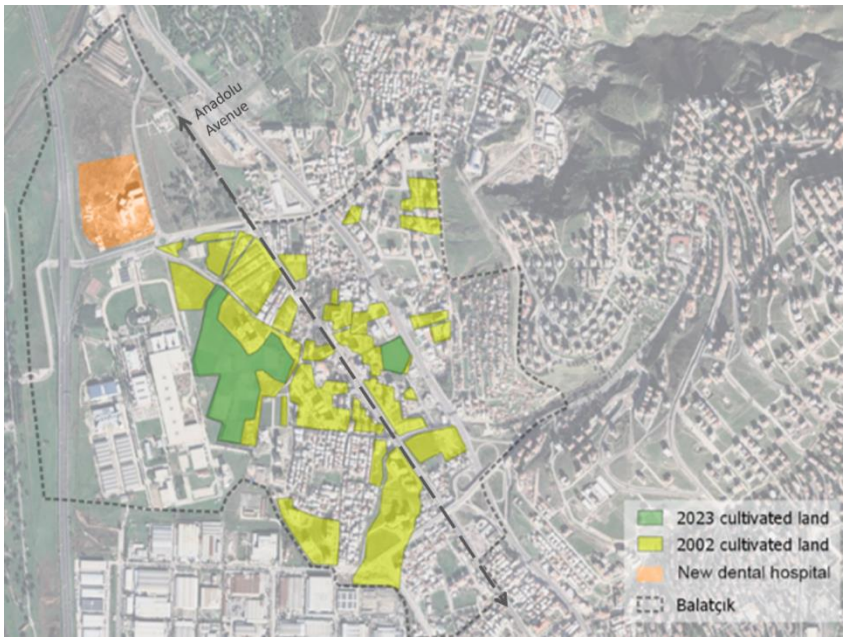

Figure 4. Cultivated land change between 2002 and 2023 (Source: Prepared by authors based on Google Earth)

It is important to emphasize that the university's dental hospital is in the process of relocating to the vicinity just across the north gate of the main university campus. This development is contributing to a significant reduction in the surrounding rural land, thereby catalysing a notable spatial transformation within the broader region. Given these circumstances, there is an increased imperative to closely examine the Balatçık area in terms of the spatial changes occurring at this critical point. This analysis will provide deeper insights into how the movement of such significant institutional infrastructures can impact the regional landscape and its development trajectory.

FINDINGS AND DISCUSSION

In this research, the spatial transformations of Balatçık Neighbourhood are explored, focusing on how land use, demographic characteristics, and housing market dynamics have been altered by the integration of İzmir Katip Çelebi University while the research aimed to answer: 'What key factors have influenced the spatial transformation of Balatçık Neighbourhood from a rural settlement to a peri-urban area, particularly in relation to the development of a new university campus?' As mentioned in the previous sections, the development of the university has played a pivotal role in reshaping the area. This discussion revisits these key transformations, offering a deeper analysis of the factors driving the neighbourhood's evolution and their broader implications for urban planning in peri-urban contexts.

The undeniable impact of demographic shifts on the spatial configuration of cities and neighbourhoods is evident as the profiles of residents evolve. These changes are influenced by various factors including age, income levels, and cultural backgrounds, which in turn necessitate adaptations in the spatial environment to accommodate these new demographics. As a response, modifications are often made to housing structures, amenities, and the broader urban infrastructure to satisfy the varied needs of the residents. Such transformations are well-documented in urban studies literature, highlighting the dynamic relationship between resident demographics and urban form (Lynch, 1960; Gehl, 2010).

This research has observed significant spatial changes over nearly a decade, coinciding with the establishment of a university in the area. These observations form the basis of the discussion in this study, which is structured around three principal themes: the transformation of land use patterns, shifts in population dynamics, and changes in the housing market. Each of these aspects reflects the broader impacts of demographic changes on the urban landscape, underscoring the complex interplay between urban development and its social fabric. This investigation aims to dissect these themes to better understand the continuous evolution of urban spaces in response to their inhabitants' changing needs.

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Change in Land Use: From the artichoke fields towards a peri-urban settlement

To understand the spatial transformations in Balatçık, it is important to consider its history and key developments. This section examines the early stages of this transformation, including from artichoke farming to the establishment of tobacco processing facilities and the subsequent influence of İzmir Katip Çelebi University on the area's development.

Before initiating a detailed investigation into the specific area of interest, it is crucial to gain a comprehensive understanding of the surroundings that define Balatçık. Notably situated on a flat plain, Balatçık retained its village status until 1992, as previously noted. According to statements from interviewees, during the 1990s, agriculture was the predominant activity in the area, conducted on a large scale. The focal point of the village life centred around what is now Balatçık Elementary School. During this time, the primary agricultural output of the village was artichoke, highlighting the region's agrarian roots and the traditional lifestyle of its inhabitants prior to its urban transformation. This historical backdrop is essential for appreciating the current and future changes in land use and community structure within Balatçık. It continued to be a rural settlement area until the 2010s (Çiğli District Governorate, 2020). Some interviewees who were also producers explained the villagers' preference for artichokes over other agricultural produce that could have been cultivated in the area;

"When it was a village, we had our artichoke fields." (A2)

"Many agricultural products can be grown [in the areas], however, artichoke is the simplest product to cultivate. Therefore, the villagers preferred to grow artichokes." (L6)

The change in spatial patterns becomes evident through both the quotations and Figures 4 and 5, revealing a transformation within a remarkably brief 15-year timeframe. Notably, the first housing development, Erzurumlular[1] Neighbourhood, has emerged on the outskirts of the village commons, rather than directly encircling the village centre. In addition to these two settlements, the neighbourhood originally comprised expanses of actively cultivated agricultural land which can be seen in Figure 4 at the southwest part of the neighbourhood.

The neighbourhood's new inhabitants had a strong employment bond with the previous Balatçık Leaf Tobacco Processing Facilities in the neighbourhood which was in operation from the 1970s until the 2000s (İZKA, 2021). They were mainly working and living in the same neighbourhood. New housing units began to be established with the establishment of Balatçık Leaf Tobacco Processing Facilities in the neighbourhood in the 1970s (İZKA, 2021).

[1] Erzurumlular Neighbourhood is named after the residents' hometown city who live in one part of the Balatçık Neighbourhood.

"The tobacco factory was closed between 2008-2009. 60-70% of the population living in the neighbourhood were working in the [tobacco] factory." (A2)

The second phase of observed development unfolded a couple of years after establishing the university's campus in Balatçık. The buildings and the land of the nonoperating Balatçık Tobacco Leaf Processing Factory were transferred to the university to be used as a campus in 2011.

As explained by Sargin (2017), a political decision, to open a large-scale industrial facility or university might initiate the urbanisation of their surroundings. The case study; the transfer of the factory's land to the university proves Sargin (2017)'s statement. With this transition, the new development was nestled in the agricultural area between the university campus and the IZBAN train line with new residential building complexes. The features of these residential areas are different from the existing housing. While the ones constructed before 2011 were mostly three-floor and three-bedroom flats, the new residential structures are multi-floor, multi-unit and gated communities (see housing market section for details).

These new residential zones, which were still actively cultivated as depicted in Figure 4, underwent a transformation into residential areas starting in 2011. This change suggests a pattern where the metropolitan city of Izmir was expanding towards the north, with Balatçık lying directly in its path. Despite this development, Balatçık managed to retain its rural characteristics until very recently. The phenomenon of leapfrog development, particularly evident in the Ulukent area from the 1990s onward, illustrates the non-continuous expansion typical of many metropolitan areas, as discussed by Colsaet et al. (2018). Leapfrog development is a common urban growth pattern where development jumps over closer areas to further ones. As a result, while Balatçık continued its traditional agricultural activities, mainly the cultivation of artichokes, the southern and northern parts of the neighbourhood were already undergoing significant urbanisation. This dual existence highlights the transitional phase of the area as it slowly integrates into the broader urban landscape of Izmir.

"It took a couple of years due to the regeneration of the university campus. They adapted the existing buildings for educational purposes. Therefore; the 2014-2015 period was the cornerstone of the development of the neighbourhood." (A2)

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Figure 5. Balatçık Neighbourhood 2011-2016-2021 (Source: Google Earth)

Figure 5 illustrates the changes in land use over the span of a decade. During this period, the neighbourhood experienced a significant increase in the density of residential zones. This surge was primarily driven by the establishment of the IKCU main campus, which acted as a catalyst for the area's development. The arrival of a substantial number of newcomers, including students and university staff, further contributed to this rapid urbanisation. These changes reflect the dynamic transformation of the neighbourhood's landscape, transitioning from less densely populated areas to more concentrated residential developments.

In summary, the spatial evolution of Balatçık highlights a complex interplay of agricultural heritage, industrial development, and educational infrastructure. The integration of İzmir Katip Çelebi University has accelerated the transformation of the area. These shifts offer important insights into the broader processes of peri-urbanisation and urban growth in the metropolitan context of İzmir, setting the stage for continued changes in the neighbourhood's demographic and housing dynamics.

Population Change

Socio-spatial features are deeply intertwined with demographic changes, as urban areas adjust their characteristics to accommodate the evolving needs of their populations. As the university attracted mainly young population, including students and university staff, the local demographic shifted significantly. The new population profile contributes to changes in housing, businesses, and service facilities. This analysis explores how these changes have shaped the socio-spatial characteristics of the neighbourhood.

Socio-spatial features and age factors are interlocked features. Urban areas are inclined to readjust their features based on the features of the population. Spatial distribution of businesses, housing types and service facilities are modified to serve specific age groups (Bruegmann, 2006; Gehl, 2010). Without effective control by the local or central government, social segregation might be observed in the long term (Logan & Molotch, 1987; Sandercock, 2017). In this perspective, the population change in the neighbourhood is scrutinised.

Figure 6 shows the change in local population structures in Balaçık, Çiğli and İzmir. The change in Balatçık presents a sharp increase right after the foundation of IKCU in 2011. The population approximately

doubled between 2010 and 2020. The neighbourhood's population increased to 14,801 in 2020 (TUIK, 2021). The upward trend in Balatçık can be correlated with the establishment of the new university in the neighbourhood. As has been experienced in many university towns, higher education institutions trigger an increase in town demographics with the student population and university employees' relocation to the neighbourhood (Gu & Smith, 2020).

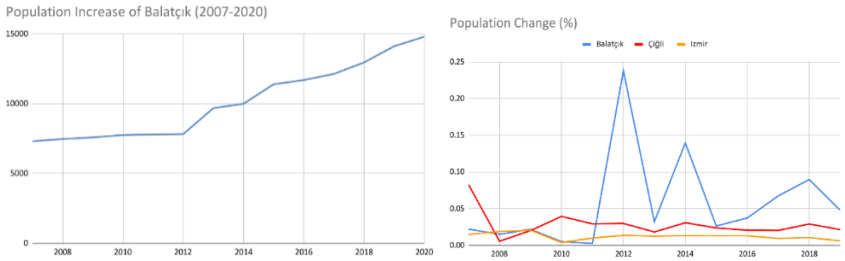

Figure 6. Population Change in Balatçık Neighbourhood (Source: Prepared by authors based on TUIK data, 2022)

The data reflecting the percentage change in population clearly highlights a significant rise in the number of residents in Balatçık, outpacing the population growth rates of both Çiğli and the broader Izmir area. This marked increase in population was most pronounced during the 2011-2012 period, which aligns with the time when the university was established in the area. This correlation suggests that the university's establishment was a key driver of population growth, attracting a larger number of residents to Balatçık as compared to its surrounding areas and contributing substantially to the demographic changes observed during this time.

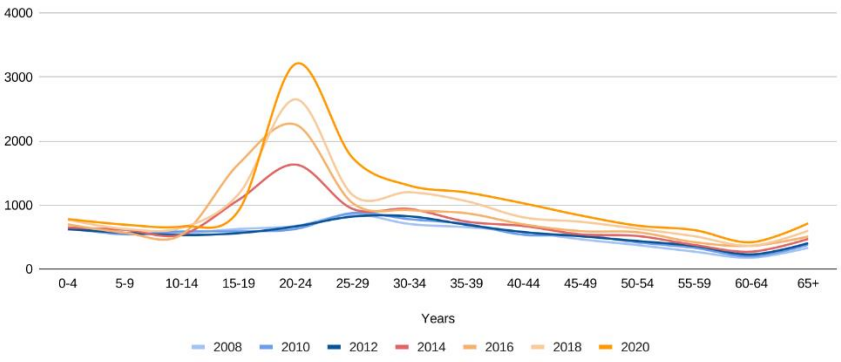

Figure 7. Population change by age groups in Balatçık Neighbourhood (Source: Prepared by authors based on TUIK data, 2022)

The age distribution by years in Balatçık is visualized in Figure 7. The blue colour lines represent the population change before the 2014 period and the orange colour lines signify the change from 2014 onwards. Balatçık stands forward with its youthful demographics. The 20-24 years old population became the predominant demographic in the neighbourhood after the university's establishment and admissions of the first students. Even though the population change can be observed in these graphs, one of the interviewees stated that most of the students do not register at their term-time addresses even though they are obliged legally. Therefore, the exact number of residences between 20-24 years might be even higher than the official statistics.

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"70 or even 80% of the students are not registered. Only one of the students registers to their student houses to register their utilities under their own names." (A2)

"The actual population is almost 20,000." (A2)

In addition to this, students who live in dormitories are not obliged to change their addresses. As a result, it can be asserted that there is a sizable discrepancy between the census numbers and the neighbourhood's real population. Up to 6,000 residents could be missing, which is 1.5 times more than what is already recorded in the census.

Interviews have also revealed another point that residents who work in the Çiğli Air Base[2] started to choose to live in one-bedroom flats in the neighbourhood as well. They are generally single men or groups of friends.

[2] The Çiğli Air Base has been situated to the west of the neighbourhood since the 1950s. Owing to the limited availability of accommodation options in the vicinity, residents have been residing in surrounding areas.

"One-bedroom flats are expensive for students. Usually, people who work at the university and Jet Base live in one-bedroom flats. Students get together and rent out two- or three-bedroom flats to share the expenses." (A2)

Spatial segregation in the neighbourhood between newcomers and local residents was observed in the fieldwork specifically in the southern part of the neighbourhood. The residents of the southern part of the neighbourhood (Erzurumlular Neighbourhood) have not leaned towards renting their flats specifically to students.

"Landlords in the Erzurumlular neighbourhood do not prefer to rent their flats to students because they claim that they [students] destroy their flats." (B11)

As a result of the population change, the service sector in the neighbourhood has been shaped to target university students such as cafes, fast food and takeaway places. The interviews prove that their customers are mainly university students. This demonstrates the market-driven nature of urban transformations. This alignment between population change and business development highlights the role of supply and demand forces in shaping local economic structures, where businesses emerge and expand in response to the needs and preferences of new residents.

The influx of students, university staff, and other newcomers has reshaped local housing markets, service sectors, and even the social fabric of the area. As the neighbourhood continues to evolve, understanding these dynamics is crucial for addressing the potential challenges of socio-spatial segregation and ensuring sustainable development in peri-urban areas like Balatçık.

Housing Market

To understand the housing dynamics within Balatçık, it is essential to examine how the broader economic situation and the university's establishment have reshaped the local real estate market and student accommodation trends. The construction sector and real estate market in Türkiye have been encouraged since 2002 through the help of regulations and public and/or private funds initiated by the government`s advice (e.g. megaprojects, urban regeneration laws, and government-directed low-interest-rate housing loans in 2020 and 2023) (Balaban, 2012; Erbaş, 2022). In addition to that, as mentioned earlier, new state universities have been established since 2006 (Karataş Acer & Güçlü, 2017) and they are 113 higher education institutions in Türkiye as of 2023 (YOK, 2023). Moreover, in parallel to the increasing number of students, the student accommodation shortage has increased as well all over Türkiye. Due to not having comprehensive upper-level development strategies, the accommodation gap has risen year by year. In addition to that, Miessner (2020) states that renting strategies are decided based on the students' needs in studentified neighbourhoods. The researchers observed the same dynamics in the case study area where former agricultural land has been converted into a peri-urban area following the establishment of a university campus. Private initiatives have been involved in the student housing market with their renting strategies (e.g. small studio flats).

The study of the residential property market in the Balatçık Neighbourhood is primarily conducted using data from sahibinden.com, which is the most frequently utilized residential property website in Turkey. The accompanying graphs provide a comparative analysis of average property prices within the Balatçık Neighbourhood, the broader Çiğli District, and across İzmir. This comparison is instrumental in understanding the impact of the housing crisis and the ongoing Turkish currency crisis on the residents of these areas. Since 2016, both housing prices and rents in the neighbourhood have experienced an astronomical surge, increasing by over 1000%. This dramatic rise in property prices has significant implications, prompting both inter-city and intra-city relocations as residents seek more affordable living options. The shifts in property values are crucial for assessing the economic landscape of the area and the resultant socio-economic movements of its population. These changes underscore the challenges faced by residents as they navigate the pressures of an escalating market within a fluctuating economic environment. Therefore, this is not only related to the university but also increasing property prices and earthquakes[3] (see Figure 8). However, the crucial part of this situation is the price gap between Balatçık and Izmir which has extended more and more during the last year. Based on these data, it might be claimed that student-oriented residential areas' unaffordability takes attention compared to the district and the city as a whole.

[3] The Aegean Sea Earthquake occurred on November 30, 2020, while the Kahramanmaraş Earthquake occurred on February 6, 2023. The seismic events prompted an assessment of the structural earthquake resistance not only in the affected areas but all over Türkiye. Also, these leaded to increase awareness and scrutiny of building resilience. Consequently, urban mobility was observed in response to these earthquakes.

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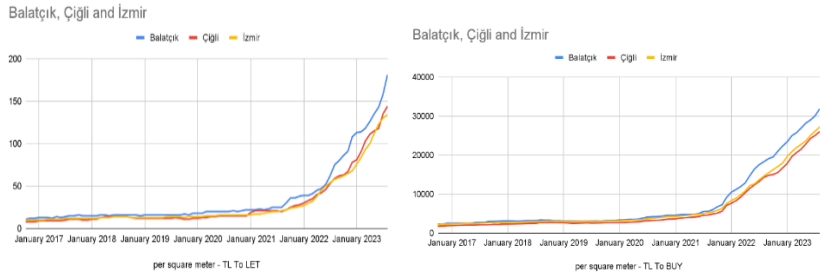

Figure 8. Housing market (Source: Prepared by the authors based on Sahibinden.com data, 2023)

We can observe how remote teaching and the COVID-19 pandemic have affected the rental graph. The disparity between Balatçk and Çiğli & Izmir rentals became less apparent when the remote teaching terms were announced by the university. Changes in housing stock have accelerated since 2011 with the university student population. As can be seen in Figure 9, the unit sizes were changed with the new housing complexes. These new options are constructed after the university's establishment (Çiğli Municipality, 2023) targeting the students as acknowledging the need for accommodation. Due to not having a social welfare policy to establish enough bed capacity with state-run dormitories, the liberal economy has stepped in with housing options. In parallel with this, it is observed that sizes of housing units have been shrunk from three-bedroom to one-bedroom or even studio flats. The research proves Miessner (2020)'s point about having mainly small studio flats in studentified neighbourhoods.

The building complexes that obtained their construction permits from 2011 onwards from the local municipality are shown in Figure 9 (Çiğli Municipality, 2023). The construction permit consists of the construction year, purpose of building use, number of units and housing unit size. Based on these data, 66% of the housing units are one-bedroom, 29% are two-bedroom, and 5% are three-bedroom flats. Most of the three-bedroom flats[4] are located in the eastern part of Anadolu Avenue which is also the mainly family-oriented part of the neighbourhood. However, owing to the rising student population and limited two and three-bedroom flats, residents are facing difficulties in finding affordable housing.

[4] The building complex known as 'My Way Wins' situated just outside of the northern border of Balatçık. However, it is shown on the map and included into the calculation due to its undeniable impact on Balatçık's housing inventory.

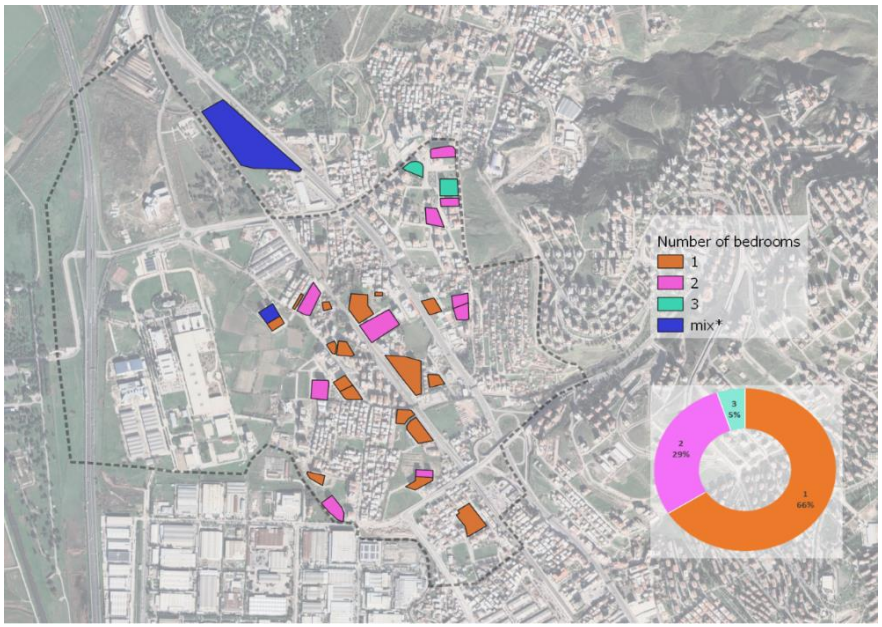

Figure 9. Housing unit sizes in the building complexes (Source: Prepared by authors based on Çiğli Municipality construction permit data, 2023)5

The building which are shown with blue colour consist of various unit sizes.

"There is a housing problem in the neighbourhood. 95% of the houses are occupied, the others are for sale and no rental house can be found." (B11)

"The housing problem in the neighbourhood will turn into a crisis in 3-4 years." (B10)

The main reason causing this problem that was expressed by the interviewees is to have limited student accommodations and diversified housing options in the neighbourhood. The university itself does not provide any student accommodation. There are two state-run dormitories (Cihannuma Female Student Dormitory and Çiğli Male Student Dormitory) in Balatçık Neighbourhood with 2106 bed capacity in total (KYK, 2023) which do not only serve IKCU but other universities in Izmir as well. The total undergraduate enrolment of IKCU is 13937 as of 2022 (IKCU, 2023). Even though it is reserved for IKCU, it only serves 15.11% of the undergraduates. Therefore, students are obliged to rent a flat in the neighbourhood or other areas of Izmir alone or with their friends. Due to the increasing rental prices during the last 3 years, real estate agencies stated that it is more affordable to rent a place outside the neighbourhood that claim is supported by the housing market statistics.

Moreover, based on the interviews and direct observations, student and non-student population distributions across neighbourhood typologies show us that while the students who rent in the neighbourhood are agglomerated in the western part of Anadolu Avenue, the university employees prefer to live in the eastern part of the Avenue due to the size of housing units. Ultimately, these changes in housing types, rental prices, and demographic distributions underscore

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the growing pressure on Balatçık's residential market, highlighting the need for more sustainable housing solutions to accommodate both students and long-term residents.

CONCLUSIONS

The establishment of İzmir Katip Çelebi University has been a key factor in shaping the urban dynamics of the area, drawing a young population and changing urban fabric based on the new population. In this context, this research sheds light on the challenges of peri-urbanisation and the consequences of policy misalignment by examining changes in land use, population dynamics, and transformations in the housing market. This study delves into the spatial transformations occurring within the Balatçık Neighbourhood, tracing its evolution from a quaint rural locale to a burgeoning peri-urban area. This transformation has been marked by several significant shifts, detailed in the following discussion and results sections.

Land Use Changes: The shift in land utilization patterns within the Balatçık Neighbourhood has been pronounced since the establishment of the university campus in 2011. This transformation was initially noted along the western end of Anadolu Street, eventually spreading eastward. Aerial photographs have captured this sprawl and concentration, illustrating how areas once dominated by artichoke fields have transitioned into residential zones. This shift underpins the broader transformation from agricultural land use to a more suburban, residential development model, highlighting the neighbourhood's evolution towards a peri-urban identity.

Demographic Shifts and Population Dynamics: Contrary to potential expectations of age-based segregation, the demographic shifts within Balatçık have not resulted in significant age segregation across the neighbourhood. Exceptions exist, such as in the Erzurumlular sector, where preferences in rental markets show a trend more akin to student-based discrimination than age segregation. New housing developments, particularly those on the periphery of the university, cater predominantly to students, offering studio and one-bedroom flats. This suggests a clear division in the neighbourhood's demographic and social fabric, with pull-push factors visibly influencing different segments of the community. While these changes offer new opportunities, they also present risks of increasing social segregation if not managed carefully by local or central government interventions.

Housing Market Evolution: Insights into the housing market evolution in Balatçık are informed by building license data from local authorities, as well as interviews with real estate agents and reviews of real estate websites. Post-2011, the housing landscape has shifted considerably, with a predominant rise in one-bedroom units. This trend is particularly impactful for residents in the western stretches of Anadolu Street, prompting a migration of families towards the eastern parts of the street and nearby neighbourhoods. The diminishing size and number of

rooms in new developments are reshaping where and how residents live, influencing community structure and social dynamics.

Challenges in Student Housing: A critical issue highlighted by the study is the inadequacy of state-subsidized student accommodation, which has not kept pace with the growing student population. This shortfall has provided an opening for the private sector to fill the gap, albeit at higher prices that many students find prohibitive. The resulting scenario is a housing market that, while addressing the supply shortage, does so in a manner that is not economically accessible for many students. It is imperative for both local and central governments to address this imbalance by expanding affordable housing solutions to mitigate the student housing crisis effectively.

In conclusion, the transformation of the Balatçık Neighbourhood encapsulates a complex interplay of urban development, demographic shifts, and economic challenges. The findings from this research underscore the need for coordinated urban planning and policy interventions to ensure sustainable development that benefits all residents of the community. Addressing these challenges will be crucial in managing Balatçık's transition and ensuring its development aligns with the broader goals of social equity and inclusivity.

FURTHER STUDY

This research was made possible through the support of the Scientific Research Projects Coordination Unit at Izmir Katip Celebi University, which provided funding for the study (Project no.: 2022-GAP-MÜMF-0049). The research is divided into two main parts; the first section, which this paper covers, delves into the spatial transformation occurring in the area. The second section, which is planned for future investigation, will explore the socio-economic and cultural shifts that have taken place in the Balatçık neighbourhood of Çiğli District following the influx of a student population. This forthcoming study will focus on the phenomenon of 'studentification,' a specific form of gentrification that has been increasingly evident over the past decade as more students move into urban areas, influencing local markets and community dynamics. The term 'studentification' refers to the process by which a growing student population in a particular urban area contributes to demographic and economic changes that can have profound effects on the local cultural and socio-economic landscape. This process is often marked by increased demand for housing and services that cater specifically to students, which can lead to a transformation of the neighbourhood's character and a shift in its cultural fabric.

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Resume

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The Impact of Trade on Architecture During the Seljuk-Ottoman Period: A Study on Caravanserai and Khan Structures in the Southeastern Anatolia Region

Dilan Kakdaş Ateş**
Gülin Payaslı Oğuz ***

Abstract

This study analyzes the impact of trade on architectural structures and examines how caravanserais and khans gradually transformed into commercial centers. Sixty-one structures built between the 13th and 20th centuries in the Southeastern Anatolia Region were identified, though historical information was unavailable for 12 of them. Among the 49 examined buildings, four belonged to the Seljuk period, 3 to the Early Ottoman period, and 42 to the Ottoman period. Eight well-preserved structures with clearly identifiable architectural elements and documented construction dates were selected for detailed analysis. The selection process included examples from the Seljuk (13th century), Early Ottoman (14th-15th century), and Ottoman (16th century and beyond) periods. Field studies were conducted to document the structures' current condition. In contrast, archival documents and official records were used to analyze architectural plans, facade designs, and the relationship between open and closed spaces.

Comparative analyses were carried out through visuals, tables, and drawings, which were systematically converted into schematic representations and categorized based on their construction periods. The findings reveal that trade routes and economic changes directly influenced the architectural plans of khans and caravanserais. While security-focused structures were common in the 13th century, declining trade in the 14th century led to the preference for smaller, enclosed plans. From the 15th century onwards, courtyards were reintroduced, and during the Ottoman period, khans evolved into commercial centers. After the 16th century, shop units were added, the number of floors increased, and aesthetic elements became more prominent in the 18th and 19th centuries.

This study highlights the architectural transformation of khans and caravanserais, emphasizing the impact of trade on their identity and the significance of factors contributing to the preservation of cultural heritage.

Keywords: *Caravanserai, Khan, Ottoman, Seljuks, Trade, Southeastern Anatolia.*

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INTRODUCTION

Monumental buildings establish a cultural connection between the past and the present. Campbell (2011) states that understanding historical sites helps us grasp their value in today's world. Aslan (2007) argues that social, cultural, and economic changes have transformed architectural structures, and understanding this transformation strengthens the connection between the past and the future (Aslan, 2007, pp. 93-102). Architectural structures are shaped by cultural, social, and economic factors (Lawrance, 1987). Cultural heritage structures are influenced by environmental and social events (Akalp & Aycam, 2024, pp.1500). When monumental buildings are examined, it becomes possible to gain insights into their living conditions, cultural interactions, and economic conditions. Altman and Chemers (1984) categorized the factors influencing architectural design into three main areas: economic, environmental, and cultural (Figure 1).

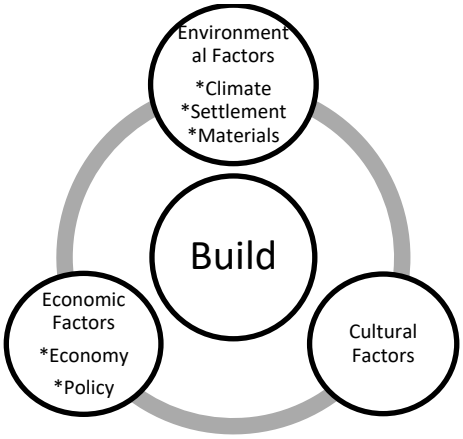

Figure 1. Factors Affecting Structural Formation (Altman ve Chemers, 1984).

Economic factors in their formation processes significantly influenced Caravanserais and khans built along trade routes. Examining this process, the trade network that started in China gradually expanded towards Anatolia, leading to new trade routes. This expansion increased the need for accommodation, prompting the development of architectural structures that provided security and shelter. The first caravan cities were established to support the growth of trade. The term "Fondouq" referred to a lodging place and eventually evolved into the word "hotel" (Liu, 2010, p.8). These structures later transformed into military-religious buildings known as "ribat" (Köprülü, 1942, pp. 267-278). Over time, ribats evolved into caravanserais. Caravanserais served as stations where caravans could shelter their animals, store goods, and procure food (Stephan, 2017). As trade expanded into Anatolia, caravanserais became widespread and adopted a standardized layout around a central courtyard (Burlot, 1995).

During the Middle Ages and Early Modern Period, these structures were built for merchants and supported by philanthropists to promote social solidarity. They became key centers for trade and cultural exchange, shaping their regions' social and economic structure (Kathryn

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& Emily, 2019, pp. 40-54). In the 11th century, as trade increased under the rule of the Anatolian Seljuks, new caravanserais were built, transforming into social hubs (Köprülü, 1942, pp. 267-278). These structures included additional facilities such as baths, markets, and stables. Over time, as cities expanded, caravanserais were also built within urban centers and were called "khans." Although urban khans resembled caravanserais in appearance, they were smaller in scale and had different functions (Güran, 1978). Some urban khans housed merchants, soldiers, travelers, madrasa students, and instructors (Yaşar, 2023, pp. 539-550). During the Ottoman period, caravanserais located around the bedesten (covered market) supported the development of bazaar culture (Kuban, 2007, p. 602). Additionally, caravanserais played a significant role within külliyes (building complexes) constructed in rural areas (Güressever Cantay, 2016).

Despite the architectural transformations of these structures over different periods, there remains a significant research gap regarding how their architectural forms and functions changed over time and how trade routes influenced their transformation. This study examines the impact of trade on caravanserai and khan architecture in Southeastern Anatolia from the Seljuk to the Ottoman periods. Unlike previous studies, this research uniquely integrates historical documents, field observations, and comparative architectural analysis to holistically evaluate the role of trade in shaping caravanserai and khan structures.

Within the scope of this study, 61 caravanserais and khans in Southeastern Anatolia were identified, and eight were selected for detailed examination. The selection criteria included accessibility to architectural plans, preservation status, and the ability to represent the architectural characteristics of their respective periods fully. The selected structures include Han El-Barur, a Seljuk-period structure with corner towers; Gevran Khan and Karakaya Khan, representing the early Ottoman period with a courtyard-less plan; and several Ottoman-period structures with courtyard-based layouts. The architectural characteristics of these structures were analyzed according to their respective periods, and their differences were presented through comparative tables.

Throughout history, caravanserais and khans have served as accommodation facilities and functioned as centers of social interaction, cultural exchange, and economic activity. Their cultural influence on local communities fostered social solidarity and facilitated the establishment of trade networks. Today, as an integral part of cultural heritage, these buildings contribute to tourism and the cultural economy. The study aims to analyze the cultural, social, and economic factors that influenced the architectural design of caravanserais and khans. In this context, preserving caravanserais and khans is a means of safeguarding historical traces and a crucial tool for transferring historical knowledge and raising cultural awareness.

Another objective of this study is to examine the impact of trade on physical structures and increase awareness of urban planning and

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architectural development processes. The evolution of trade, which plays a key role in shaping urban identity, has influenced various aspects of cities, from spatial organization and street layouts to building designs and architectural details. In this regard, khans and caravanserais have played a critical role in shaping urban identity, serving as commercial hubs and spaces for cultural, social, and economic interaction. Understanding the influence of trade on architecture provides valuable insights for developing sustainable urban planning approaches today. This study contributes to society by promoting awareness of architectural preservation and emphasizing the importance of transferring cultural heritage to future generations.

These structures provide deep insights into past socioeconomic conditions, trade expansion routes, and forms of social organization, thereby strengthening a sense of community. The connection with these buildings allows individuals to understand better how past commercial dynamics and economic activities continue to shape their lives today. This awareness fosters interest in historic preservation and supports efforts to protect, maintain, and repurpose heritage assets for future generations. By establishing a connection with monumental buildings, modern societies can recognize their cultural heritage, protect architectural assets, and appreciate the role of cultural values in sustainable urban development.

From the Seljuks to the Ottomans: Commercial Life in Anatolia

Trade has been of great importance since the first Turkish states. With the establishment of the Anatolian Seljuk state in the early 11th century, Turkish beyliks began to settle in Anatolia. The Seljuks' settlement in Anatolia resulted in the acquisition of coastal cities such as Antalya and Alanya (Alaiye), opening trade routes to the Mediterranean. While maintaining their influence in overland trade, the Seljuks also moved their capital to Konya, allowing them to spread Turkish architecture, which had emerged in Central Asia, to Anatolia. Transit trade taking place in regions like Konya, Sivas, and Sinop led to the involvement of Russian and Armenian merchants in trade. Similarly, the Seljuk state faced challenges in Mediterranean trade with Italy. Recognizing this, the Seljuk state increased security measures to protect trade (Tuncer, 2007). Caravanserais were built along trade routes to ensure safety on the roads. These caravanserais provided lodging for caravans while also serving social purposes with features such as mosques, hospitals, fountains, and baths. The spatial dimensions of the Seljuk period were related to the size of the cities. During the Seljuk period, cities were enclosed by walls, and stringent security measures were taken. Commercial life influenced both cities and roads throughout the trade process. As the Seljuk period came to an end and the transition to the Ottoman period began in the 14th century, there was a change in trade. Drought in Anatolian lands disrupted production and trade. During this period, small neighborhoods outside the cities began to form. Commercial stagnation led to

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architectural structures being simple, small in scale, and devoid of extravagance (Nikaein, 2019).

After the formation of the Ottoman Empire in the late 14th century, the nature of trade changed significantly. Sea trade began to replace overland trade, leading to the importance of port cities. Urbanization increased around port cities, and trade was conducted through these regions. The rapid population growth led to migration from castle cities to areas outside the fortifications, expanding the urbanization phenomenon. Urbanization in the Ottoman period, starting in the 16th century, was facilitated by complexes. These complexes, which included various social spaces, met the needs of new settlements. Commercial areas called 'bedestens' emerged, creating places for the trade of valuable goods. Khan structures, considered urban caravanserais, were placed around the bedestens (Faroqhi, 1993, p.13). In the 17th century, the Silk Road's change in direction further decreased overland trade, and the security gap in caravanserais along land routes increased. With the advancement of wheeled vehicle technology during the Industrial Revolution, road vehicles began to replace pack animals. This movement, which began in the 19th century, eliminated security concerns outside the city. Consequently, rural caravanserais gave way to urban khan structures.

Architectural Features of Caravanserais and Khans

Caravanserais and khans, strategically situated along major trade routes, were historically constructed to ensure continuity in commerce, security, and lodging (Cesaris et al., 2014). These edifices, exemplifying the unique features of Turkish-Islamic architecture, underwent notable architectural transformations over time to accommodate evolving economic, social, and security demands. This transition can be attributed to the intermediary period when trade shifted from mountainous areas to urban areas. While the terms "caravanserai" and "khan" are sometimes used interchangeably, caravanserais generally refer to lodging structures located outside cities along the road, whereas khans refer to lodging structures located within cities. These terms are used to describe structures that served as places for rest and accommodation for travelers and nomads, especially during periods when vehicles were not common means of transportation. The construction of caravanserais began during the late 12th century in the Seljuk period and continued until the Seljuks' decline. During the early Ottoman period, the construction of caravanserais declined, and the focus shifted more towards the construction of khans within cities. With the establishment of the Ottoman state, caravanserais transformed into city khans and distance khans. During this period, khans provided lodging and services for trade activities in bustling trade centers (Albak, 2007, p.106-107). Distance khans, also referred to as caravanserais, are defined as structures located on important trade routes, offering accommodation and stable facilities for caravans traveling along trade routes. In this context, caravanserais

provided lodging facilities for caravans traveling on trade routes. City khans, on the other hand, were in regions with active trade and were characterized by their courtyard and multi-story design. These khans were typically located in city centers and served as venues for both lodging and trade activities. Complex khans, referred to as külliye khans, housed various functions and were typically part of a larger külliye complex. These khans can be divided into two groups: those located within the city and those located outside the city. While city-based külliye khans were primarily used for educational and religious purposes, those located outside the city were trade-oriented (Keleş Usta, 1994, p.96). A detailed examination of khans and caravanserais from the early Turkish states to the Ottoman Empire, particularly in terms of plan typology and facade elements, reveals distinct transformations that reflect the era's shifting priorities. In the 13th century and earlier, caravanserais exhibited characteristics such as rectangular or square layouts, single-story structures, high protective walls, and defensive towers, aligning with the dense trade networks of the period. These fortified complexes, designed to safeguard goods and travelers, often featured a functional courtyard-centered plan with rooms oriented towards a shared courtyard, while stables were located within the same enclosure. During the Seljuk period, adobe and brick—locally sourced materials—were primarily used, thus embedding regional architectural characteristics into the structures (Turan, 1946, p.474-481). While the courtyard served as a place where animals were tethered, the rooms provided living spaces for travelers. (The painter Charles Thedore depicted daily life in a caravanserai courtyard in the 19th century (Figure. 2)).

Figure 2. Daily life in the courtyard of the Okale Caravanserai in Cairo by Charles Théodore Frère (1814- 1888)

Functional units in caravanserai and khan structures include Courtyard-Enclosed area (stable and hall)-rooms-entrance hall-eyvan (iwān)-rewak-Mosque-Shops-Depot-Kitchen-Hospital-Water Element-Security Room-Special spaces. These spaces are classified into unit types based on the form, size, location, roofing, and number of these spaces within the structure. The fundamental needs in caravanserai and khan structures are accommodation and resting places for packing animals. These two needs are met through the courtyard-room-stable elements. These structures were typically designed as fortified complexes with

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rooms around a courtyard. The courtyard served as a place to tether animals, while the rooms provided living spaces for travelers. Additionally, these caravanserais could also serve defensive purposes, as they were often used as isolated points in rural areas (Ahmad and Chase, 2004, p. 44-48). Caravanserai structures were first observed during the period of the earliest Muslim Turkish states, particularly during the rule of the Ghaznavids and the Karakhanids from the 9th century onwards. The distinct features of caravanserais and khan structures from the early Turkish state period included a single-story design with an ornate entrance portal, corner towers, a courtyard layout, a combination of iwan[1] (eyvan) and domes, and a square plan. The construction materials were typically adobe and brick. An early example is the Ribat al-Mahi, built during the Ghaznavid era in 1019-1020 by Mahmud of Ghazni. The spaces behind the courtyard were designed for lodging purposes (Aspanapa, 1990, p. 38-40). (Figure. 3). Another example is the Ribat al-Malik caravanserai, located between Samarkand and Bukhara during the Karakhanid period, built in 1079. The caravanserai was designed as a single-story structure using adobe and brick as construction materials. Today, only the entrance gate remains standing, but examination of the restitution plan reveals that the structure consisted of two main sections (Kuyulu, 1996, p.97-116). (Figure. 3).

[1]Iwan (eyvan): Generally, a space located in the middle of buildings, with three sides closed and opening onto an inner courtyard, covered with a vaulted ceiling.

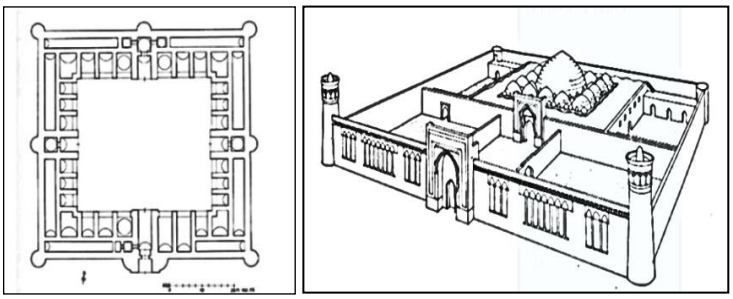

Figure 3. Ground floor plan of Ribat-i Mahi (Korn, 2020, p.12).
Figure 4. Ribat-i Melik Caravanserai (Un, 2012, p.4-12)

The Great Seljuk Empire ruled over Anatolian lands in the 11th century and beyond. When examining caravanserais and khan structures from the Great Seljuk period, it is observed that the courtyard element was preserved. Caravanserais of the era were designed with plain facades, high outer walls, and watchtowers (Turan, 1946, p.474-481). The dominant plan type featured a single-story, entrance portal, square-plan design around a courtyard, like those in the early Turkish states. Some examples featured a second courtyard and rewak[2]. The primary construction materials of the period were adobe and brick. The construction of these structures continued to decline until the Early Ottoman period. The caravanserais built during the Seljuk period were planned as centers to establish infrastructure for trade, part of an initiative. The transition period between the Seljuks and the early Ottoman period sheds light on their connection. By the 14th century, economic downturns and heightened security concerns prompted adjustments in caravanserai design, leading to the construction of smaller, enclosed structures without commercial stalls. As classified by

[2] Rewak (revak): The term for a space commonly found in Turkish Islamic architecture, supported by the building it's attached to, with an open front facade, covered roof, and supported by columns or piers, is known as a 'portico.

Güreşsever Cantay and Ayşıl Tükel Yavuz, closed-plan types emerged, categorized by single nave, double nave, triple nave, and equal-aisled configurations (Tükel Yavuz, 1991; Güreşsever Cantay, 2016). The inward-facing design provided a fortified refuge, addressing the need for heightened protection during a period of increased instability (Blessing and Goshgarian, 2017, p.58-62). The 15th century marked a significant period of transformation as the Ottoman Empire asserted dominance over Anatolia. While khans retained the traditional courtyard-centered layout, they incorporated commercial stalls along the street-facing side of the courtyard, reflecting the expansion of economic functions (Güran, 1978). This integration of trade into the architectural fabric added a dynamic layer to urban centers, enhancing social and economic interactivity. With the expansion of urbanization in the 16th century, Ottoman cities witnessed a strengthened market and bazaar culture, with khans positioned as central nodes of trade within city landscapes (Kuban, 2007; Akkuş, 2009). These khans, commonly situated within or adjacent to bustling market areas, became indispensable to the city's commercial life. The facade design was characterized by minimal ornamentation, reflecting the practical requirements of daily trade. Concurrently, the divergence of lodging and commercial functions led to the relocation of stables to less prominent areas at the back of the khan or to larger adjoining spaces.

In the 17th century, the architecture of khans evolved to cater primarily to urban commerce. These buildings adopted a design emphasizing retail over lodging, reshaping both their internal spatial organization and external presentation. The addition of multiple stories (often two or three) provided enhanced access to natural light through large windows, facilitating a design that supported greater social and commercial interaction (Güreşsever Cantay, 2016). By the 18th century, ornamentation assumed greater significance, particularly in independently constructed khans, where richly decorated portals and intricate facade details conveyed the aesthetic ideals of the Ottoman Empire. This emphasis on embellishment underscored a period of architectural refinement, transforming khans from mere functional spaces into cultural landmarks. The 19th and 20th centuries saw the emergence of taller, three-story khans as the Ottoman Empire neared its twilight. These khans, with their ornate portals, intricate facade elements, and extensive fenestration, aimed to create spacious, light-filled interiors. Influenced by the Empire's modernization efforts and Western architectural styles, these later khans shifted away from the classical Ottoman approach to blend harmoniously with the evolving urban fabric (Yaşar, 2023, p.539-550). (Table-1).

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Table-1. Development of Khan and Caravanserai Structures in Turkish States (References: Ilter, Ismet. (1969). Turkish Caravanserais. Republic of Turkey General Directorate of Highway, Ankara, 1969., Erdmann. (2008). "Kargi khan near Alanya," p. 254. Koroglu; (2021). "Caravanserai in Western Anatolia and Their Place and Importance in Anatolian Trade Life (1071-1308)" (Author's archive), 2022, 2023)

Period	Gazne period	Karakhanid period	Seljuk Period 13th		Ottoman Period of the 16th Century	Ottoman Period of the 17th Century	Ottoman Period of the 188th	Ottoman Period of the 19th Century	Ottoman Period of the 20th Century
Courtyard Number	Single	Single	Single	Single or no courtyard	Single or no courtyard	Single or Multi	Single or Multi	Single or Multi	Single or Multi
Floor Plan Type	Spherical Form, Corner Towered	Spherical Form, Corner Towered	Spherical Form	Spherical Form	Spherical Form	Spherical Form	compatible with the parcel	compatible with the parcel	compatible with the parcel
Number Of Floors	Single	Single	Single	Single	2	1	1	2 +	2 +
Basement	no	no	no	no	Partly	Partly	Partly	Existent	Existent
Decoration	Existent	Existent	No	No	Existent	Existent	Existent	Existent	Existent
Portal Door	Existent	Existent	No	No	Existent	Existent	Existent	Partly	Partly
Rewak	No	No	No	No	Existent	Existent	Existent	Partly	Partly
Material	Adobe-Brick	Adobe-Brick-Stone	Brick-Stone	Brick-Stone	Brick-Stone	Brick-Stone	Brick-Stone	Brick-Stone	Brick-Stone
Sample Plan Type									
Name of build	Ribatı Mahi (Şeras)	Ribatı Melik (Semerkand)	Sultan Khan (Konya)	Sincik Taşkale Khan	Delilller Caravanserai	Sülüklü Khan (Diyarbakir)	Mecidiye Khan	Büdeyhi Khan (Gaziantep)	Bican Ağa Khan

The Caravanserais and Khan Structures of Southeastern Anatolia Region

The Southeastern Anatolia Region (SEAR) represents the region between the Taurus Mountains in Anatolia and the southern border with Syria. With a total area of 57,000 square kilometers, it is the smallest geographical region in Turkey (Karadoğan and Ozgen, 2006, p.15). The region encompasses a total of 9 provinces, including Adıyaman, Diyarbakir, Batman, Mardin, Sanliurfa, Gaziantep, Kilis, Siirt, and Sirnak. In terms of land area, Sanliurfa is the largest province in the region, while Kilis is the smallest (Figure. 5).

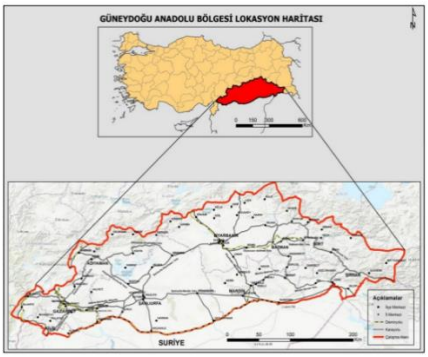

Figure 5. The location of the Southeastern Anatolia Region in Turkey (Ogel and Avci, 2022, p.12-14).

The Southeastern Anatolia Region shares its borders with Syria and Iraq. In terms of climate, it is the region with the highest temperatures in the country. The region experiences a continental climate, although in some microregions, a Mediterranean climate can also be observed (Kuşçu, 2000, p. 10-18). The primary livelihood in this region, located in the Mesopotamian lands, is agriculture. Historical records also indicate that sericulture, the cultivation of silkworms, was carried out intensively in the region. Due to favorable climate conditions in the vicinity, Diyarbakir province became a significant center for sericulture in Anatolia. With increased production during the Ottoman period, silk trade gained momentum, and the Silk Road's importance in the region grew (Başkaya, 2016, p. 43-67). The caravan routes connected Anatolia from east to west and from north to south, linking trade centers both within and outside the borders of the Anatolian Seljuk state. In the 13th century, the main trade centers were Tabriz in Iran, Baghdad in Iraq, and Aleppo in Syria, primarily accessed by transit through the Southeastern Anatolia region (Tükel Yavuz, 1997, p.80-95). (Figure. 6).

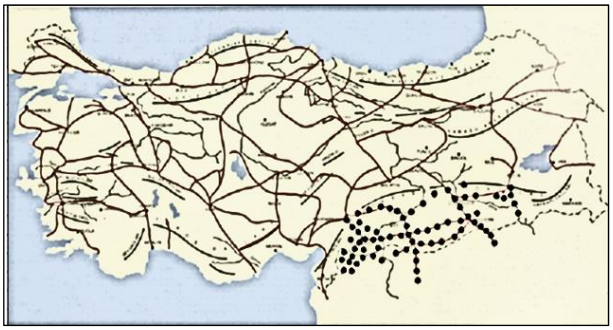

Figure 6. The density of caravanserais and khans in the Southeast Anatolian region during the Ottoman period (based on the map by Bektas, 1999) (Tükel Yavuz, 1997, p.80-95).

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When examining caravanserais and khan structures in the Southeastern Anatolia region, a total of 61[3] structures have been identified. It was observed that there are 4 structures dating back to the pre-Ottoman period until the 13th century, 12 of the remaining structures could not be dated, and a total of 42 structures belong to the Ottoman period (Table. 2) (Figure 7).

Table 2. Table of Khan and Caravanserai Structures Identified in Southeast Anatolia Region According to Periods (Author's Archive).

Period	Century	Diyarbakir	Gaziantep	Sanliurfa	Batman	Mardin	Sirnak	Kilis	Adiyaman	Total
Seljuk period	13th			1		1			2	4
Early ottoman period	14th	2								2
	15th		1							1
Ottoman period	16th	4	4	1						9
	17th	2		1						3
	18th		5	5		1				11
	19th		9	3			1	1	1	15
	20th		1	2		1				4
Unknown Historical Information		3		4	2	3				12

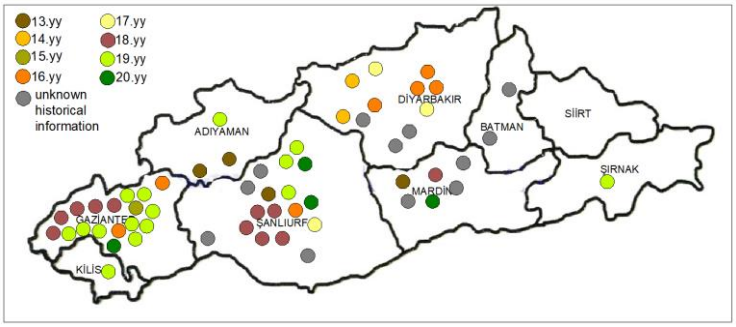


Figure 7. The historical density of caravanserais and hans in the Southeast Anatolia region

When examined according to the characteristics of their respective periods, these structures are categorized as Seljuk period (13th century), Early Ottoman period (14-15th century), and Ottoman period (16th century and beyond) caravanserais/khan structures. The transition from the Seljuk period to the early Ottoman period, represented by the dating of the 14-15th centuries, is also reflected in the architectural design of lodging structures. When examining the 14th and 15th-century structures found in the Southeast Anatolia region, a notable example is the no courtyard plan type. Eight structures were selected as examples from 61 buildings as part of the study. Structures with unknown construction dates were excluded from the study. Among the four structures from the Seljuk period, Damlacık Khan and Taşkale Khan were

[3] The structures included in the study cover various cities in Southeastern Anatolia. These include Kalaycılar Caravanserai (19th c.) in Kilis, Kavuncu Caravanserai (19th c.) in Şırnak, Eymir Caravanserai (unknown) and Vazde Caravanserai (unknown) in Batman. In Adıyaman, examples include Taşkale Caravanserai (13th c.), Damlacık Caravanserai (13th c.), and Tuz Khan (19th c.). In Mardin, notable structures are Artuklu Caravanserai (13th c.), Sirur Khan (18th c.), Gelüşke Khan (20th c.), Merkez Khan (unknown), Hayvan Khan (unknown), and Estel Khan (unknown). Diyarbakır features Gevran Han (14th c.), Karakaya Khan (14th c.), Şerbetin Khan (16th c.), Hasanpaşa Khan (16th c.), Deliller Caravanserai (16th c.), Çifte Khan (16th c.), Çeper Khan (17th c.), Sülüklü Khan (17th c.), Konak Khan (unknown), Pirinçlik Khan (unknown), and Güzelşeyh Khan (unknown). In Şanlıurfa, examples include El-Barur Khan (13th c.), Gümrük Khan (16th c.), Samsat Kapısı Khan (17th c.), Mençek Khan (18th c.), Şaban Han (18th c.), Barutçu Khan (18th c.), Millet Han (18th c.), Gümrük Han in Siverek (18th c.), Ilgar Caravanserai (19th c.), Buğday Pazarı Khan (19th c.), Hacı Kâmil Khan (19th c.), Topçu Khan (20th c.), Cudi Paşa Khan in Siverek (20th c.), Çarmelik Caravanserai (unknown), Kantarma Khan (unknown), Kap Han (unknown), and Titriş Caravanserai (unknown). Lastly, in Gaziantep, examples include Emir Ali Khan (15th c.), Yeni Khan (16th c.), Sam Khan (16th c.), Lala Mustafa Paşa Khan (16th c.), Tuz Han (16th c.), Mecidiye Han (18th c.), Pürsefa Khan (18th c.), Yüzükçü Khan (18th c.), Yemiş Khan (18th c.), Tütün Khan (18th c.), Millet Khan (19th c.), Şeker Khan (19th c.), Kumru Khan (19th c.), Anadolu Khan (19th c.), Gümrük Khan (19th c.), Güven Khan (19th c.), Belediye Khan (19th c.), Kürkçü Khan (19th c.), Büdeyri Khan (19th c.), and Bayaz Khan (20th c.).

excluded due to their ruined condition. Artuklu Caravanserai was omitted as it currently contains numerous additions. Therefore, only Khan el-Barur was included in the study for the Seljuk period.

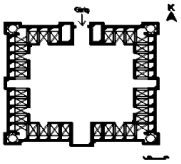
Additionally, two structures from the 14th century, representing the Early Ottoman period, were included. For the Ottoman period, structures within city centers that had undergone minimal plan changes and lacked significant additions were chosen. Efforts were made to select structures that retained their original plans.

Deliller Caravanserai was included among the selected structures due to its separately designed stable section and its central location in Diyarbakir. Sülüklü Khan, despite being a 17th-century structure, was chosen for its single-story design. Care was also taken to select one structure from the center of each city. For this purpose, Gelüşke Khan in Mardin city center was chosen as an example of 20th-century architecture. Similarly, Millet Khan and Barutçu Khan, located in the city centers of Gaziantep and Sanliurfa, respectively, were included as examples from the 18th and 19th centuries, as they have retained their architectural integrity.

Seljuk Period (Seljuk Era)

Among the caravanserai and khan structures identified in the Southeast Anatolia region, four of them belong to the Seljuk period. One of these four structures has been selected for the study. When examining the plan and façade features of khan El Barur caravanserai located in Harran, Sanliurfa, dating back to the 13th century, it is observed that some of the era's characteristics are reflected in its design. Notably, the corner defense towers, designed for defensive purposes, are incorporated into the structure's plan. High walls were constructed for security reasons. The courtyard-type structure adheres to the era's characteristics, being a regular square-shaped design. The structure is single-story, featuring a entrance portal entrance on the front façade. The façade surface is plain, with minimal window openings. This lack of windows is considered a reflection of the security concerns prevalent during that period (Table.3).

Table 3. Pre-Ottoman Period Caravanserai Examples in Southeastern Anatolia Region - Sanliurfa Khan el Barur (Guler, M, (2021) (reorganized by the author) (Güler, 2021, p.276).

Building Name/Location	Building Plan	Building Facade	century	Period Features
Khan El Barur Caravanserai Sanliurfa /Harran/ Goktas Village			13th	Courtyard plan type Corner towered Regular rectangular courtyard type Entrance portal Single-story Simple facade type

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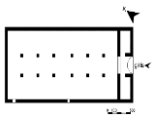
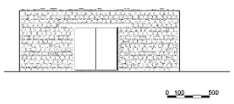
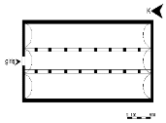
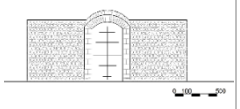
Early Ottoman Period

When we examine the caravanserais and khan structures built in the 14th century, considered as the transition from the Seljuk period to the Ottoman period, it is evident that closed-plan, small-volume, plain, unpretentious plan types were constructed due to the increase in security vulnerabilities. One of the structures, Gevran khan, is in the village outpost of Ergani district in Diyarbakir. The building has a regular rectangular shape with a closed-plan type. It measures approximately 35x15 in size and consists of three sections. The sections are divided into seven parts by square stone pilasters supporting columns. The arches facilitating passage are pointed arches, and the roof is covered with a barrel vault. The entrance gate is simple and unadorned. The khan structure is currently used as a warehouse. Another example from the 14th century is the Karakaya khan, located in the village of Karakaya in the Cermik district of Diyarbakir. The distance between these two structures is approximately 40 km. Karakaya khan is an example of reconstruction. The khan has a north-south oriented rectangular plan. It consists of three sections, and the sections are divided into nine parts with columns supported by square stone pilasters. Passage is provided through pointed arches, and the roof is covered with a barrel vault. The entrance gate is plain and unpretentious. When examining the period characteristics of these structures, it is observed that the traces of the Seljuk era gradually disappeared in the architecture of caravanserais and khans during the 14th century, which marked the transition from the Seljuk to the Ottoman era (Table. 4).

Table 4. (Author Archive for drawings, 2022-2023)

Building Name/Location	Building Plan	Building Facade	century	Period Features
Gevran khan Diyarbakir/ Ergani/Gevran Village			14th	No courtyard plan type Regular rectangular courtyard type With nave plan type Simple façade type Single-story
Karakaya khan Diyarbakir/ Cermik/ Karakaya Village				

Ottoman Era

When we look at the 15th century, it is evident that the increase in secure trade practices began to reflect in the building plans as city trade started to thrive. The buildings were now significantly different from the Seljuk era characteristics. There was a noticeable reduction in the size of the structures, and shop openings appeared on the façade. The presence of shops was parallel to the development of urban trade. In the scope of this study, the selected structure from the 15th century is the Emir Ali

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khan, located in the central district of Gaziantep. When examining the plan of the khan, it is again observed that it has a regular rectangular shape and an enclosed courtyard of the same form. Entry to the khan is through a pointed arched entrance gate located on the front facade. Symmetrically positioned shops are on the right and left sides of the entrance gate. The entrance gate is plain and unadorned. It opens into the entrance eyvan. The roof is covered with a barrel vault. In the 16th century structures in the Southeastern Anatolia region, the Deliller caravanserai, located in the Sur district of Diyarbakir, is selected as an example. When looking at the plan features of the Deliller caravanserai, it is seen that the plan layout was shaped according to the period's trade relations, and the distinction between urban trade and stable space is reflected in the plan. Shop openings are present on the façade. The two-story plan type with numerous window openings began to replace the one-story high castle-walled plan type with heavy security measures of the Seljuk period. It can be said that the regular plan type from the Seljuk era continued to exist. However, examples of the plan type that shaped according to the shape of the plot on which it was located, which is a characteristic of the Ottoman period, began to emerge during this period. Within the scope of the study, among 61 structures identified in the Southeastern Anatolia Region, examples from the 17th century and beyond were selected. For the 17th century, there is the Sülüklü khan, located in the Sur district of Diyarbakir. The entrance facade is plain and unadorned due to the khan's location, opening to the street within the bazaar. The khan is built in the courtyard plan type with a rewak system. The irregular rectangular courtyard plan reflects the shape of the parcel. For the 18th century, there is the Barutçu khan, located in the central district of Sanliurfa. It is partially three stories high and has a courtyard plan type. It has a grand facade and an entrance portal, reflecting the characteristics of the period. These structures, which served as business centers, were primarily focused on trade. They include numerous interior and exterior shops, as well as accommodation areas on the upper floors. For the 19th century, there is the Millet khan, located in the central district of Gaziantep. Millet khan has a courtyard plan type, an irregular rectangular plan, two stories, rewaks, and a entrance portal. Space openings for shops are present on the facade. For the 20th century, there is the Gelüşke khan, located in Midyat, Mardin. The structure has a courtyard plan type, an irregular rectangular plan, two stories, and rewaks. The entrance gate is a grand entrance portal, and the façade is highly ornamented, with numerous window openings and built with cut stones (Table. 5).

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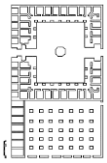
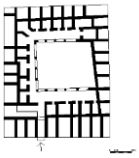
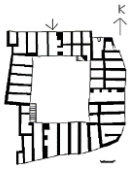
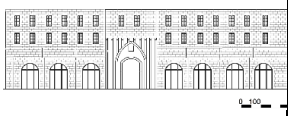
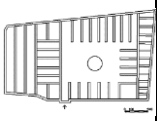
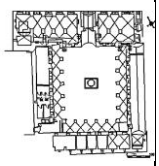
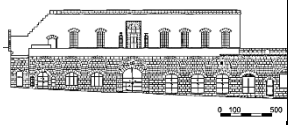
Table 5. (Sources: Plan drawings; Geluşke khan from Sakir Guler Archive, other structures from Author's archive, 2022-2023) Güler, 2018).

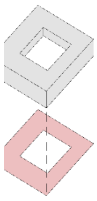
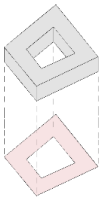
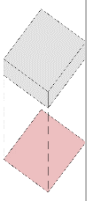
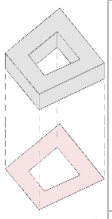
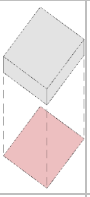
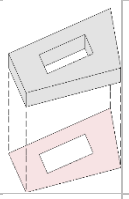
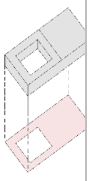
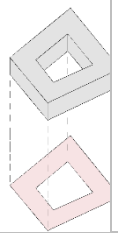
Building Name/Location	Building Plan	Building Facade	Century	Period Features
Deliller caravanserai Diyarbakir/ Sur			16th	Courtyard Plan Type Rectangular Courtyard Plan Two-Story Rewak Entrance portals Ground Floor Stables Presence of Shops on the Facade
Suluklu khan Diyarbakir/ Sur			17th	Courtyard Plan Type Irregular Courtyard Plan Single-Story With Rewak Presence of Shops on the Facade
Barutcu khan Sanliurfa			18th	Courtyard Plan Type Irregular Quadrilateral Courtyard Plan Two-Story Arcaded Entrance portal Presence of Shops on the Facade
Millet khan Gaziantep			19th	Courtyard Plan Type Irregular Quadrilateral Courtyard Plan Two-Story Arcaded Entrance portal Presence of Shops on the Facade
Geluske khan Mardin/ Midyat			20th	Courtyard Plan Type Irregular Quadrilateral Courtyard Plan Two-Story Arcaded Entrance portal Presence of Shops on the Facade

ASSESSMENT

When trade routes passing through Anatolia were the focus, various political events, economic changes, and military movements from the Eastern Roman Empire to the Seljuk era negatively affected trade. During the Seljuk era, a series of measures were taken to revive these trade routes. One of these measures was the construction of lodging and defense structures such as caravanserais and khans to ensure the safety of the routes. This policy followed during the Seljuk period continued into the Ottoman period. Indeed, with the urbanization movements that occurred during the Ottoman period, the nature of trade also changed. In this study, the physical impact of this change on caravanserais and khans is discussed. Among the 61 structures identified in the Southeastern Anatolia Region, one sample structure was selected for each period, and it was observed that these structures gradually shifted from being built outside the city in the Seljuk period to being built inside the city over time. This change can be attributed to the increase in urban trade and the

elimination of security issues related to the transportation of commercial goods (Table. 6).

Table 6. Parcel status of the selected structures in the field study

Century	Name of structure	Parcel shape	Location of the building	Century	Name of structure	Parcel shape	Location of the building
13.th	khan el barur			17.th	Sülüklü khan		
14.th	Gevran khan			18.th	Barutçu khan		
	Karakaya khan			19.th	Millet khan		
16.th	Deliller caravanserai			20th	Gelişke khan		

Limitations in urban space, parcel shape, parcel size, and the presence of shops, among other criteria, had an impact on the plan type of khans. When examining the khans and caravanserais in the Southeastern Anatolia region, it is observed that (13th century and earlier) in the selected example (Khan El Barur), caravanserais with an enclosed rectangular plan type, one-story high with protective walls and defensive towers were built. However, in the early Ottoman period, also known as the transitional period (14th century) (Gevran Khan and Karakaya Khan), due to economic crises and security vulnerabilities, smaller-volume structures with enclosed courtyards and no shops were constructed. These sahn structures can be built as one-story, attached to the sahn, and can show different plan types. In the period after the 15th century, when the Ottoman Empire fully established its dominance, a change in the plan type of caravanserais and khans is observed. Although the courtyard plan type is still present, the arrangement of spaces around the courtyard continues, and shops open to the street are present behind the spaces. In the 16th century, (Deliller Caravanserai) with the increase in urban trade,

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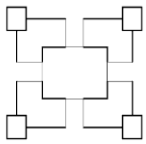
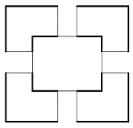
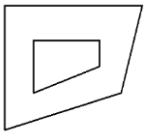
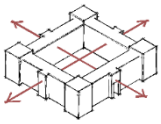
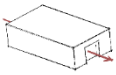
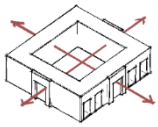
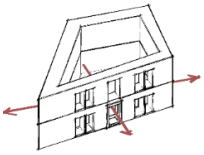
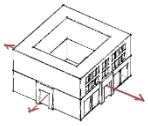
the concept of the bazaar-marketplace emerged, and khans and caravanserais located within the bazaar became prominent. This situation led to simplicity in the facade design of structures located within the bazaar. Furthermore, the shift in focus from lodging to daily shopping, a characteristic of the period's commercial activities, is reflected in the plan type, with the separation of stable spaces. When looking at the period from the 17th century (Sülüklü Khan) onwards, it is seen that the structures now primarily serve urban trade, with an emphasis on shopping rather than lodging. In this context, khan structures take precedence over caravanserais. In the 17th-century structures, the number of stories increased, and there were numerous window openings in the facade.

In the examination of 18th-century khan and caravanserai in the study area (Barutçu Khan), it is seen that independently constructed structures had grand facades and entrance portal. Due to the construction of the structures within the city and the small parcel sizes, the structures deviated from regular rectangular forms and adapted to the shape of the parcel. Also, khans constructed within the logic of the bazaar-marketplace served as business centers during this period, prioritizing trade over lodging. Numerous interior and exterior shops are present on the facades of the structures. There are accommodation areas on the upper floors.

When examining the 19 th (Millet Khan) and 20th (Gelüske Khan) centuries, it is seen that these periods are a continuation of the 18th century. Khans with three stories, including the ground floor, can be found. The entrance facades of the structures have entrance portal, ornate facade elements, and many window openings. There are numerous shops on the ground floor facades of the structures. This situation indicates a significant increase in urban trade. Furthermore, the increase in window openings on the facades suggests the elimination of security issues (Table 7).

Table 7. Plan and Facade Changes in Caravanserais and Khans in the Southeastern Anatolia Region

13.th and early	14.th	15-17. th	17.th and then
			
			
			

CONCLUSION

Over time, the khan and caravanserai structures built to meet the lodging needs on trade routes have transformed into bustling trade centers. One of the significant factors contributing to this transformation is commerce itself. As trade began, these structures, originally designed for lodging, underwent physical changes as commerce evolved. The changes in accommodation structures over time provide insights into how trade progressed.

This study discusses how the historical buildings were affected by the commercial, politics and social changes that occurred in various periods. In conclusion, in the study conducted on khan and caravanserai structures located in the Southeastern Anatolia Region, when the current drawings of the examined structures are compared, differences in dimensions in both plan and facade, open-closed space relationships, newly added architectural elements, or removed elements have been identified (Table. 8).

• In the 13th century, functional additions related to security issues were observed. Since these structures served both accommodation and military defense purposes, observation and defense towers were included in the building plans. The presence of high castle walls in the structures can also be related to the environmental factors affecting rural trade activities of the period (Table. 8- No 1).

• In the 14th century, it is observed that due to the decrease in trade speed and the increasing security problems in the transportation of commercial goods, small volume khan and caravanserai structures with closed plan types were constructed. The shrinking of plans and the transition to courtyard-less plan types indicate the absence of the semi-open space element of the revak. Unlike other periods, in the 14th century, simple and small entrance doors are observed instead of grandiose entrance gates (Table. 8- No 2,3).

•Khan and caravanserai structures designed for caravans traveling on trade routes were in the caravanserai during the 13th century. Until the Ottoman Empire, this trade operated in this way, but it continued within the city from now on. With the transition to the Ottoman State, the situation changed, and the plan shape emerged according to the shape of the parcel. The reduction of parcel area, the increase in urban population, and the increase in trade led to an increase in the number of stories in buildings (Table. 8- No 4,5,10).

• In khan and caravanserai structures with courtyard plan types, the courtyard was used for the resting of pack animals carried by caravans. In the period when trade took place in the city due to the lack of security issues, the courtyard served as a safe inner street in closed structures. In the 14th century, when the plan type became smaller, the courtyard disappeared. It is determined that this situation is due to the decrease in trade and the security problems experienced during the transportation of commercial goods. In the later periods, with the change in state policy and the increase in trade security and commercial relations, the

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courtyard regained its place in the plans from the 15th century onwards. Due to the decrease in the need for lodging with the acceleration of trade in the Ottoman State and the increase in urban trade, a separate stable unit was formed for animals. This unit was solved on both the ground floor and the basement (Table. 8- No 6,7).

• The increase in the circulation of commercial life within the city turned khan and caravanserai structures into business centers rather than lodging facilities. With the acceleration of trade, the importance of daily shopping has increased. This situation necessitated the addition of shops to the facades. From the 16th century onwards, the presence of shops is observed in buildings (Table. 8- No 9).

• Until the 15th century and earlier, it is observed that minimal openings were made in the building facades. However, this situation disappeared with the transformation of commerce. The increase in urban trade and the elimination of security problems resulted in an increase in window openings in building facades (Table. 8- No 11).

Table 8. Periodic Architectural Element Analysis Table of Khan and Caravanserai Structures in the Southeastern Anatolia Region

No	Period-specific Features	13th	14th	15th	16th	17th	18th	19th	20th
1	Defense Towers	√							
2	Entrance Portal	√		√	√	√	√	√	√
3	Rewak	√		√	√	√	√	√	√
4	Rectangular Plan	√	√	√	√				
5	Harmonious Parcel Plan				√	√	√	√	√
6	Courtyard	√		√	√	√	√	√	√
7	Independent Stable Structure					√	√	√	√
8	Decorative Facade Elements						√	√	√
9	Shop Space				√	√	√	√	√
10	Number of Floors			√	√	√	√	√	√
11	Window Opening			√	√	√	√	√	√

By examining the environmental, cultural, and social factors that have influenced cultural heritage structures, architectural insights into past situations can be gained. In this study conducted in the southeastern Anatolia region, where trade routes are located, the impact of khan and caravanserai structures on architectural terms due to the period's trade relations has been analyzed. Determining the changes that monumental buildings have undergone until the present day will strengthen the cultural connection between the past and the future. This study conducted in the Southeastern Anatolia region is important for future research in different regions, as it aims to identify the factors that have

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influenced the formation processes of khan and caravanserai structures, which are cultural heritage structures in the historical process. Future research may wish to explore the role of trade in shaping the identity of structures and their contributions to interregional relations, as well as examining intangible cultural heritage potentials worthy of preservation and further scholarly investigation.

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Resume

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The Role of Place Experience and Satisfaction in Revisit Intention at Trabzon's Avni Aker Millet Bahçesi

Doruk Görkem Özkan *
Regaip Yılmaz **

Abstract

Urban open spaces create experience spaces for users with the physical and social features they offer. "Millet Bahçesi" is one of the places designed and implemented in recent years within the scope of open spaces. This research aims to investigate the effects of the environmental features of the Millet Bahçesi on place experience and place satisfaction, as well as revisit intention within the scope of open spaces. In this context, the environmental characteristics of "Trabzon Avni Aker Millet Bahçesi" were evaluated by post-use evaluation method with 211 users. Scales were applied to measure the effects of environmental features on place satisfaction and revisit Intention The research conducted correlation and regression analyses between socio-demographic characteristics, space use characteristics, environmental characteristics, place satisfaction and revisit intention. As a result of the study, when we examined the factors affecting the revisit intention, it was seen that only the factors "place satisfaction, sociability, uses and activities, revisit Intention" were included in the model. In this research, aims to focus only on the environmental characteristics of open spaces. In this regard, the newly implemented Millet Bahçesi, where the users have no previous experience, was chosen as the study area. Evaluations can also be made in open spaces where users have past experiences. It is very important to determine the factors that affect the sense of satisfaction as a result of the place experience in urban open spaces that play an important role in the city center, such as Trabzon Avni Aker National Garden. The importance of spatial designs and socialization opportunities that offer diversity in terms of uses and activity in particular on the sense of satisfaction is explained. Additionally, comparisons can be made by examining more than one Millet Bahçesi. These are among the limitations of the research. The results of this study, which focuses on urban open space environmental characteristics, are significant for city managers, designers and users. In particular, the factors affecting the revisit intention will contribute to the design process of newly designed open spaces.

Keywords: *Place experience, Place satisfaction, Public gardens, Revisit intention.*

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INTRODUCTION

Studies addressing human-environment relations within the scope of urban open spaces have become even more critical today. Especially in the last 20 years, cities' physical and social transformations have accelerated. In addition, the differentiation of human needs and requirements clarifies the necessity of evaluating human-environment relations in urban open spaces. The environment limited to meet people's needs and requirements and creating experiences is called urban spaces within the city. According to Canter (1983), a place's experience consists of physical and social elements. In order to meet people's needs, urban open spaces come to the fore in line with the physical and social features offered by the environment. Urban open spaces are essential places where users living in that area can make their free time more quality and productive with recreational activities, relieve the users from the stress and fatigue of the city and living in the city, and have many social gains that relax them physically and mentally (Birol & Aydın, 2019).

As a result of the rapid increase in industrialization and urbanization since the Industrial Revolution, the importance of green areas and recreation needs in cities is increasing. In particular, the decrease in urban open spaces in the 21st century has caused the opportunities offered by these areas to users to become more prominent. Gür (1996) states that the space, also known as the volumes where users carry out their activities in line with their different wishes and needs, are typical living and usage areas with different qualities in the city (Özkan, 2011). According to Madanipour (1999), brings various parts of the city closer together, integrates people, creates experience and develops a sense of community (Mumcu, 2009).

Space and place are different concepts. While Tuan (1977) defines space as a region with defined borders, he also defines particular areas within this region where needs and requirements are met as places (Özkan, 2017). When a meaning is attributed to the place, the place turns into a place. It is crucial to experience the place in order to establish feelings, meaning and belonging to the place. People evaluate and attribute meaning to the physical environments they experience. A clear phenomenological understanding of places isaccessible to users through bodily experiences (Eldardiry & Konbr, 2022 ; Tolegen et al.2023). If they have a good experience with the places' physical and social features, they tend to revisit them. In this regard, it is necessary to answer the following questions:

- How do the physical and social features offered by the place relate to the place experience?
- What is the impact of place experience on revisit propensity?

In order to find answers to these questions, first the human-environment relationship and the process of transforming space into place must be understood. Then, the impact of the relationship between user needs and requirements the physical and social characteristics of the place on the place experience, and the consequences of these interactions

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on revisit intention should be examined. People orientate themselves and use and experience urban open spaces that align with the physical and social features they offer. As a result of these experiences, they form their future behavioral intentions. For this reason, this study will investigate the effects of the physical and social features offered by the Trabzon Avni Aker Nation Garden on the revisit intention by focusing on the relationship between the place experience and the physical and social features offered by the Trabzon Avni Aker Millet Bahçesi within the scope of urban open space. In this direction, the theoretical framework of the study was created.

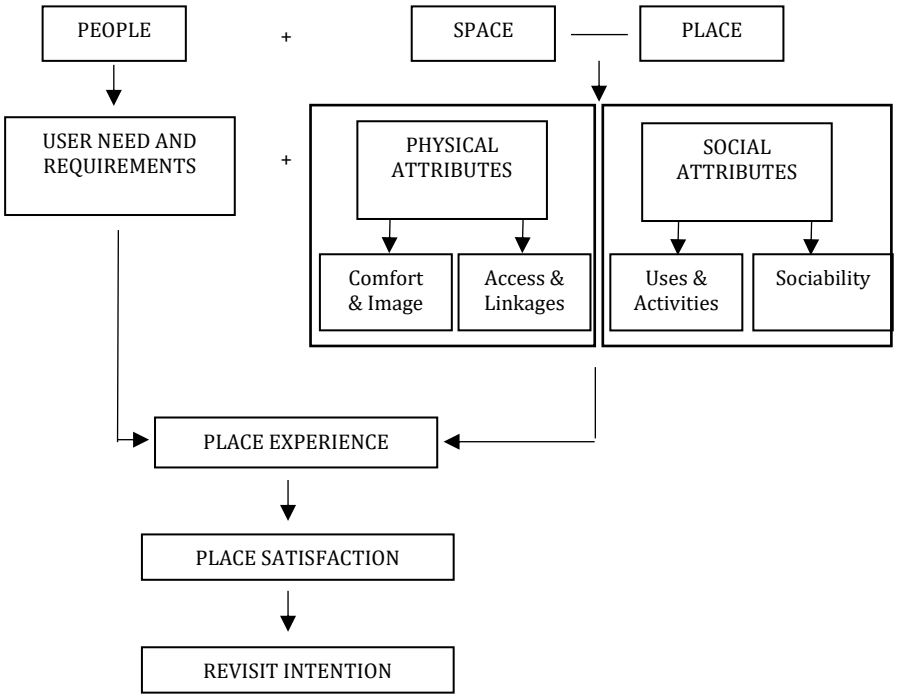

Figure 1. Theoretical framework of the research

LITERATURE REVIEW

Space is a concept that we encounter in many branches of art and science. Throughout history, answers to questions about "what" and "where" the concept of space is have been sought in different disciplines. Many disciplines such as philosophers, sociologists, architects, historians, psychologists and designers have influenced each other with the different definitions of space they put forward, and different ideas and definitions have been obtained by questioning the concept of space according to their own disciplines. However, until the 1960s, research on the interaction between humans and the environment and how people perceive the environment was conducted with an emphasis on humans, the natural world, and how humans learn about, encode, and interact with their environment (Göregenli, 2010; Solak, 2017).

Gür (1996) defined the concept of space as "a space where people, human relations and the equipment required by these relations are located, and whose boundaries are determined according to the structural character of the organization it covers." People and the

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environment constantly interact, and as a result of this interaction, spaces are formed that limit and separate people from the environment to a certain extent. Although many factors that make up the environment, the main subject of the place is people. The spaces created due to people's needs and requirements are designed to be viewed from the outside and lived in and experienced. In other words, what shapes space is people's spatial experience over time. That is why urban spaces are of great importance for users today. People's relationships with space are primarily affected by the physical and social characteristics of the place. To the extent that the design of urban spaces responds to the user's needs and requirements, they become successful urban spaces if the user experiences the created space and is satisfied.

The most important fact distinguishing the concept of place from the concept of space is that it is based on subjectivity and experience (Replh, 1976). Relph (1976) associated the concept of place with our knowledge based on practice and action. Each user gains a unique experience in the environment he lives in. In other words, places turn into places from various layers of life and experience in that place (Özkan, 2017).

Depending on this experience, they shape their behaviour and life centres (Asiliskender, 2004). Canter (1977) argues that when looking at a place as an environmental or architectural object, it should be viewed not only as an abstract concept or a separate context, but also as use and experience (Özkan, 2017). Canter states that the experience of a place is a combination of two components: social and physical (Canter, 1983). As a result, activities within the space are shaped and transformed into a place as a result of how individuals define and evaluate an environment (Canter, 1977).

While needs mediate the psychological foundations of experience, the need itself is a result of the desire to have the experience (Ryan and Deci, 2000). Things people acquire throughout their daily lives are kept in memory and then applied, known as experiences. Events from daily life, good or bad, serve as a guide for future decisions. Place is a space component with meaning and value that people use and experience (Özkan&Yılmaz 2019; Alpak et al. 2018). The most important thing that connects people to a place is their experiences because each person gains unique experiences where he lives or where he is and shapes his behavior as a result.

The physical and social features that the space offers to the user are important factors in the user's experience of the space and the formation of his/her feelings about the space. Due to the space's abstract and concrete characteristics, users can meet the needs and requirements, enabling them; to establish a relationship with the place, create place satisfaction, and create a revisit intention. Satisfying the users with the physical organizations offered by the space has an important role in transforming the space into a place.

Gehl (2020) expressed the concept of urban open space, which he described as "life among buildings", as very different activities that

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people engage in while using the shared urban space. Examples include walking from one place to another for a purpose, excursions, short stops, long stays, looking at store windows, conversations and meetings, exercise, dancing, recreation, street trading, children's games, resting, and street performances. To summarize, urban open spaces integrate users and, when well designed, serve as the stage for our public lives (PPS, 2008). In evaluating thousands of public spaces around the world, the Project for Public Spaces (PPS) stated that in order to be successful, these spaces generally share the following four characteristics: They must be accessible for people to engage in activities, the place must be comfortable and have a good image, and finally, it must be a social space where people meet each other. It is a place.

In studies on the success levels of urban open spaces, the first thing to consider is evaluating the space by its users (human-space interaction). In people-place interaction, the degree to which the physical and social features offered by the place meet the user needs and requirements determines the success level of the place as a result of the space experience (Kyle, 2004a, 2004b; Stedman, 2002; 2003; Özkan & Yılmaz 2019; Özkan & Akyol, 2021). Research in the literature has stated that a feeling of satisfaction occurs in urban open spaces where user needs and requirements are met and users increase their Intention to reuse this space (Tema, 2012; Quadri & Fiore, 2013; Ramkissoon, 2014; Hwang & Lyu, 2015; Lee et al. 2020). Revisiting intention is crucial, especially in tourism-oriented studies (Bintarti & Kurniawan, 2017). However, evaluations within the scope of urban design projects are limited. This research aimed to investigate the effects of the physical and social features offered by public gardens within the scope of urban open spaces on the revisit intention. In this context, focusing on revisiting intention and its indicators is necessary.

Revisit Intention in Millet Bahçesi as an Urban Open Space

The concept of Millet Bahçesi is designed and implemented under the umbrella of the Ministry of Environment, Urbanization and Climate Change of the Republic of Turkey. According to Article 4 of the Planned Areas Zoning Regulation, "Millet Bahçesi in general terms; It is defined as "large green areas that bring people together with nature, meet their recreational needs, and can be used as city gathering areas in case of disaster." Public gardens offer activities to city residents, enable them to be in touch with nature, and can be used as gathering areas in emergencies situations when necessary. Public gardens are areas that preserve natural elements from the past and reflect cultural heritage, reflect the social and cultural structure of the country and its history, develop the country's vision for its future and make significant contributions (Sağlık et al., 2019).

One of the most important success parameters of urban open spaces is the Intention of users to revisit where their movements and behavior occur. The revisit intention is the user's desire to come back to that area again as a result of experiencing the place and being satisfied. In order for

a place to remain active and alive, it is important to ensure circulation and keep users coming back. Since urban open spaces have different features and activities and each user has their own needs and requirements, it is very difficult to ensure users' desire to revisit (İlban et al., 2016).

Planning a particular behavior is done with a purpose known as behavioral Intention. As a result, a user's strong feelings to perform a certain behavior will cause him/her to take action to perform it (Pratminingsih et al., 2014; Kahraman, 2019). One idea that can be explained by behavioral Intention is users' revisit Intention. Revisit Intention is defined as "the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior" (Warshaw & Davis, 1985,) Quality places that users can perceive satisfy the users and leave positive experiences in their memories. affects the trend.

Various studies show that the relationship between "experiential quality, place image and experiential satisfaction" positively affects revisit intention (Aziz et al., 2012; Jin et al., 2013; Li and Wu, 2013; Wu and Li, 2014). Experiences that will remain in the minds of users are of critical importance to make the place experience permanent and to gain new users (Yelkur, 2000; Rattanaprichavej, 2019).

Visitor satisfaction is also very important in the revisit intention. The positive and negative relationship between the experiential quality offered by the place and experiential satisfaction has a positive or negative effect on the revisit intention. The concept of satisfaction can be defined as a result of personal evaluations regarding whether the selected product or place meets or exceeds expectation. When visitor satisfaction is desired to be measured, their experiences are generally considered (Koç, 2017).

Experiential quality and experiential satisfaction are important variables that interact with each other and are one of the factors affecting the revisit intention. The revisit intention is directly affected by satisfaction (LaBarbera & Mazusrky, 1983), and satisfaction is more influential than experiential quality in forming a person's revisit intention (Cronin & Taylor, 1994). Experiential satisfaction indicates how satisfied the visitor is with their experience.

In the context of outdoor venues, revisit intention indicators are factors used to determine how often an outdoor venue is visited and its revisit intention. These indicators can be based on various factors, such as the design of open spaces, their features, accessibility, intended use and socio-demographic characteristics of visitors. Aziz et al. (2012) suggested "experiential quality and experiential satisfaction" as variables affecting visitors' revisit intention. However, experiential quality affects the revisit intention through experiential satisfaction (Jin et al., 2013; Li & Wu, 2013; Wu & Li, 2014; Bintarti & Kurniawan, 2017). The conceptualization of experiential quality includes emotional responses and environmental conditions, such as meeting the psychological benefits, physical, and social characteristics that visitors want from an

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experience. Moreover, experiential quality is subjective and depends on the experience and emotions visitors perceive (Chan & Baum, 2007). Experiential quality is related to the quality of the place, and the factors that affect this are factors such as the location of the place, its design, and its intended use.

In general, the quality perceived by visitors is more related to their experience during the visit process than to the service provided by the place (Bintarti & Kurniawan, 2017). This plays an active role in the revisit intention of a place. Elements such as "location of the place, design, purpose of use, environmental conditions, social and cultural factors, physical and social features" are included as symbolic indicators of the revisit intention (Bintarti & Kurniawan, 2017; Erap et al., 2021).

As can be understood from the literature, for the intention to revisit, the physical and social features offered by the place must meet the user's needs and create a feeling of satisfaction in the user. Therefore, this research will evaluate the physical and social features the Millet Bahçesi offers. Thus, the effects of these features on place experience, place satisfaction and revisit Intention will be investigated.

MATERIALS AND METHODS

Study Area

The study area is the Trabzon Avni Aker Nation Garden, located in the city center of Trabzon province in the Eastern Black Sea Region of Turkey and opened in September 2021. The Millet Bahçesi, which has an area of 63764 m^2, has a tribune with a capacity of 1021 spectators, a green area of 29719 m^2, and a 2440-meter walking path. In the public garden, which has a 7741 m^2 indoor parking lot, a 340 m^2 Coffeehouse/Library, 30,324 shrubs and 960 trees were used herbically. It also has an exercise area, cycling and jogging path, a swimming pool, a restaurantand children's playgrounds. The area where the public garden is located also has special meanings for the city and its citizens. Trabzon Avni Aker Nation Garden is an urban green area that has been brought to the city by transforming the Avni Aker Stadium, which is the temple of the Trabzonspor club, and its immediate surroundings, which are identified with various concepts such as spirit, love, excitement, childhood, happiness, sadness, enthusiasm, victory, legends and myths for the citizens. A Millet Bahçesi also has the title of Turkey's first sports-themed Millet Bahçesi (Figure 2).

Survey and Participants

This research only aims to investigate the effects of the physical and social characteristics of the place on the revisit intention. For this reason, "Avni Aker Nation Garden", where the users have no previous experience and whose design and implementation process was completed in September 2021, was chosen as the study area. In the research,

- Evaluating the physical and social features of the public garden open spaces with the post-occupancy evaluation method
- Evaluating the place experience and place satisfaction of the users
- Determining the revisit tendencies of the users

• Evaluating all the data together and determining their effects on the revisit intention

Figure 2. Trabzon Avni Aker Millet Bahçesi: Study Area Overview.

For these purposes, the survey questions were structured under 3 headings. Each item was measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

The survey participants were selected randomly from those using the Millet Bahçesi. The surveys were conducted with 211 people on weekdays and weekends. Data were entered, cleaned, and analyzed using the Statistical Package for Social Sciences Version 24.0, which SPSS developed.

Survey instruments for open spaces physical and social attributies

This part of the survey, aimed to determine how users perceived the physical and social features of Trabzon Avni Aker Nation Garden. For this reason, research focusing on user needs in urban open spaces and the features that successful open spaces should provide were used. In this

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research, the physical and social features offered by the place were determined because of literature research (Maslow, 1954; Whyte,1980; Francis, 1987; 2003, PPS,2000 and Özkan&Yılmaz, 2019). The physical and social features offered by urban open spaces designed by taking into account user needs are an important factor affecting the users' relationships with the environment. These features of urban open spaces are important in terms of creating an experience by allowing people to integrate with the space. In line with these acceptances, in this study; the physical and social features offered by the place will be evaluated by combining them with the classification made by user needs in urban open spaces (Maslow, 1954; Whyte,1980; Francis, 1987; 2003) and PPS (2000). As a result of this evaluation, the effects of open space success levels on satisfaction and revisit intention will be investigated (Fig.3). As a result of these evaluations, they were categorized as physical and social in order to survey users in the study area.

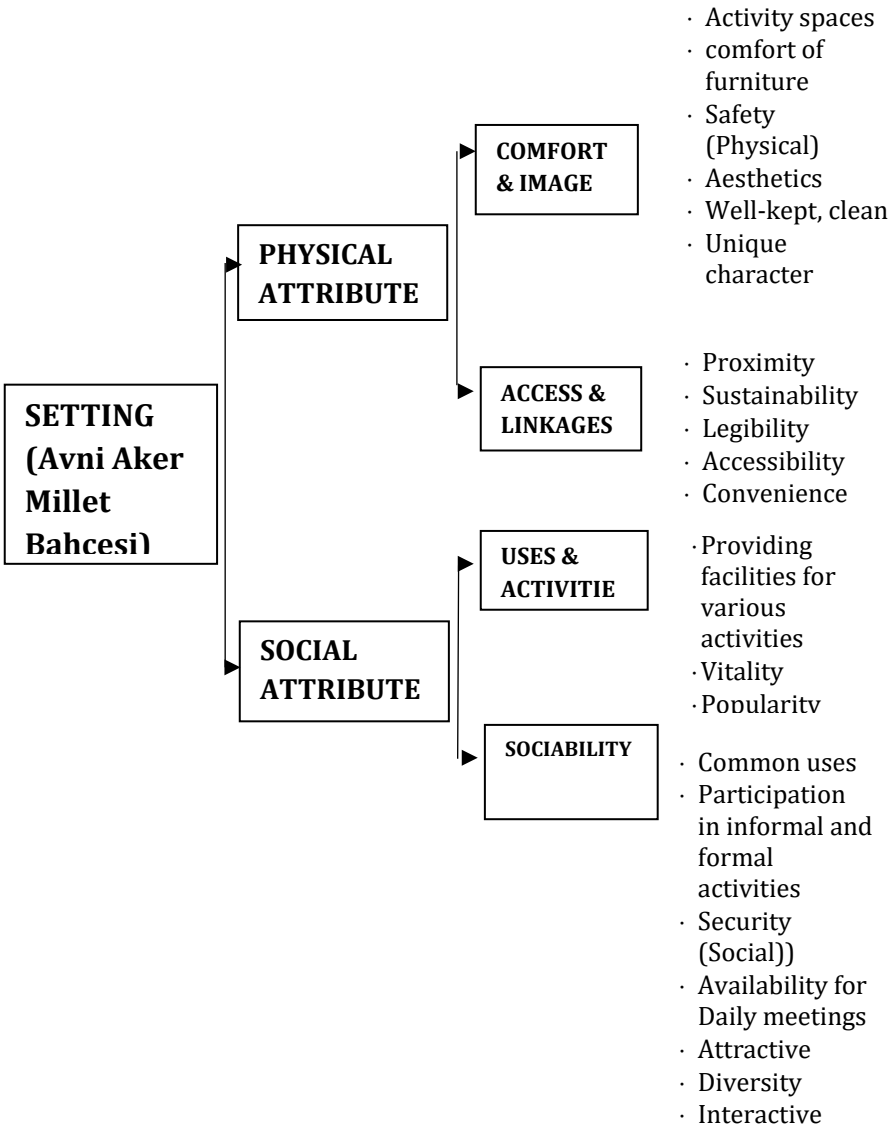

Figure 3. Statements in the survey attitude scale (developed based on Maslow, 1954; Whyte,1980; Francis, 1987; 2003, PPS,2000 and Özkan & Yılmaz, 2019;).

Survey instruments for open spaces physical and social attributies

The second phase of the survey was designed to measure user satisfaction as a result of whether the physical and social features of the public garden are compatible or incompatible with visitors' needs. While creating the scale for satisfaction measurement, different studies in the literature (Mesch & Manor, 1998; Stedman, 2002; Williams et al., 1992) were used to explain the relationships between satisfaction and loyalty (Table 1).

Table 1. Place Satisfaction items

Satisfaction Item and Constructs Name	
Satisfaction 1	I am satisfied with the comfort facilities this place offers.
Satisfaction 2	I am satisfied with the accessibility facilities this place offers.
Satisfaction 3	I am satisfied with the activity facilities this place offers.
Satisfaction 4	I am satisfied with the social facilities this place offers.
Satisfaction 5	Overall I am satisfied with my visit to this place

Survey instruments for open spaces physical and social attributies

The third and final stage of the survey aims to determine visitors' revisit Intention to the area after measuring user satisfaction. When creating a scale to measure revisit intention, reference was made to Kım, H.J., Park, J., Kim, M.J., and Ryu, K. (2013), which explains the relationship between satisfaction and revisit Intention in the literature. (Table 2).

Table 2. Revisit intention items

Revisit Intention Item and Constructs Name	
Revisit intention 1	I will recommend Avni Aker Millet Bahçesi to my friends as a recreation area
Revisit intention 2	I will visit Avni Aker Millet Bahçesi again for my next free time.
Revisit intention 3	I want to visit this place more often.

RESULTS

Sociodemographic and Visitation Characteristics

Trabzon Avni Aker Nation Garden, the working area, appeals to users of all ages and walks of life. Therefore, the demographic characteristics of the participants in the survey, including information such as gender, age, marital status, educational status, profession and life expectancy in Trabzon, were first revealed (Table 3). A survey was conducted with a total of 211 people in the study area, and the results of the socio-demographic characteristics of the participants who visited the area are as follows:

Of the 211 participants who visited the study area and were surveyed, it was determined that 114 people were women and 97 people were men. As a result of the survey, it was determined that the participants who visited the area were concentrated between the ages of 26-40. It was determined that while 110 people were single, 101 were married. As a result of the survey, it is seen that the participants who visited the area were mostly university (undergraduate) graduates. As a result of the

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survey, when the life expectancy of the visitors who visited the area in Trabzon was considered, it was determined that the majority had lived in the city for more than 15 years.

Environmental Attributes

As a result of the literature research, an environmental characteristics evaluation scale (41 items) was given to users visiting the region to evaluate the physical and social features provided by the public gardens (Table 4). Before the scores were obtained from this scale, the scale was subjected to factor analysis and evaluations based on the analyses were created.

Table 3. Sociodemographic and visitation characteristics

Socio-demographic findings	Trabzon Hüseyin Avni Aker Millet Bahçesi N=211		Socio-demographic findings	Trabzon Hüseyin Avni Aker Millet Bahçesi N=211	
Gender	Frequency	%	Education	Frequency	%
Female	114	54,0	primary education	10	4,7
Male	97	46,0	High school	48	22,7
Total	211	100,0	Pre-graduate	33	15,6
Age Group	Frequency	%	Undergraduate	101	47,9
0-18	21	10,0	Graduate	19	9,0
19-25	53	25,1	Total	211	100,0
26-40	89	42,2	Profession	Frequency	%
41-60	43	20,4	Officer	40	19,0
Over 60 years	5	2,4	Housewife	23	10,9
Toplam	211	100,0	Student	51	24,2
Marital Status	Frequency	%	Unemployed	22	10,4
Single	110	52,1	Selfemployed	65	30,8
Married	101	47,9	Retired	10	4,7
Total	211	100,0	Total	211	100,0
Length of Life	Frequency	%			
Less than 5 years	10	4,7			
5-10 Year	15	7,1			
10-15 Year	29	13,7			
More than 15 years	157	74,4			
Total	211	100,0			

The environmental characteristics and physical and social components of the Trabzon Avni Aker Millet Bahçesi were evaluated using 41 expressions, and the environmental characteristics of the nation's garden were evaluated. Factor analyzes were applied to see and explain the sub-dimensions of the environmental characteristics of open spaces, and after many analyzes, scales were created along with various reliability tests showing suitability for factor analysis. Principal component analysis with varimax rotation was used. The results were repeated seven times to hide factor loadings below 0.40. Finally, the 41-item environmental variables scale was reduced to 21 items, and these variables were determined to consist of four factors. These factors represent 74.983% of the total variance. In order to name the 4-factor structure, those with factor loadings greater than 0.3 were selected.

As a result of the analysis: The first factor is named usage and activity and consists of 7 items. The second factor was socialization and consisted of 6 items. The third factor was access and connection and consisted of 4 items. The fourth factor was comfort and identity consisting of 4 items (Table 5).

Table 4. Environmental attributes scale items and descriptive statistics

Environmental attributes	Mean	SD
1.The activity spaces are sufficient in this area.	3.24	1.08
2. The furniture elements are sufficient in this area.	3.11	1.10
3. The furniture elements are comfortable and practical in this	3.29	1.14
4.The pavement elements are comfortable and practical to walk.	3.64	0.99
5. Security services are sufficient in this area	3.00	0.94
6. I like the form, texture and color of the furniture elements in	3.61	1.08
7.I like the pavement.	3.61	1.08
8. I like the appearance of green fields in this area.	3.98	0.95
9.The pavements in this area are clean and well-maintained.	3.12	1.05
10. The furniture elements in this area are clean and well	3.19	1.04
11. The green fields in this area are clean and well maintained.	3.65	1.05
12. The activity spaces, furniture and green fields in this area are	3.48	1.15
13. People take pictures of the area.	3.82	1.12
14. The locations of the area activity spaces are well-connected.	3.38	1.09
15. The location of the area is quite close to other spaces.	4.29	1.10
16. I can easily walk in this area.	3.97	1.05
17. I can see the area activities from a distance.	3.60	1.05
18.The area is well-connected to the immediate vicinity.	4.27	1.19
19.I can access the are using different means of transportation	4.33	1.24
20.The area activity spaces serve their purpose.	3.61	1.12
21.The area pathways take me to my destination.	3.41	0.94
22.The area makes it possible to conduct several activities.	4.03	1.00
23. People intensively use the area.	3.90	1.10
24. The area can be used actively.	3.93	1.14
25.People form groups in the area.	3.94	1.04
26.Certain parts of the area are used intensively, while others are	3.96	0.98
27.The space is known and used by all.	3.99	1.01
28.There are options available in the area that enable me to do.	3.98	0.93
29.When using the space, I feel that there are people in charge of	3.27	1.00
30.People converse in groups in the area.	3.75	0.93
31.The activities conducted in the area involve more than one	3.69	1.04
32.I use the area regularly or to conduct a particular activity.	3.10	1.04
33.I use the space, albeit not for a particular activity.	3.45	1.08
34.I can safely use the area at night.	3.23	1.10
35.The number of female users of the area are more than that of	3.16	1.14
36.The area makes it possible for me to meet my acquaintances.	3.66	0.99
37.I want to introduce the area to a friend of mine.	3.41	0.94
38.I always want to participate in the activities when I visit this	3.36	1.08
39. There is user diversity in the space.	3.62	1.08
40.The space enables me to meet different people.	3.05	0.95
41.I can establish eye contact with others in this space.	3.34	1.05

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Table 5. Principle components analysis of environmental attribute items

Dimension	Factor	Varience %	Mean	α
1. FACTOR: USES AND ACTIVITIES (7 ITEMS)		35.596	3.96	.93
22. The area makes it possible to conduct several activities.	0.964		4.03	
28. There are options available in the area that enable me to do what I want.	0.963		3.98	
27. The space is known and used by all.	0.938		3.99	
24. The area can be used actively.	0.937		3.93	
25. People form groups in the area.	0.924		3.94	
26. Certain parts of the area are used intensively, while others are not.	0.916		3.96	
23. People intensively use the area.	0.888		3.90	
2. FACTOR: SOCIABILITY (6 ITEMS)		15.607	3.33	.91
40. The space enables me to meet different people.	0.776		3.05	
38. I always want to participate in the activities when I visit this space.	0.767		3.36	
41. I can establish eye contact with others in this space.	0.677		3.34	
37. I want to introduce the area to a friend of mine.	0.651		3.41	
39. There is user diversity in the space.	0.638		3.62	
34. I can safely use the area at night.	0.607		3.23	
3. FACTOR: ACCESS AND LINKAGES (4 ITEMS)		11.967	4.21	.94
19. I can access the are using different means of transportation	0.970		4.33	
15. The location of the area is quite close to other spaces.	0.969		4.29	
18. The area is well-connected to the immediate vicinity.	0.954		4.27	
16 I can easily walk in this area.	0.341		3.97	
4. FACTOR: COMFORT AND IMAGE (4 ITEMS)		7.183	3.49	.87
2. The furniture elements are sufficient in this area	0.757		3.11	
3. The furniture elements are comfortable and practical in this area.	0.708		3.29	
7. I like the pavement elements' form, texture and	0.673		3.61	
8. I like the appearance of green fields in this area.	0.618		3.98	
Total variance		74.983		

Note. Items are coded on a 5-point scale ranging from strongly disagree (1) to strongly agree (5).

The differences were found to be statistically significant for all groups in the independent groups t-test, which was used to evaluate whether there was a significant difference between the arithmetic means of the groups to determine the distinctiveness of the scale sub-dimension and total scores ($p < .001$). The environmental factors determined in this study are usage and activity features, socialization features, access-connection features and comfort-identity features.

Place Satisfaction

Within the scope of the environmental features offered by the public garden, the average values and factor loadings regarding the evaluation of the users' sense of satisfaction depending on their place experiences are shown in Table 6. As a result of the exploratory factor analysis (EFA), it was revealed that 5 items were collected in a single factor with 67.392% of variance (Table 6). It was observed that the overall satisfaction average was 3.47.

Table 6. Principle components analysis of place satisfaction items with varimax rotation

Dimension	Factor	Varience %	Mean	α
1.FACTOR: PLACE SATISFACTION (5 items)		67.392	3.47	.88
1. I am satisfied with the comfort facilities this place offers.	0.829		3.31	
2. I am satisfied with the accessibility facilities this place offers.	0.696		3.91	
3. I am satisfied with the activity facilities this place offers..	0.822		3.23	
4. I am satisfied with the sociable facilities this place offers.	0.882		3.40	
5. Overall I am satisfied with my visit to this place.	0.862		3.53	
Total varience		67.392		

Note. Items are coded on a 5-point scale ranging from strongly disagree (1) to strongly agree (5).

Revisit Intention

At this research stage, findings regarding the Intention of users to revisit the environmental features offered by the Millet Bahçesi were evaluated. Mean values and factor loadings for revisit intention are shown in Table 7. 3 statements regarding revisit intention were collected into a single factor with 80.270% variance. The item numbers in the original scale and descriptive statistics for the factor are shown in Table 7. 211 data were included in the analysis and the reliability coefficients were found to be high. The range between revisit intention factor loadings was determined as (0.964 – 0.938).

Table 7. Principle components analysis of revisit intention items with varimax rotation

Dimension	Factor	Varience %	Mean	α
1.FACTOR: REVISIT INTENTION (3 items)		80.270	3.44	.91
1. I will recommend Avni Aker Millet Bahçesi as a recreational area to my friends	0.964		3.49	
2. I will visit Avni Aker Millet Bahçesi again in my future leisure time	0.963		3.53	
3. I want to visit this place more often	0.938		3.32	
Total varience		80.270		

Findings on the Effect of Socio-demographic Characteristics, Environmental Features and Place Satisfaction on Revisit ıntention

Correlation analysis determined the relationships between socio-

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demographic characteristics, environmental characteristics and place satisfaction with the revisit intention (Table 8). When we examine the results of the correlation analysis, the factors that are positively related to the revisit intention are, respectively, Place satisfaction (r=0.710, p<.0.01), Sociability (r=0.642, p<.0.01), Uses and Activities (r=0.410, p<.0.01) according to the relationship size. Comfort and Image (r=0.394, p<.0.01), Access and Linkages (r=0.249, p<.0.01), Length of use (r=0.246, p<.0.01), Frequency of use (r= 0.209, p<.0.01). A low level of correlation was detected between marital status, Profession and revisit intention at p<0.05 level. There is no significant relationship between other socio-demographic characteristics and revisit Intention.

Table 8. Socio-demographic factors, Environmental Factors, Place Satisfaction and Revisit Intention: Bivariate correlations

Factors	**Revisit Intention**
Comfort and Image	0.394**
Access and Linkages	0.249**
Uses and Activities	0.410**
Sociability	0.642**
Place Satisfaction	0.710**
Gender	0.057
Age Group	0.075
Marital Status	0.046*
Education	0.045
Profession	0.035*
Length of Life	0.036
Frequency of Use	0.209**
Length of Use	0.246**

Note. Significance indicated by *p<.05, **p<.01

Regression analysis was performed to determine the factors that predict the revisit intention (Table 9). As a result of the regression analysis, it was seen that the variables comfort and identity, Access and image, frequency of use, marital status and profession, which are related to the revisit intention, could not be added to the model. In the 4th and last step of the regression analysis result, the R2 value was calculated as 0.585. The analysis fits the linear model (F (4-210) = 79.200; p=0.000) with no autocorrelation. In this case, it has been revealed that satisfaction statistically, sociability uses and activities, and length of use have a positive and significant effect on revisit Intention.

Table 9. Regression analysis on demographic characteristics, environmental factors, satisfaction and revisit intention

Model		B	Std. Hata	β (Beta)	t	p
4	Constant	0.481	0.266		1.805	.000
	Place satisfaction	0.499	0.065	.445	7.648	.000
	Sociability	0.377	0.067	.318	5.624	.000
	Uses and Activities	0.248	0.088	.126	2.813	.005
	Length of use	0.143	0.055	.128	2.613	.010
R=.770; R^2=.593; Adj. R^2=,585; Model F $_{(4\text{-}210)}$ = 74.889; p<0,01						

CONCLUSION AND SUGGESTIONS

Within the scope of this research, it was aimed to investigate the effects of the environmental features of the Millet Bahçesi on place satisfaction and revisit Intention. In recent years, the design and management of open spaces have gained more importance and have been discussed. At this point, the design and implementation process has been completed and it is extremely important whether the urban spaces where the use has started will create a intention for the user to revisit. Although there are studies in the literature on the revisit intention, especially in tourism studies, the e studies are lacking within the scope of urban design. It is essential to evaluate the public garden, which offers people the opportunity to spend time with nature and relax, especially in city centers, and also allows them to create social interaction, within the scope of the revisit intention.

For this reason, Trabzon Avni Aker Nation Garden, which is an important point for the city, served as Hüseyin Avni Aker Stadium in the past and has users' experiences, memories and memories, but was later converted into a public garden was chosen. In this way, the environmental characteristics of the public garden, which the users had no previous experience with and encountered for the first time, were evaluated. Thus, only the effects of environmental characteristics on satisfaction and revisit Intention were revealed.

When we examined the research results, it was seen that a 4-factor structure of environmental characteristics (Comfort and Image, Access and Linkages, Uses and Activities, Sociability) was formed. This structure coincides with the open space success criteria of the Project for Public Space PPS (2000). It also coincides with the research of Özkan and Yılmaz (2019), which focuses on the environmental characteristics of the place. When we examined these factors within the scope of the values received in Avni Aker Millet Bahçesi, it was seen that Access and Connection had the highest value and Comfort and Image had the lowest value. The fact that Trabzon Avni Aker Millet Bahçesi is located in the city center and the possibility of reaching it by various means of transportation can be explained by the value of the access and connection factors.

When the results regarding place satisfaction were evaluated, it was seen that the statement "I am satisfied with the accessibility opportunities offered by this place" received the highest value. It was observed that the 5-statement scale for place satisfaction was defined in a single factor and received high values. The overlap between the needs and requirements of the users of Trabzon Avni Aker Millet Bahçesi and the physical and social environmental features offered by public gardens is an indicator of the success of those spaces (Whyte, 1980; Kyle et al., 2004; Insch & Florek, 2008 Chen & Dwyer,2018).

Therefore, place satisfaction is expected to occur in spaces that meet user needs and have successful physical and social features. Research results support these studies. usedTheir revision intention statements used the Kim et al. (2013) scale. At this stage of the research section, the

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main aim is to determine the Intention of users to revisit the Millet Bahçesi. In this context, Kim et al. passed validity and reliability tests to determine the revisit intention value. (2013)'s 3-item scale was used. The scale consisting of these 3 statements is collected in a single factor.

The study examined the relationship between revisit intention and all other variables. When we list them according to relationship levels, the order is Place satisfaction, Sociability, Uses and Activities, Comfort and Image, Access and Linkages, Length of use, Frequency of use. In this context, it was determined that there was a positive and significant relationship between all environmental features and place satisfaction and revisit Intention. This result supports studies demonstrating the positive relationship between revisiting and experiential satisfaction (Aziz et al., 2012; Jin et al., 2013; Li and Wu, 2013; Wu and Li, 2014).

Regression analysis was performed to determine the variables that predict the revisit intention. It was revealed that the variables Place satisfaction, Sociability, Uses and Activities and length of use had a positive and significant effect on revisit intention. This result supports the assumption that "as user satisfaction increases, the intention to revisit them increases". As users' level of satisfaction with the places they visit increases, the revisit intention them increases. As a result, it has been determined that there is a directly proportional relationship between environmental characteristics and satisfaction, and as satisfaction increases, the revisit intention increases.

To summarize, "User satisfaction" had a positive and significant effect on revisit intention and was the variable with the highest impact on the revisit intention model. Social characteristics of the environment, such as "socialization" and "use and activity", are the second and third variables that have the highest positive impact on the revisit intention, and studies have shown that the sense of place attachment develops in places that allow informal social activities (Bonaiuto et al., 1996; 2006; Brown et al., 2004; Kasarda & Janowitz, 1974; Lewicka, 2005; Mesch & Manor, 1998; Moser et al., 2002) are supportive. The use of the Millet Bahçesi for entertainment events, concerts, festivals and celebrations held in the area keeps it active and adds liveliness. These facilities increase the popularity of the place. It has been observed that the fact that the area is already a well-known and place has an impact on the intention to revisit the place. Therefore, the usage and activity factor is an important dimension to revisit.

Among the demographic characteristics, only the "duration of use" variable was shown to be included in the revisit intention model and had a significant positive effect, and it was the 4th variable with the highest effect.

According to the obtained factors and analysis results, Trabzon Avni Aker Millet Bahçesi has a design suitable for different age groups and various user requests. The open green areas of the public garden provide flexibility for different types of use and thus enable various activities to be carried out within the public garden. In addition, the fact that it is a

place that appeals to the interests and socio-demographic characteristics of users from all age groups has increased user satisfaction and the revisit intention of the place.

The main purpose of this research is to find the elements that provide place experience in urban space and public garden designs, better understand place's effect on user satisfaction and contribute to the studies and knowledge in the field of visitors' revisit intention. As a result, the effects of public gardens on visitors were examined and the results obtained were explained, as well as the effect of place experience and place quality on the revisit intention of public gardens. The research discussed the relationships between environmental features and their sub-dimensions, user satisfaction, revisit Intention and sub-dimensions. When the discussions are summarized, the most important results of this thesis are as follows:

•It has been observed that increasing the success of environmental features increases place satisfaction and revisit intention.

•A conceptual relationship model was created by investigating the effects of all environmental factors, gender, age, marital status, occupation, life expectancy, duration of use, frequency of use and satisfaction variables on the revisit intention. According to the correlation analysis results, no significant relationship was detected between gender, age, education levels, life expectancy, and revisit intention. Frequency of use, duration of use, comfort and identity, access and connection, usage and activity and socialization variables were found to have a significant and positive effect on satisfaction.

•When we examined the effects of all variables on the revisit intention, it was determined that satisfaction, socialization, usage and activity, and duration of use were added to the model for their effect on the revisit intention and had a significant effect.

This research aims to ensure that the Millet Bahçesi, which will be designed at the target determined by the Ministry of Environment, Urbanization, and Climate Change, saying "We have a promise of 81 million square meters of Millet Bahçesi in 81 provinces", will serve as a guide for new Millet Bahçesi projects that meet user needs, offer physical and social features. It is aimed to contribute to scientific studies with its original structure in academic studies involving places such as urban open spaces and public gardens. The fact that this research was conducted only in Trabzon Avni Aker Millet Bahçesi can be interpreted as the limitations of the research. In addition, in the future stages of the research, urban open spaces where users have past experiences can be evaluated and the effects of the experience dimension on the revisit intention can be revealed.

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Resume

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The Impact of COVID-19 on Housing Design and New Approaches for Multi-Housing

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Abstract

In response to contemporary urban challenges, architectural practices have increasingly embraced rapid production methods to address emerging needs. However, this approach to production and consumption has generated various problems, which became more evident during the COVID-19 pandemic. Challenges across urban and architectural scales such as the lack of public and green spaces, circulation and accessibility issues, and ecological issues has become more important. It was observed that the existing urban fabric contributed to higher rates of disease transmission. Consequently, lockdown measures were imposed to mitigate the spread of the virus which leaded to extended time spent at home. The necessity for people to stay at home during the pandemic created a sense of "confinement" which is caused by the problems associated with housing design. Disconnection from the environment and the limited access to green and public spaces contributed to this feeling of isolation. This study critically examines problems of the current housings and their relation to urban fabric through literature review and spatial analysis, focusing on issues at both urban and individual housing scales. Housing unit issues are addressed through specific spatial elements, and new solutions are proposed. Key aspects, such as the relationship between ground-level housing and the street, apartment living spaces, rooftop areas, and circulation spaces are analysed. Solutions are developed within a theoretical framework, aiming to address future crises as well as pandemic-like situations. The study concludes with a design proposal: a vertical housing model that aims to support everyday needs such as socializing, working, resting, and learning, while enabling social interaction and engagement with the surroundings in an adaptable and sustainable living environment. In conclusion, the issues highlighted by the pandemic are not new and may reemerge in the future. Therefore, architecture must continue to develop innovative solutions that address both social and environmental needs.

Keywords:
COVID-19, Mass housing, Multiple housing design, Social distance, Sustainable design.

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INTRODUCTION

The COVID-19 pandemic has introduced unprecedented challenges, particularly in the way individuals engage with the built environment. To mitigate the risk of disease transmission, it is essential to implement strategies that ensure the safety of those spending prolonged periods indoors. The changes in daily life and the issues arising from them have transformed this into a global concern, prompting a critical reassessment of established patterns of living (Arın Ensarioğlu, 2021, pp.10-45).

The pandemic exposed the inadequacy of the current systems, demonstrating that no country was economically equipped to handle such a crisis and that existing spatial planning practices contributed to the spread of the epidemic. The virus's strong connection to space has shifted our perspective on cities and homes, highlighting the need for rethinking new design and planning approaches.

At the urban scale, issues such as insufficient public spaces, limited green areas, circulation problems, high-density development, standardized housing designs, and a lack of social spaces have forced people into overcrowded urban areas, facilitating the spread of airborne viruses in close quarters. Although lockdown measures, were implemented to reduce these risks, they confined individuals to their residential settings, highlighting the inadequacies of these environments and in some cases, making exposure to the virus difficult to avoid.

Standardized housing typologies were inadequate in addressing the needs of residents' during the COVID-19 pandemic and in some cases, even increased health risks. Shared spaces in apartment buildings, such as narrow corridors and elevators, emerged as areas of viral transmission, due to the unavoidable need to use these shared circulation spaces, thereby increasing exposure to potential infection. Interior design of the flats within the apartment buildings also proved insufficient, with small living rooms, kitchens and bathrooms which were undersized to meet the daily activities and also the activities imposed by lockdown measures such as home-schooling and remote work. This spatial inadequacy and also lack of personal space contributed to increased psychological stress and a sense of confinement. Furthermore, small or non-functional balconies and outdoor extensions, restricted contact with nature, negatively, was impact both physical and mental well-being.

"The effects of the COVID-19 pandemic on human behaviour have changed our perception of new space, and this has influenced life across various scales. There are changes in housing demands and users ask for parks, squares, and open spaces, which are the subject of public space use (Çörek Öztaş, 2021, pp.107-108)". In this context, developing a "new" typology that serves as an interface during pandemics, particularly in multi-housing design, is essential as it supports both mental and physical well-being of individuals (Zamfir M. et al., 2021, p.33).

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The COVID-19 pandemic highlighted the physical limitations of cities and housing, revealing that homes need to serve more than just as shelter during prolonged lockdowns. This study, proposes a design concept based on the idea that a building within a city can function like the city itself, allowing individuals to meet all their basic and social needs within their home.

This architectural design proposal integrates multifunctional spaces that address individuals' needs for socializing, work, interacting with nature and recreation. Organized as a multi-level structure, the housing concept includes a variety of spaces, ranging from social areas and sports facilities to children's playgrounds, green terraces for relaxation, workspaces, and child-friendly environments. These spaces allow users to carry out all their activities within the building itself. This building not only merges living and social spaces but also maintains a strong connection to nature through purposefully integrated green spaces across different layers. Vertical gardens, wide balconies, and rooftop terraces offer natural experiences within the urban fabric, creating areas for relaxation and fresh air. The uniqueness of the building proposal lies in its ability to provide not only enclosed spaces but also open and semi-open spaces ensuring connection with the city while enhancing liveability. Circulation paths and wide corridors are designed to allow users to maintain safe social distancing from each other.

In principle, this building proposal functions as a micro-city within its boundaries, acting as a self-sufficient development. It offers a unique multi-housing design concept that contributes to healthy living, social interaction, providing a strong connection to nature, even during extraordinary conditions like a pandemic, without requiring residents to leave their home.

THE AIM OF THE STUDY

This study explores the emerging needs in individuals' daily lives brought by the pandemic, the adequacy of existing multi-housing designs and the architectural elements that define the housing structure. The main objective is to underscore the limitations of current multi-housing typology and emphasize the need for a "new" typology that reflects evolving patterns in the use of public, semi-public and private spaces in the post-COVID-19 context. The study aims to recommend solutions to the issues identified in the literature review, aligned with post-pandemic living needs.

METHOD OF THE STUDY

The study primarily, employs a literature review to identify the limitations and challenges of current housing design, with the objective of proposing a theoretical new housing typology that addresses the spatial needs associated with existing apartment buildings. In response to the problems identified during the pandemic and the information gathered through the literature review, the research poses the central question: how can a new housing design respond effectively to these

emerging challenges? To address this, a theoretical building concept was formulated, which informed the development of a design proposal. It is aimed that the proposed theoretical concept to be explored as a studio project, hence a sample site in Mersin was selected as the project location. The initial phase of the study involved a literature review that examined historical and contemporary epidemic diseases and their effect on the city focusing on the changes in public space usage aftermath of COVID-19, and changes in domestic life and use the domestic space. The literature review was supported by the research of architects and academics, and the parameters to be considered during the design phase were identified.

Next phase involved a detailed analysis of a multi-dwelling unit, focusing on the relationship between the ground floors and the street pattern, the organization of the internal living spaces within the apartments, the role of the attic in defining the building's vertical envelope, and the design of the front door spaces and circulation spaces connecting individual units. This analysis revealed the shortcomings of the current typology for multi-dwelling units, as documented in the literature.

Based on these findings and the detailed discussions that took place during the process, suggestions for a new typology were developed, and the study was completed with evaluations of the proposed design solutions.

RESEARCH FINDINGS

Based on the literature review, the study's main scope was defined to encompass the historical and contemporary impact of epidemic diseases on cities, the changes in public space usage after COVID-19, the general approach to housing after COVID-19, and user-driven transformations in multiple housing design, as discussed by architects.

Epidemics from Past to Present and Their Effects on the City

A historical review of major epidemics includes the Plague of Justinian in 541 and its successive continuation in the 6th-7th and 8th centuries; leprosy which prompted the 3rd Lateran Council in 1179; the plague that spread via the Silk Road and Islamic regions in 1347; the cholera epidemic in London in 1850, which also affected the Ottoman Empire and Anatolia in the 19th century; and the Spanish flu, which had a significant impact in the late 19th century (Yıldırım and Özmertyurt, 2021, pp.305-306; Yılmazsoy et al., 2021, pp.426-427). The increase in epidemics, especially in the 19th century, was due to the Second Industrial Revolution, railway travel, greater use of public spaces, expansion of the entertainment sector, worker housing, and low-quality residential areas. Factors that contributed to the spread included the neglect of building principles such as inadequate sun exposure and ventilation, as well as cramped, high-rise structures, and rising population density in urban locations (Yıldırım and Özmertyurt, 2021, p.306; Yılmazsoy et al., 2021, p.427).

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Sewage and infrastructure works have been accelerated in London to slow the pandemic. Window openings were increased for ventilation and access to daylight on the building facades. Additionally, measures that encourage walking rather than public transportation during epidemic periods, such as curfews, have been taken into use. A limitation on the use of public spaces, and efforts have been made to slow down urban growth (Yıldırım and Özmertyurt, 2021, p.306; Yılmazsoy et al., 2021, p.427).

In the 20th century; important epidemics included the he typhus epidemic that spread during the First World War, the Spanish flu epidemic of 1918-1919, the Asian flu (H2N2) originating in China in 1957, and the Hong Kong flu (H3N2) epidemics in between 1968-1970 (Yılmazsoy et al., 2021, p.427). The developments in the city and planning during this period can be summarized as; The creation of satellite cities, the distribution of the population by building closed sites and the development of studies for the optimum state of the individual such as the "Gardens of the Future" proposed by Ebenezer Howard and the "Beautiful City Movement" proposed by Daniel Hudson Burnham, the development of mass housing areas to provide minimum living conditions in the 1930s such as the "minimum comfort conditions for the building" by Le Corbusier and the determination of "basic urban living standards" at the neighbourhood level by Clarence Perry, the appreciation of "living standards based on quantitative and material values" with the Second World War, changes in social sciences and taking into account the "Maslow Pyramid of Needs" in the development of urban living standards (Yılmazsoy et al., 2021, pp.427-428).

In the 21st century, as stated by the World Health Organization, the period from 1990 to present can be described as the "virus age" due to the increased frequency and rapid spread of epidemics. During this period, outbreaks such as SARS (2003), Swine flu H1N1 (2009), Ebola (2014), MERS (2015), and COVID-19 (2019) gave rise to urban planning measures to mitigate the effects of the epidemics (Yılmazsoy et al., 2021, p.428). After the 1990s, concepts such as compact city, sustainable city, eco-city, low carbon city, liveable city, digital city, and smart city emerged. Today, in the post-pandemic period, studies on the formation of alternative city models focus on "smart cities", "healthy cities" and "sustainable cities" (Yılmazsoy et al., 2021, p.428; Yıldırım and Özmertyurt, 2021, p.309).

The literature review explored changes in public space usage and housing needs following COVID-19, and the study proposed solutions based on emerging user expectation.

The Changes of the Public Spaces after COVID-19

Public spaces are recognized as important meeting points in daily life (Tekçe, 2021, p. 56). During lockdown, individuals were confined to their homes, and the house, has turned into sub-sections that try to meet the public space needs of the individuals. Balconies and gardens began

to be used as open public spaces. However, these restrictions on the use of public spaces led to social isolation and psychological strain. When balconies and gardens proved insufficient, people turned to streets for relaxation, yet restrictions on street use further pushed users to seek alternative spaces for relaxation (Tekçe, 2021, p.56). Users have started to spend more time around their living spaces in non-restriction times, and in a sense, they have had the opportunity to rediscover the neighbourhoods they live in. Especially white-collar users stated that they did not care that much about the environment they lived in before, but when they started to spend more time around their homes and living spaces, they realized the deficiencies of the environment they were in and experienced that it was not suitable for their new needs (Tekçe, 2021, p.58). Public spaces such as streets, parks, recreational areas, and green spaces have become more important for users. While the desire to see more green areas has led many users to move from city to the countryside, detached houses have been preferred. However, considering the socio-economic structure of cities, only a limited number of users are able to move to the suburbs. This situation makes it inevitable to organize public spaces in cities and develop solutions that can address user needs. As Suri (2020) stated; Article 56 of the Constitution affirms that "Everyone has the right to live in a healthy and balanced environment (RG, 1982)", thus guaranteeing these rights for all citizens (Suri, 2020, p.53). The components of a healthy and balanced environment are all the elements that make up the natural and built environment (Suri, 2020, p.53). Research examining the relationship between individuals and their interaction with nature shows that access to green spaces can positively influence life expectancy (Ward Thompson, 2011, pp.187-195). For this reason, before the pandemic, the presence of green spaces which was carried directly into the living space of the individual, was interpreted as a luxury element, but with the new normal, this situation has become a necessity (Rebecca, 2020). Yıldırım and Özmertyurt (2021), emphasise the importance of addressing a range of urban issues such as using more green spaces, improving social green spaces, controlling air quality, waste management, light pollution, urban resilience, preservation of cultural landscapes and values, creating flexible public spaces, transforming urban voids and collapsed areas (Yıldırım and Özmertyurt, 2021, p.324).

This process has revealed the necessity of accessible urban services on a regional scale and the importance of the natural environment in the urban texture where the individual interacts in the open space. The necessity of replacing relatively larger entertainment venues and shopping centres that accommodate a large number of people has started to be discussed (Özdede et al., 2021, p.366). In the same source, it is stated that Barbarossa (2020) proposes the reorganization of streets, squares, parks, and other public spaces for people with the concept of resilient cities, with the aim of new urban transformation

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that develops intertwined with the natural texture (Özdede et al., 2021, p.380).

Alongside these regulations made in open space, the ability to access public spaces during lockdown restrictions becomes increasingly important. Problems such as stress, mental disorders and depression are among the most observed problems when the individual moves away from the natural environment (Avçin and Erkoç, 2021 pp.1-13). It is essential for individuals to spend time in natural and social environments to reduce stress and promote mental relaxation. This study explores how users can access public spaces without leaving their homes, with a focus on utilizing balconies, terraces, and gardens. The concept of the street is also reconsidered, with proposed solutions discussed in the following sections.

The Changes in Residential Use after COVID-19

Keleş (1983); defines the house, in its physical dimension, as a shelter where users can fulfil basic needs such as sleeping, cooking, protection from cold and heat, washing (Keleş, 1983, p.79; cited in Güney Yüksel, 2022, p.89). However, as Rapoport (1969) stated, influenced by cultural contexts and traces, the house has evolved from a purely physical space to a space that addresses a broader range of needs (Rapoport, 1969; cited in Güney Yüksel, 2022, p.89). Güremen (2016), on the other hand, mentions that housing plays a crucial role in shaping the quality of life for its occupants (Güremen, 2016, p. 25; cited in Güney Yüksel, 2022, p.90).

The new normal has drastically altered individuals' perspectives on housing. The need for self-isolation, driven by the instinct to protect oneself from illness and the physical limitations caused by infection, has forced individuals to remain confined to their living spaces for extended periods (Maggies, 2020). During the period of lockdown, driven by the need for isolation, it became evident that existing homes have turned into spaces that disconnect individuals from their surroundings, rather than serving as environments that protect them from disease (Avçin and Erkoç, 2021, p.1-13).

Architects have begun to explore the increasing need for interaction with the street and access to social activities without leaving the building (UN-Habitat, 2021). Yıldırım and Özmertyurt (2021) highlight the problems emerged during lockdown periods, including inflexible spatial layouts that do not support various activities such as sleeping, working or playing; small entrance spaces that hinders effective sterilization; insufficient personal space for users; insufficient semi-open spaces like balconies, terraces and rooftops; inadequate natural ventilation; and challenges in maintaining social distance (Yıldırım and Özmertyurt, 2021, pp.318-319). Experiencing prolonged confinement, users have started to look for alternative flexible living spaces which support a wider range of activities.

The fact that an infected individual can expose everyone using the same transportation route to the pathogen, increases the risk of transmission. For this reason, the necessity of a circulation system that offer separate routes for individuals to access their residences has become increasingly important (Caulfield, 2021).

COVID-19 is not just a health problem; but also it presents a significant design challenge. The prolonged time spent indoors has led to significant shifts in housing design. With these changes and transformations, the living space of the individual has evolved into multifunctional environments where individuals carry out nearly all aspects of their daily life: playing, working, exercising, dining and etc (Flake, 2020).

Concepts such as sustainability, user comfort, flexible-transformable space organization, and simplicity have become important. This shift has led to transformations from open-plan layouts to more clearly defined spaces. Existing entrance halls have been reconfigured to support sterilization, with hygiene-focused additions such as handwashing stations and designated areas for leaving personal items before entering the main living space. This section, which was designed before reaching the kitchen, also includes an area where you can leave your belongings at the entrance (Güney Yüksel, 2022, pp.94-95).

The need for isolation, combined with the integration of work functions into the home, has further distanced individuals from the natural environment. Studies examining the increased demands during the pandemic show that people are calling for more green spaces in mass housing, particularly on rooftops and terraces (Alati, 2020).

Balconies and shared social spaces have emerged as key spaces whose function gained importance. Based on this, spaces such as balconies and terraces, which were treated as storage and underused prior to the pandemic, have become vital for accessing to open space and enabling social interaction with the outside world, while remaining within isolation areas (Aronis, 2020, p.1-27).

In addition to these issues mentioned so far, it has become a necessity for individuals to access public space without leaving their homes and isolation areas (Tekçe, 2021, pp.46-70). In this direction, in multiple housing designs, the penthouse and ground floor have been re-examined under the titles of public space need and social interaction in terms of users with the spatial potential they offer (Ahsan, 2020, pp.281-285).

The emergence of COVID-19, has given rise to a new lifestyle and associated challenges. At this point, architectural design can provide solutions to mitigate the unpreparedness and shortcomings experienced during this crisis from recurring in future scenarios. The issues discussed within the scope of all these studies will be integrated into the studio process, with proposed measures and design recommendations detailed in the following sections.

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Discourse and Suggestions of Architects

The spatial limitations and structural shortcomings of the buildings, revealed by the pandemic have created a need for a new architectural approach. In response, architects have focused on flexible, user-centred solutions that address both pandemic-related and individual lifestyle needs. Reflecting on this shift, Toshiko Mori emphasised the evolving role of the home, “Now that working from home has become much more common, the home should be a dedicated space for doing work and a complementary space to relax. This space doesn't have to be large, but it should be separate enough to feel away from work when you're at home. A well-ventilated porch can serve as an ideal dining and entertainment area. Cooking can be moved outside and, accordingly, the kitchen becomes a social gathering space where family and friends come together, cook together and eat together in an informal environment’’. He shared his views on additions, changing needs, and their spatial counterparts (Curkin, 2021).

Thomas Kligerman; noted the growing demand for home-centred lifestyles: Everything you used to go out to exercise, you can now do at home. We are asked to create rooms to play virtual golf. Customers do not cite COVID-19 as the reason for making these requests. However, what is implied is that we are planning to be at home more.” He stated that, as individuals spend more time at home after the pandemic, they are in search of an environment where they can do more activities in their living space when looking for a home (Curkin, 2021).

Joy Moyler also stated her predictions as “Houses will be divided into more distinct, quiet and noisy areas for entertainment, learning, and relaxation," and emphasized the need for a change that different needs should not be realized in one place, but in privileged areas that are specialized for them (Curkin, 2021). These views and insights of the architects shaped the topics addressed during the studio process. By reviewing these evaluations in the literature, the core problem was defined, and solutions were developed for the identified design challenges.

PROBLEM DEFINITION

The pandemic revealed that standard mass housing fell short in meeting user needs during lockdowns, often leaving residents feeling “trapped” at home. The separation from urban space disrupted social interactions, raising questions about how a new housing typology could better accommodate the demands of the “new normal”.

Considering the importance of the insights presented in Table 1, mass housing needs to be reimagined to better accommodate the evolving needs of its residents. Future design should focus on flexible, adaptable spaces that support health and social well-being. Shared spaces within housing complexes should facilitate safe social interaction and connection with green spaces. Entryways should function as transitional zones between private and public spaces, while increased

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green spaces respond to the desire for nature. Enhancing natural ventilation is crucial, and flexible layouts should accommodate diverse needs. Additionally, circulation systems should be redesigned to ensure safer movement throughout buildings, and rooftops should serve as essential communal areas that combine green and social areas.

Finally, the increasing demand for open space can be integrated into the housing typology through multi-functional outdoor spaces that extend the living area and strengthen the connection to nature, and transform homes into dynamic elements of the urban fabric rather than merely serving as shelters.

Table 1. Changes in User Needs in Post-COVID-19 Multi Housing Design; Problems, Approaches/Views and Suggestions of Academics and Architects

	User's Perspectives	**Problems**	**Approaches/Views and Suggestions of Academics and Architects**
Urban Scale	Desire to spend more time in open spaces Rediscovering the neighbourhoods, they live in and noticing the shortcomings of the environment Streets, recreation areas and green areas become more important	Lack of public space Lack of green space Dense construction Standard housing design approach Lack of social space Accessibility issues	Urban resilience and the transformation of slums Improving existing green spaces and social facilities, controlling air quality, Creating flexible public spaces for increased use during restrictions, integrating green areas into housing designs, and expanding landscaping on roofs, terraces, and ground levels. Providing access to natural and social spaces through balcony, terrace, and garden solutions without leaving home. Rethinking the concept and use of streets.
Housing Scale	Shifting the individual's perspective on housing. The psychological impact of self-isolation, particularly due to inadequate physical space. Homes have become spaces that, instead of protecting from disease, isolate individuals from their surroundings. Users, feeling confined in long-term spaces, seek flexible areas to diversify their activities. Preferring detached houses (for those who can afford it)	Inability to access social areas Narrow corridors in apartments Common areas such as stairs and elevators increase the risk of infection. Inadequacies in residential interior designs Spatial structures that do not allow for flexible arrangements Small seating areas Narrow kitchens and bathrooms Reflections of home working and distance education problems on space Insufficient semi-open spaces Lack of natural ventilation	Redesigning attic and ground floors to meet public space needs and enhance social interaction. Rearranging balconies and terraces to provide open space during isolation. A circulation system solution that allows users to reach their apartment from different routes. Making entrance halls suitable for sterilization Design focuses on concepts like sustainability, user comfort, flexibility, and simplicity. Transforming living spaces to accommodate all daily activities. Shifting from open-plan layouts to defined spaces. Sound insulation, indoor air quality regulation, and the use of smart home technologies and furniture systems. Choosing materials that support sterilization and hygiene.
References	(Word Thompson,	(Yıldırım ve	(Alati, 2020)

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	2011) (Rebecca, 2020) (Maggies, 2020) (Avçin ve Erkoç, 2021)	Özmertyurt, 2021)	(Flake, 2020) (Coulfield, 2021) (Güney Yüksel, 2022) (Ahsan, 2020) (Curkin, 2021)

Considering the findings of these studies, different proposals were developed as a result of the studio practice, guided by the defined parameters. The project presented in this paper, introduces a new multi-dwelling housing typology designed as a vertical city, where individuals can meet all their needs while in isolation. Throughout the design process, two practicing architects provided critical feedback to help ensure the project's feasibility and real-world applicability.

GENERAL CHARACTERISTICS OF THE SITE

Figure 1. Location of the Project Area

It was found that in order for the proposed new housing theory to be realized as a studio project, a real site selection is necessary. At this point, it was also important to show how the proposed building would appear within a specific context. While the chosen site 11.400 m2 does not affect the construction method of the housing itself, it was explored how the theory would materialize in a real-world setting. The theory was designed as a modular concept that could be applied anywhere. Of course, this modular design should be revised for different contexts by evaluating factors such as climate, view, topography, plot size, etc. The direction of the facades where the gaps will be left, the ratio of housing to social areas within the floor, floor circulation areas, core design, location and number, orientation according to the view are some of the factors that should be taken into consideration when arranging the floors.

Figure 2. Function Analysis of the Project Area

The project focuses designing a post-pandemic housing and commercial complex, located in the Mezitli district of Mersin (Figure 1), a city along the Mediterranean coast in southern Turkey. The site's context features a dynamic coastline, coupled with underdeveloped and stagnant side roads leading to it. Surrounding the area are point-type buildings arranged around a single circulation path, forming a repetitive and monotonous typology (Figure 2).

Upon examining the region's weaknesses, the lack of functional commercial areas stands out. Additionally, it is observed that the roads around the study area are functionally inadequate, except for the coastline, which is an attraction point in Mersin. There is also a notable absence of open space activities, apart from the coastline being used for social walking (Figure 2). The area has a mild climate with dry winters and summer temperatures that make semi-open spaces more popular than fully open areas. The prevailing wind direction flows from southeast to northwest, and the landscape opportunities are primarily concentrated along the southern coastline.

SUGGESTIONS

A new design typology for the multi housing has been developed to address the evolving needs before, during, and after the pandemic, while also preventing the same issues in future pandemics. The architectural program includes a variety of spaces such as different housing units, social areas, commercial and gastronomic facilities, office spaces, management areas, healthcare services units, emergency accommodation units, sports facilities and concept areas. The total area of the program is approximately 28500 square meters, as outlined in Table 2.

Table 2. Architectural Requirement List for Multi Housing Design

Residential Units		**Approximately 21500 m²**
Type 1 (1+1)	25 Units	101 m²
Type 2 (2+1)	32 Units	130 m²
Type 3 (3+1)	41 Units	204 m²
Type 4 (4+1)	28 Units	227-235 m²

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Social and Commercial Units		**Approximately 5000 m²**
Shopping Venues or Shopping Street	32 Units	39 m²
Gastronomic Units	6 Units	117 m²
Sports Area	3 Units	164 m²
Offices	34 Units	39 m²
Administrative Units	4 Units	87 m²
Staff House	1 Unit	72 m²
Emergency Accommodation Units	9 Units	72 m²
Medical Point	1 Unit	75 m²
Spaced Base on Concepts		**Approximately 2000 m²**

The proposed building is organised in three main sections: the ground floor, which provides connections to the outer urban environment; the residential floors, where individuals carry out their daily activities and functions; and the rooftop, which acts as the largest gathering area offering the greatest interaction with the surroundings. Suggestions have been developed throughout the article to address the shortcomings related to these sections (Figure 3).

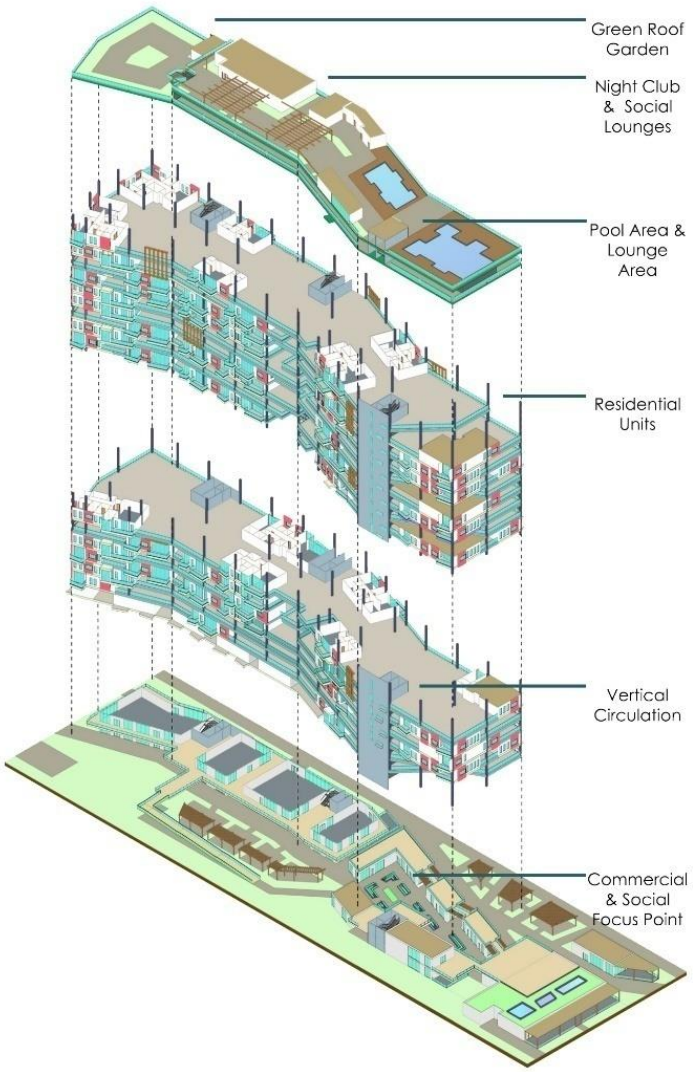

Figure 3. Axonometric representation of the general structure of the building

Rather than placing enclosed commercial spaces beneath the residential blocks, as seen in Figure 4, the floor plan introduces public areas with diverse functional uses, enabling individuals to meet essential daily needs even during potential lockdowns. These spaces cater to various functional uses, including commercial, social, gastronomic, and office areas. Figure 5 shows the ground floor layout in an axonometric view. In this layout, the area operates as a continuation of the existing street arrangement, housing units intended for commercial, social, gastronomic, and office uses. The main goal here is to embed into the structure the types of spatial experiences typically found throughout the city. Figure 6 presents visualizations of the area, demonstrating how the conceptual framework translates into design proposal. The ground floor is designed to support passive ventilation and maximise natural light.

Figure 4. Diagrammatic Representation of Ground Floor

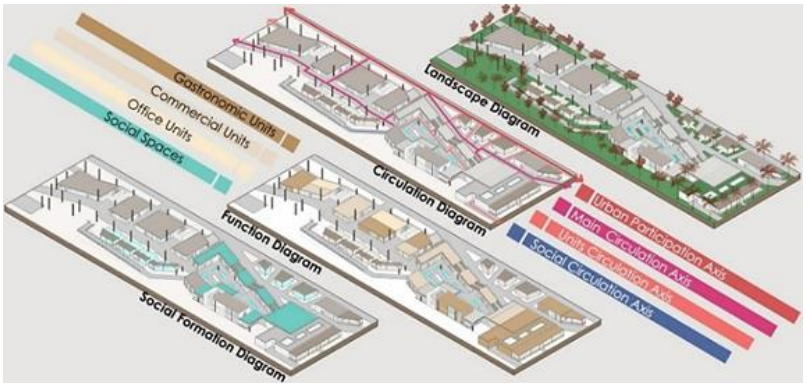

Figure 5. Axonometric Representation of Ground Floor

Figure 6. Visualization Studies for Ground Floor

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As shown in Figure 7, the mass diagram illustrates that in the floor plan schema, each apartment has a single-family home, and each floor operates like a street layout with different spatial arrangements and needs (space requirements, number of occupants, functional needs, etc.). These street-like platforms consist of apartments designed to accommodate families of varying sizes, with recreational spaces located between the apartments, green spaces surrounding both the social and residential spaces, and vertical and horizontal circulation routes (Figure 7). The design proposal aims to incorporate elements such as privacy, acoustic barriers, positive psychological effect, integration with nature, and ecological design within the proposed single-family home environment.

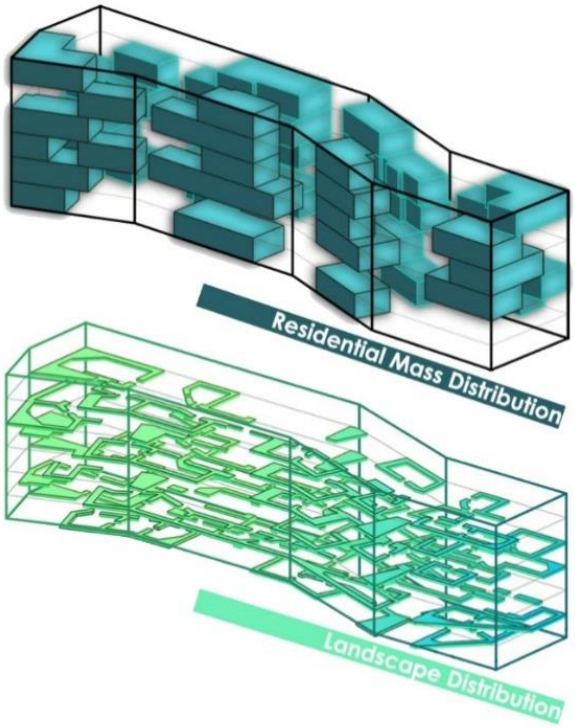

Figure 7. Formation Diagrams of Proposed Mass Housing Floors

Each floor includes residences and social spaces of various sizes and designs to accommodate different spatial requirements (Figure 8). In contrast to conventional layouts, this open design (Figure 9-10), allows natural ventilation in both the front-door space and the spaces surrounding the apartments. Public spaces have been expanded to incorporate essential activities during the pandemic, including workspaces, relaxation areas, entertainment zones, reading areas, playgrounds, and sports facilities, based on observations and collected data (Figure 11). Each floor covers a total of approximately 4000 m^2, while the social spaces ranging from 1000 m^2 to 1500 m^2. This means that 25% to 35% of each floor's total area is allocated to social spaces. These social areas are designed to serve different age groups and various activities. Depending on the requirements, the functions of these areas can be adapted, or two adjacent modules can be combined to create a larger space.

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Figure 8. Indoor Spatial Organization Layout

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Figure 9. Mass Housing South Façade Organization

Figure 10. Mass Housing North Façade Organization

Figure 11. Social Spaces Between Flats in Mass Housing Floors

The horizontal circulation spine proposes a layout where the concept of "street" as it is in the urban fabric is integrated into the living spaces, replacing the door-front areas that currently function only to connect the dwelling with circulation path (Figure 12).

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Figure 12. Main Circulation Backbone between Apartments in Mass Housing Floors

Vertically, 3 different circulation paths that are capable of accessing every floor on the platform, have been proposed; as an alternative to the single circulation path found in conventional housing typologies, which proved inadequate during the COVID-19 (Figure 13). In this approach, the number of circulation choices, previously limited to a single path for exiting the building, has been increased. This allows for the designation of a specific path for infected individuals, while healthy individuals can avoid contact by using the other routes. A disinfection area has been proposed at the entrances of the apartments, which are the main isolation space of the individual, to reduce the risk of brining the virus into the home, even in cases where the occupant may be an asymptomatic carrier. The disinfection zones located at the entrance of each dwelling are intended to support a more hygienic indoor living environment, while also promoting a long-term healthy habit which could become an integral part of daily home life.

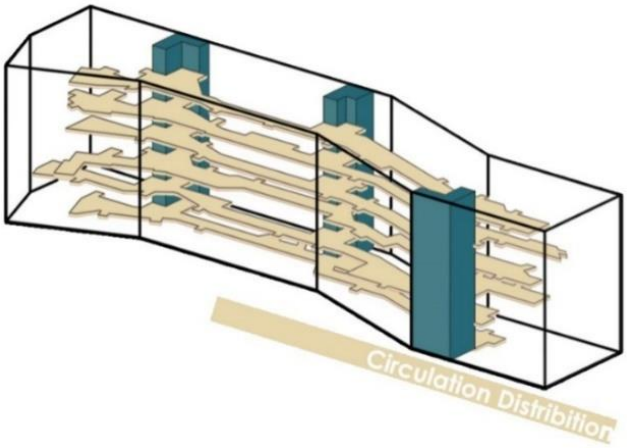

Figure 13. Circulation Diagram Connecting Floors and Apartments in Mass Housing Floors

In terms of the interior organization of the apartments, a layout where different functions are realized in separate and defined spaces has been proposed instead of an “Open Plan” approach based on the data obtained. The importance of the rooms has been increased; each room has been arranged in a way that can meet these needs when the need for isolation is required, and their own dedicated wet areas have been added to the rooms (Figure 14).

The spaces are designed for maximum flexibility, allowing them to adapt to changing needs while supporting a healthy, virus-free home environment. The fact that the walls of some rooms used for indoor activities (study, hobby, music, sports, etc.) can be removed and hence

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the volume of the space can be enlarged or reduced for different purposes. This allows individuals having a better quality of life at home. While each room has clearly defined boundaries, the design supports functional flexibility, particularly through the inclusion of private bathrooms in the bedrooms. Additionally, isolation needs identified during the pandemic have been integrated into daily life practices. For example, if users choose to convert their bedrooms into home offices, they can do so without disrupting the overall organization of the home.

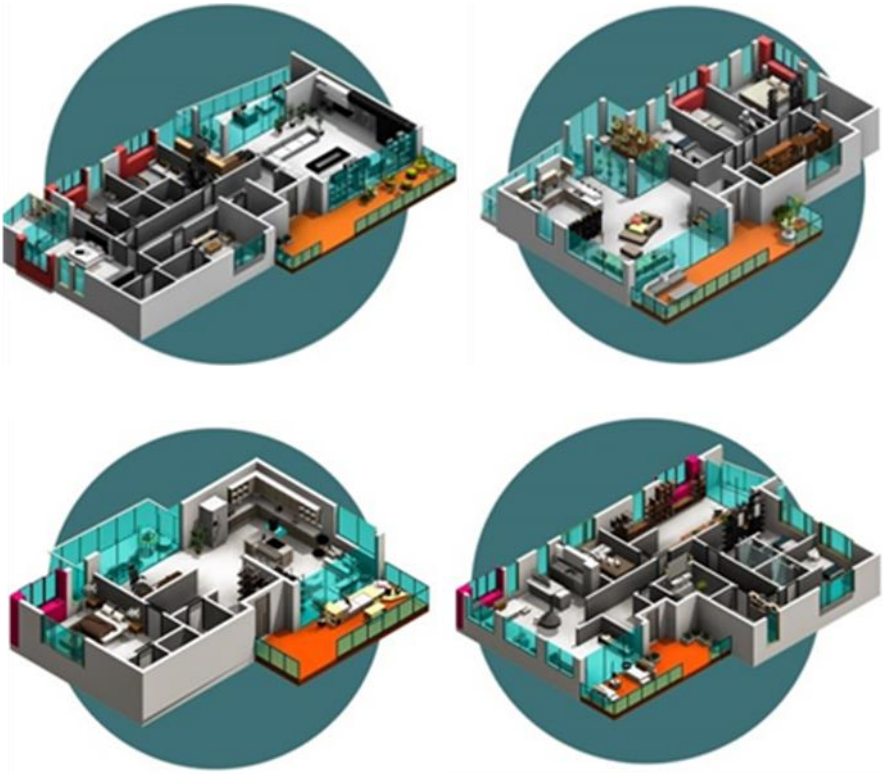

Figure 14. Examples of Suggested Flat Typology

The design concept for the bedrooms ensures that each room has its own private wet area, allowing individuals to meet all their needs while isolating, without leaving the room or exposing others to potential infection. Additionally, it has been suggested that large spaces such as the hall can be enclosed with panels and used as a containment area for the infected individuals if needed. Some rooms, such as those for study, hobbies, music, and sports, feature removable walls to adjust the space size. This design aims to improve the quality of time spent at home.

The current size and function of balconies, once the only link to the outside, were found to be inadequate. It is suggested that balconies be redesigned to better support public and social activities. Additionally, since kitchens also serve as social hubs for families during lockdowns, alternative layout configurations have been developed to integrate them with the living room. The size of the balconies ranges from 9 m^2 to 17 m^2. These dimensions support the overall design concept of the building, providing different interior usage option. For instance, balconies can function as dining or workspaces. The structural features of the balconies may vary depending on the specific context of the

project`s location. Since the project is located on the Mersin coast, it has been designed to be suitable for the Mediterranean climate.

Ventilation solutions for the apartments have been designed using combination of passive and partially active systems. Each apartment, designed as an independent, private unit with features such as porches and green spaces to enhance privacy and to reduce virus exposure, includes openings on all four facades to enable cross-ventilation.

A roof design has been proposed to allow the users to enjoy the surrounding landscape and to experience the sense of open space within the urban environment. The roof features, a communal garden, social areas, hobby-activity zones, and a pool, all accessible to residents (Figure 15).

Figure 15. Recommendation for Roof Use against Pandemic

This proposed design incorporates improvements to address user needs that emerged during the pandemic and to allow for solving the challenges encountered during the lockdowns. Additionally, it embraces a sustainable design approach by adapting to climatic data, promoting natural ventilation, integrating greenery into the building, and supporting a flexible and modular design.

CONCLUSIONS AND RECOMMENDATIONS

While previous epidemics had mostly regional impacts, COVID-19 escalated into a global pandemic that affected even countries with advanced healthcare systems and robust infrastructure. Unlike previous outbreaks, COVID-19 left nations vulnerable for an extended period, despite their economic and medical capabilities. The rapid global spread and the vast scale of the pandemic were further intensified by inadequate urban planning and poor spatial organisation, which hindered efforts to control the virus.

Like many other sectors, architecture has been shaped by rapid technological advancement and globalization, turning it into a fast-paced, consumable product. This shift has led to greater standardization and a tendency to design within confined frameworks. As speed became the priority, design diversity declined, resulting in uniform, limited projects. Homes, as the most private spaces for individuals and essential elements of society, have not only been influenced by this trend but also have played a role in driving it forward.

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The lack of diversity and innovation in housing design has resulted in uniform living spaces, which had negative effects during the pandemic. Inadequate indoor and outdoor spaces, lack of isolation areas, and poor ventilation systems in existing housing typologies contributed to the rapid spread of COVID-19. It is essential to reconsider and redesign our residential spaces to mitigate the impact of future pandemics and to promote safer, healthier environments.

Home isolation measures aimed at preventing the spread of the virus, confined individuals to live within the spatial and functional limits of their homes. This study revealed that, as social beings, people cannot fully meet all aspects of daily life in spaces designed solely for shelter. The pandemic exposed the shortcomings of conventional housing, which often fails to support broader living needs beyond basic habitation. The literature review suggests that housing should integrate public spaces, nature, social spaces, and work environments. Architects, academics, and individuals should reconsider housing designs that isolate people from their surroundings. In response to the pandemic, architects have focused on improving the connection between indoor and outdoor spaces, supporting social interaction. Having experienced the constraints of their homes during lockdown, users are now demanding greater functionality and spatial flexibility in new housing designs.

Based on the research findings, the goal is to design a complex, adaptable, flexible, and sustainable living environment that accommodates social interaction, work, rest, learning, and recreation. The proposed design will enable individuals to interact with their environment, strengthen neighbourly relations, overcome isolation challenges, and connect with nature.

Epidemics are not a new challenge for humanity: they have repeatedly emerged throughout history from the Middle Ages, into the modern era, shaping the history. Despite the likelihood of facing similar crises in the future, architecture, as in the past, must continue to address these challenges while responding to the contemporary needs.

This study has explored the various aspects of the topic, highlighting changes in user needs, issues within current designs, and potential solutions through comprehensive literature review. With the two and three-dimensional visuals it has presented a design concept aimed at offering optimal solutions to the identified challenges. This design proposal is tested in the site within the context; however, it has not yet been implemented and therefore can be categorized as a theoretical, conceptual proposal. It is important to implement and test these and similar design concepts, assessing their economic feasibility are crucial steps to be better prepared for future crisis. This study should be evaluated as a foundation for design discussions within the context of the topic. It is recommended that this project be constructed (potentially in a smaller scale) and tested against user needs, economic factors, security, structural challenges, and other relevant criteria to evaluate practical advantages and disadvantages. The project can be

further developed and disseminated with the feedback received. This study should be considered a foundation for initiating design discussions within the context of the topic.

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What Makes a Space Relatively Memorable? A Study on the Recollection of Spaces through Space Syntax and Imageability Theories

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Abstract

Space is a fundamental component of our existence, without which we cannot live or think. During our daily lives, we perceive various components of space concurrently and we build an understanding of the environment in our memories. The spatial properties/qualities of the environment have their own unique place in this context and have been studied in psychological and several non-psychological disciplines such as architecture, phenomenology, sociology and geography. In this frame, imageability theory focuses on the environment's visuo-spatial quality, whereas space syntax theory focuses on its spatial configuration, and they both enable the systematic evaluation of numerical data.

Starting with the question "What makes a space memorable among all its different components/features?", the research aims to investigate the effect of certain spatial qualities on spatial memory through quantitative research on an architectural scale. Within a multidisciplinary framework, the methodology presents a unique approach that integrates space syntax with memory data. Firstly, content analysis was applied to cognitive maps, and the obtained data were redefined according to the configurational (syntactic) and imageability qualities of the real environment they represent. Secondly, the redefined data was tested to evaluate the effect of spatial qualities on memory. 77 participants (age 23-75; 52M/25F) attended the case study and drew the plan schemas of the school building they graduated from. The relation between memory and (1) spatial units' imageability categories is searched through ANOVA tests, and (2) spatial units' syntactic values is searched through correlation tests. The significant results reveal that configurational and visual qualities of spaces are essential factors on what will be stored in memory depending on their lead of participants' spatial experience routines via their formal qualities. Furthermore, the case study presents multidisciplinary data that contributes to architectural design, environment and behavior, and space syntax theories and provides new insight into cognitive research on memory.

Keywords: *Architectural space, Cognitive map, Imageability, Space syntax, Spatial memory.*

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INTRODUCTION

Kant states that leaving space, time, and causality aside is out of the question in any given context (Akarsu, 1994). “Space” is a fundamental component of human existence that we cannot live or think without. From the first moment of birth, individuals perceive various components of space concurrently and build a total understanding of their environment. Human memory processes and stores various spatial information to maintain a consistent daily life in the environment and make sense of new spaces/spaces to be experienced in the future. However, individuals do not remember every place they have been or all the components of the places they remember. Then, what makes one place more memorable than others? Is it its components such as structural elements and plants, or users, features such as color, sound, temperature, or the events experienced there? Although all of these possible factors have been investigated separately within the scope of different research disciplines, still not enough clear findings have been presented as to why and how a space is recalled or unrecalled.

In this frame, three research fields come to the fore as they present valuable findings on how people's minds relate to places. Cognitive map research has presented valuable findings about participants' experiences, perceptions, and memories of their environment, mostly its configurational and formal qualities. On the other hand, imageability and space syntax theories have offered systematic evaluations of the built environments' physical qualities, configuration, and form and their relation to their users' social lives and perceptions. In tandem, the interdisciplinary findings obtained in these three fields offer researchers different perspectives to argue human-place relations through the lens of memory. Inspired by this observation, this study is structured on a multidisciplinary framework based on memory, cognitive map, imageability, and space syntax theories.

Starting with the question "What makes a space relatively memorable?", this study aims to systematically investigate the effect of specific qualities of spaces on memory by applying two well-known spatial analysis methods, space syntax and imageability, to memory research. In this context, the theory section presents the dynamics of human memory in regard to spatial information, the cognitive map concept, Lynch’s imageability theory and space syntax theory with the inclusion of related current research. The following sections present case study and methodology, results, discussion and conclusion.

THEORY

The transformative nature of memory

According to cognitive theories, every kind of information about the environment is data coded and stored in memory, which has been attributed with a meaning. The selective operations process these data, and only several components of that information are coded/stored to be recalled by memory (Smith & Kosslyn, 2014; Goldstein, 2011). Besides,

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memory has a transformational nature (Smith & Kosslyn, 2014; Nadel et al., 2008), and the coded information is not always the same as the recalled information. In unsuccessful recalls, the memories can be transformed, thwarted, or replaced with the effect of misleads (Goldstein, 2013) or affected by prejudice, misattribution, and infusion (Smith & Kosslyn, 2014); or the performance of memory may change by human factors (Rubin et al., 1999; Levine et al., 2002; Grysman & Hudson, 2013). Individuals tend to recall more number experiences if they repeatedly occurred (Wagner, 2006; Evans et al., 1981; Schouela et al., 1980), happened more recently (Rubin & Schulkind, 1997a), or belong to early adulthood and late adolescence, both under the effects of social and personal factors (Rubin, 2000; Levine et al.,2002; Piolino et al., 2009; Piolino et al., 2010; Conway & Pleydell-Pearce, 2000; Pillemer, 2001; Rubin et al., 1986). For instance, emotions serve as contextual cues for episodic memories (Allen et al., 2008; Reisberg & Hertel, 2003), and events that caused significant emotional responses are recalled in more detail (Goldstein, 2013; McGaugh, 2008). Moreover, the coding and recalling processes such as rehearsing, sharing, recurring, or replaying memories through thinking or talking lead to better recalling (Nelson, 1993; Nelson & Fivush, 2004; Piolino et al., 2009; Fivush, 1988).

Spatial information in memory and cognitive maps

Spatial information mostly derived from the visual perception of relatively constant, stable, and predictable environmental elements (walls, roads, trees, buildings) and has a formal reciprocity with them, whereas elements open to change and interpretation (wind, sound, people, animals) are omitted (Nadel et al., 2008). Similar elements and in-between relations in different environments support differentiating the spatial information and defining the context correlatively. Based on these basic qualities, it is possible to re-experience and re-consolidate the contextual information acquired from the environment, as opposed to the arbitrary/abstract conceptual information (Cooper & Lang, 1996; Nadel et al., 2008; Talarico, 2009).

The prementioned differentiations in memory are also valid for spatial/environmental information. Research indicates that the spatial scale and content of memories were found to change between children and adolescents depending on their relationship and dependence on their parents (Chawla, 1992). Memories that have more intense emotional effects include more number of perceptual (visual or auditive) and conceptual (time, place) details (Comblain et al., 2005); and individuals recall the places where they are informed/heard about an important public event more easily than the other places as an outcome of their raised feelings (Bauer et al., 2012; Brown & Kulik, 1977). On the contrary, in some cases spatial memories are not affected by manipulations towards episodic memory, and the spatial context is not transformed in the process of recalling (Nadel et al., 2008).

Apart from cognitive theories, the memory of spaces is argued via cognitive map concept in environment and behavior theories. Cognitive map theory is based on the schema concept in developmental psychology (Hart & Moore, 1973). Starting from infancy, human beings build up schemas in their minds through experience by collecting information about the world. These schemas are continuously formed, enriched with abstract thoughts and symbols after early adolescence, and reach an extensive content and complexity in adulthood (Norberg-Schulz, 1971). As a form of schema, cognitive maps include spatial information in a unique structure that develops over topological relations, and they have a web-like form in which every point is connected to the other (Kuipers, 1978; Penn, 2003; Long et al., 2007). Every cognitive map is unique, schematic, sketch like, unfinished, deformed, simplified, and open to change (Downs & Stea, 1973; Kaplan, 1973; Zimring & Dalton, 2003). For instance, complex configurations can deteriorate cognitive maps (Moeser,1988), and simple configurations are more legible and lead to more effective cognitive maps (Wang et al., 2019; O'Neill, 1991). In addition, they strengthen and organize memory and work as a solid lead to recall episodic memories (Gattis, 2001). Above all, they provide general information about the world and are requisite for human survival (Kaplan, 1973). Sketch maps presenting a previously experienced environment in drawing represent the cognitive comprehension of that environment and have been evaluated as the actual representation of a cognitive map on paper (Canter, 1977). In literature they are termed as cognitive maps (Tarcin Turgay et al., 2015; Karakus, 2007; Milgram 1972; Downs & Stea, 1973; Tuncok Sariberberoglu & Unlu, 2018; Sudas & Gokten, 2012) or mental maps (Tuan, 1975; Saarinen, 1988) by many researchers. Similar to spatial memory, every component of these sketch maps is reciprocal to a component or quality of the environment. Their ratios, scales, forms, contents, and drawing qualities differ depending on the participant's skills, but they still include valuable data about how an individual perceives and represents the environment (Haq & Girotto, 2003; Kim & Penn, 2004). Lynch (1960) has significantly contributed to the acceptance of the sketch map technique as a scientific method to analyze environmental elements and humans' perception of them for both architectural and urban research areas via his “imageability” theory (Göregenli, 2010).

Imageability

Lynch’s (1960) "imageability" concept is based on the qualities of environmental objects that give them a high probability of evoking a strong image in a perceiver. He focused on the visual qualities and stated that objects' shape, color, or arrangement facilitates vivid, powerful, and useful mental images. This powerful image ensures convenience in perception and priority and detail in recalling. Then, according to their goals, individuals structure a total environmental image focusing primarily on the ones that present potent images. During research Lynch

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asked the participants to draw a sketch map of their city and analyze which elements strongly shape an urban area's image in mind. According to the results, he defined five categories of urban elements based on their visual and formal qualities: paths, edges, districts, nodes, and landmarks. Paths are the movement axes that people use for going from one place to another; they are mostly predominant and arranged and relate to other urban elements. Edges are linear boundaries or breaks in continuity that work as lateral references; they are used for gathering generalized areas that could be penetrable or seamed. Districts are medium-to-large scaled, two-dimensional areas that have their own identity and significant inside-outside differences. Nodes are some strategic spots or symbolic areas that participants can enter, like the intersection points of transportation axes, a crossing of paths, and shifting points in which a function or symbol is condensed. Finally, landmarks are external reference points like buildings, signs, towers, or stores that fill the environmental image of the participants. Lynch theorized that an urban area is legible if its components can be easily identified and organized into a coherent pattern, and this pattern is structured with the synchronic and relational existence of elements belonging to all five imageability categories. This theory regarding the five basic urban element categories has been widely accepted and used by much urban research since (Al-Kodmany, 2001; Charles & Sorenson, 1985; Ökesli & Gürçınar, 2001).

There is an apparent distinction between architectural and urban spaces. First of all, cities are extensive in scale and can be perceived in more extended periods than buildings. Architectural spaces have continuous boundaries separating the inner space from the outer space and significant entrance points that transmit the user between them. On the other hand, urban areas have more porous boundaries defining an edge by combining multiple elements and several transition points serving as entrance points. Therefore, individuals always started to experience a building/a floor from its entrance point and move on to its other units. This movement is directed by and limited to the topological relations of the indoor spatial system, basically the adjacency and range of each unit. Despite these apparent differences, both cities and architectural objects are constructions in space (Lynch, 1960); therefore, architectural spaces can also be evaluated within imageability theory. Following that, Hunt (1985) argued the imageability of buildings and suggested a learning strategy that can enhance that, even in existing buildings. Danielsson (2005), on the other hand, argued for imageability in office environments to understand how employees perceive and use their office from a psychological perspective. Sachs (1999) also implemented Lynch's element categories to a school campus and defined the café and small theatre as landmarks and repetitious elements (like classrooms and family suites) as routes. Similarly, Lacanna et al. (2019) focused the design elements on a hospital layout and categorized corridors as paths, health zones as districts, zone boundaries as edges, intersection of paths as nodes, and architectonical/artistic elements as

landmarks. Finally, Akan (2017) searched the effect of spatial configuration on participants' behavior and cognition in elderly institutions and categorized rooms as zones, commonly used spaces as landmarks, and corridors as roads.

Moreover, imageability categories are all strongly related to the spatial configuration of the city besides their visual qualities (Lynch, 1960; Charles & Sorenson, 1985; Todor et al., 2022; Abeynayake, 2022), which leads to an intersection between imageability and space syntax theories.

Imageability, cognitive maps and space syntax

Space syntax is a social space theory based on the configuration concept (Hillier, 2007). It divides spaces into two-dimensional units (convex space, axial line, isovist) and provides numerical equivalents of various relations between them. This enables the systematic evaluation of a configurational system or comparison of different systems with different scales and geometries via their configurational characteristics (Turner et al., 2001). In convex map and axial map analysis, the configuration can be transformed into "justified graphs" in which every unit is represented by a node, every connection between two nodes is represented by a line, and all nodes are organized relative to the defined root node (Bafna, 2003). Here, each connection between two nodes is regarded as a unit of depth, the primary measure of space syntax. The least number of connections between two nodes is the depth of one according to the other, and the number of connections of a node from a root node is its depth value in the configurational system. The sum of the depth values of each unit relative to the root node in a justified graph is the total depth value of the layout according to its defined root node (Hillier, 2007). The mean depth value is calculated by dividing the total depth value to the total number of nodes in the configurational system (Peponis & Wineman, 2002). This value represents the degree of accessibility of a layout independently of the number of nodes in it, and enables the accessibility values of different spatial systems, and therefore their syntactic structures, to be compared. Mean depth is inversely proportional to integration, the basic accessibility measure of space syntax. Therefore, a less integrated spatial system will have higher accessibility, while a more integrated system will have lower accessibility.

Dalton and Bafna (2003) have suggested that space syntax offers a sense of hierarchy to imageability elements, where paths could be regarded as axial lines, nodes as their intersections, and districts as intersecting paths with specific qualities. Research showed that landmarks are mostly located where they could be perceived from integrated paths with distinctive isovist areas (Dalton & Bafna, 2003; Güngör & Harman Aslan, 2020), streets with higher integration values are also significant paths in cognitive maps (Penn, 2003; Güngör & Harman Aslan, 2020), and the most significant nodes are usually located on the

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most integrated streets (Güngör & Harman Aslan, 2020), and have higher circularity values (Turner et al, 2001). Similarly, both the major landmarks, major nodes and paths of the city are mostly located at points with integration values well above the city average (Topcu et al., 2021).

Similar to imageability categories, some aspects of spatial cognition are implicit in space syntax as it investigates legibility, orientation, and wayfinding (Penn, 2003; Canakcioglu & Unlu, 2025). For instance, Long (2008) questioned the relationship between imageability categories and their configurational qualities. He correlated the frequency and accuracy of imageability elements drawn in cognitive maps with their syntactic values, and found a positive association between their cognitive representation and spatial configuration (global integration, local integration, and connectivity) values. Within the close period, some other research evaluated a different perspective and compared sketch maps' syntactic values and the spaces they represent. Kim and Penn (2004) and Zheng and Weimin (2011) implemented axial map analysis on cognitive maps and found that the configurational qualities of cognitive maps and the real environment are significantly similar. From a different perspective, Canakcioglu (2015) correlated the frequency of spaces in children's cognitive maps with their syntactic values and found a significant relationship between them.

The summarized literature shows that imageability and space syntax research's primary concerns are perception and cognition. However, both perception and cognition are cognitive operations that operate concurrently with and foster memory. From this perspective, literature on imageability also indicates that configurational and visual qualities are primarily perceived, coded, and stored in memory as they are significant aspects of cognitive maps. In addition, space syntax literature presents that, besides the imageability approach, it can also be regarded as a relatively new and effective tool for analyzing memory through cognitive maps. However, the literature does not provide evaluations that discuss how memory is affected by environmental factors despite the appropriate tools that have been generated within research. On the side, the memory literature strictly focuses on the participants' minds and does not concern the effects of the environmental elements or qualities on what is recalled or unrecalled. The lack of perspective across multiple fields has resulted in the absence of an approach examining the environment's effects on memory.

This study intends to bridge this apparent gap by combining previously presented tools and theories and to propose a new systematical method for memory researchers. Focusing on architectural scale, two primary research questions were specified: (1) "What makes an architectural space memorable among all its multiple components/characteristics?" and (2) "Can we reveal any spatial characteristic's effect on memory quantitively?". To address these inquiries, this study aims to systematically investigate the effect of specific qualities of an environment on human memory, and with a new

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approach, a unique methodology that adapts space syntax and imageability research tools to cognitive map analysis is proposed.

CASE STUDY AND METHODOLOGY

A simple methodology inspired by cognitive map theory and space syntax tools is designed to search for the effect of specific visuospatial qualities of architectural spaces on memory. To be more precise, measures derived from space syntax and imageability analyses have been instrumentalized to search the effects of configurational and visual qualities of an environment on its recall in cognitive maps. On the other hand, human factors such as age, gender, emotion, and recalling process are purposely left out of the scope to focus on the spatial factors on memory more clearly, even though preliminary studies indicated a strong relationship between spatial memory and human factors (Chawla, 1992; Bauer et al., 2012; Tarcin Turgay & Unlu, 2017). In this frame, this section presents the case study's participants, selected environment, and the proposed methodology in detail, respectively.

Participants

The case study is conducted with adults who were educated in the building of İstanbul Male High School. An average of 150 students have graduated from İstanbul Male High School annually since 1936. To rule out recent graduates' advantage on recall, the bottom age value is specified as 23 (the college graduation age) (Rubin & Schulkind, 1997a; Rubin, 2000), and to rule out the disadvantage of elderliness the top age value is limited to 75 (Old & Naveh-Benjamin, 2008; Hasher & Zacks, 1979). Approximately 7950 graduates were found to be in the age range. The case study includes 77 participants between the ages of 23 and 75 (25F/52M; M= 46.35, SD:1.579), that corresponds to the %0.96 of this target population and presents a generic frame of adulthood.

Case Study Environment

Research asserted that past experiences are recalled more and better if they occurred recently (Piolino et al., 2002; Rubin & Schulkind, 1997a), repeatedly (Wagner, 2006; Evans et al., 1981; Schouela et al., 1980), or in a certain period of life (Rubin, 2000; Levine et al.,2002; Piolino et al., 2009; Conway & Pleydell-Pearce, 2000; Pillemer, 2001), such as personal milestones (Conway & Pleydell-Pearce, 2000), or personally important events (Conway & Pleydell-Pearce, 2000). The middle and high school buildings experienced during adolescence, which is a turning point in life and where many important personal events take place, stand out as one of the public spaces promoting all these memory advantages. Accordingly, Istanbul Fatih (Male) High School, a historic educational institution, is selected as the case study environment (Figure 1 and 2).

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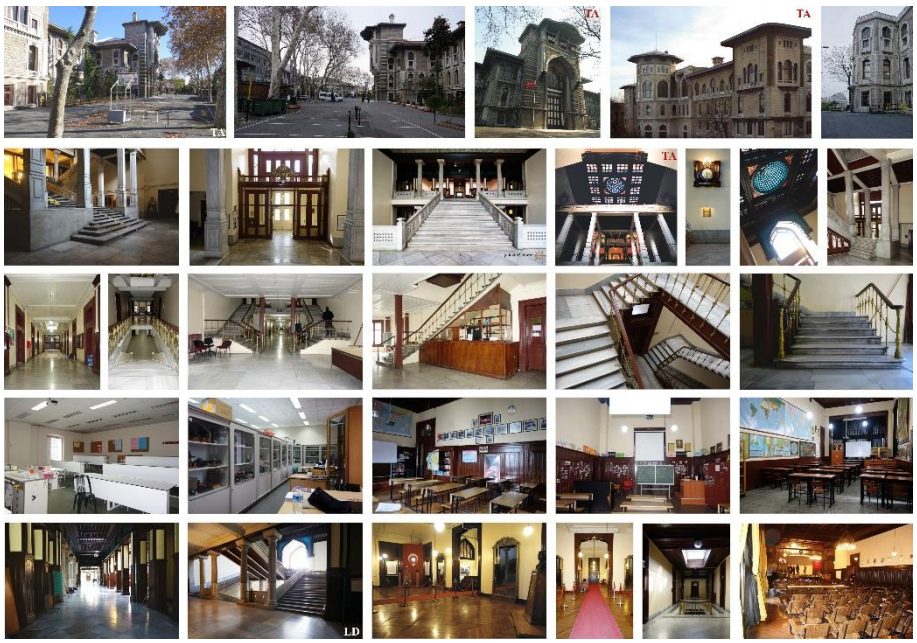
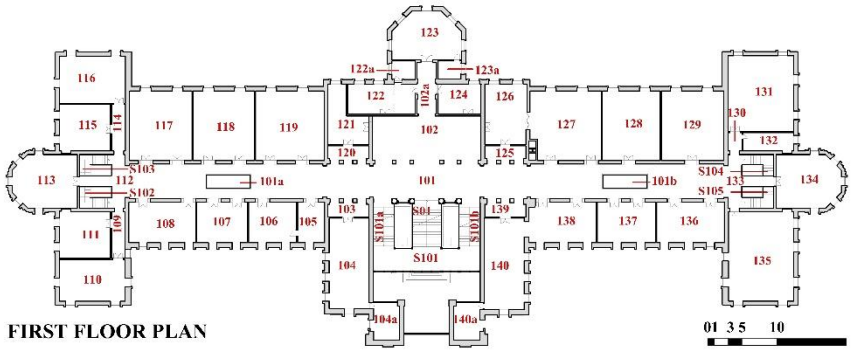
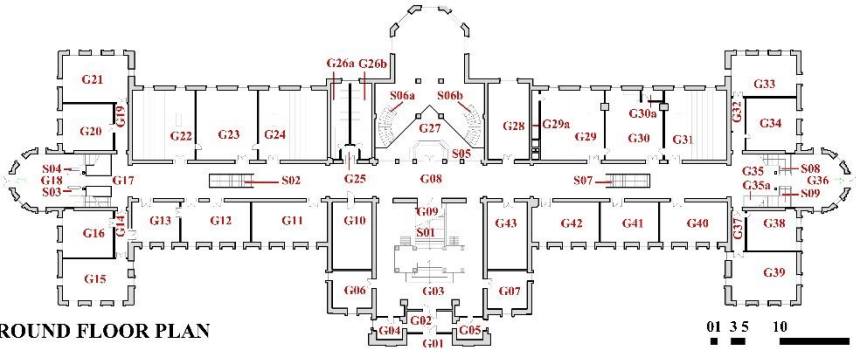


Figure 1. Visuals from the building (Photographs by the authors; Tansel Atasagun (TA) and Levent Deniz (LD).



ZONE LIST

101 Main Corridor	106 German Room	115 Classroom	123 Princ. Office	131 Classroom	140 Teachers' Room
101a Gallery -1	107 Classroom	116 Classroom	123a Princ. WC	132 Elec. Room	140a Teachers' Room
101b Gallery -2	108 Classroom	117 Classroom	124 Private Secretary	133 Stair Hall	S101 Main Stairs
102 Hall	109 Clas. Corridor	118 Classroom	125 Entrance	134 Classroom	S101a Main Stairs
102a Admin. Hall	110 Classroom	119 Classroom	126 Admin. Room	135 Library	S101b MLanding
103 Entrance	111 Classroom	120 Entrance	127 Classroom	136 Classroom	S102 Tower Stairs -1
104 Classroom	112 Stair Hall	121 German Room	128 Classroom	137 Classroom	S103 Tower Stairs -2
104a Classroom	113 Ass. Princ. Room	122 Ass. Princ. Room	129 Classroom	138 Teachers' Room	S104 Tower Stairs -3
105 Secretary	114 Class. Corridor	122a Ass. Princ. WC	130 Class. Corridor	139 Entrance	S105 Tower Stairs -4



ZONE LIST

G01 Entrance	G10 Safe Room/Museum	G19 Corridor	G27 Canteen (Mezzanine)	G34 Classroom	G43 Photocopy R.	S08 Tower Stairs -3
G02 Windbreak	G11 Classroom	G20 Classroom	G28 Admin. Office	G35 Stair Hall	S01 Main Stairs	S09 Tower Stairs -4
G03 Entrance Hall	G12 Classroom	G21 Classroom	G29 Chemistry Clas.	G36 Entrance Hall	S02 Corridor Stairs -1	
G04 Admin. Office	G13 Classroom	G22 Physics Clas.	G29a Storage	G37 Corridor	S03 Tower Stairs -1	
G05 Admin. Office	G14 Corridor	G23 Physics Lab.	G30 Chemistry Clas.	G38 Classroom	S04 Tower Stairs - 2	
G06 Admin. Office	G15 Classroom	G24 Physics Clas.	G30a Storage	G39 Classroom	S05 Canteen Stairs -1	
G07 Admin. Office	G16 Classroom	G25 WC Entrance	G31 Chemistry Clas.	G40 Classroom	S06a Canteen Stairs -2	
G08 Main Corridor	G17 Stair Hall	G26a WC	G32 Corridor	G41 Classroom	S06b Canteen Stairs -2	
G09 Tea House	G18 Entrance Hall	G26b WC	G33 Classroom	G42 Classroom	S07 Corridor Stairs -1	

Figure 2. Plan drawings and zone lists, ground-floor and first-floor.

The building has a rectangular form of 24 meters to 106 meters, which expands to 48 meters to 120 meters with corner towers. Its symmetrical plan schema is defined by a main corridor parallel to the long edge of the building and two vast halls (entrance and main) that intersect with it at the center. There are classrooms, laboratories, wet cores, administrative rooms, and a conference hall lining up on both sides of the main corridor. The tower is used as a canteen on the ground-floor, administrative offices on the first-floor, and a lounge room on the second floor. At the two ends of the main corridor, there are stair halls on the ground-floor and octagonal classrooms on the first and second floors. Inside the four towers on the corners are two classrooms, an electrical room, and a library. There are two symmetrical gallery holes on the ground, first and second floors. The case study is conducted over the areas most used by students: the ground-floor and the first-floor (Figure 2).

Methodology

The procedure consists of four steps: (1) Generation of convex maps of each floor, (2) definition of configurational and visual measures via (2a) syntactic and (2b) imageability analysis of each floor, (3) data collection, (4) data generation and analysis according to the defined measures, and (5) statistical evaluation tests.

Step 1_Generating convex maps: Each floor plan schema is divided into convex spaces considering both the configuration and functional program of the building, regarding the fact that participants experience and give meaning to these spaces via both (Figure 3). In the following steps, each convex space is considered and expressed as a *node*.

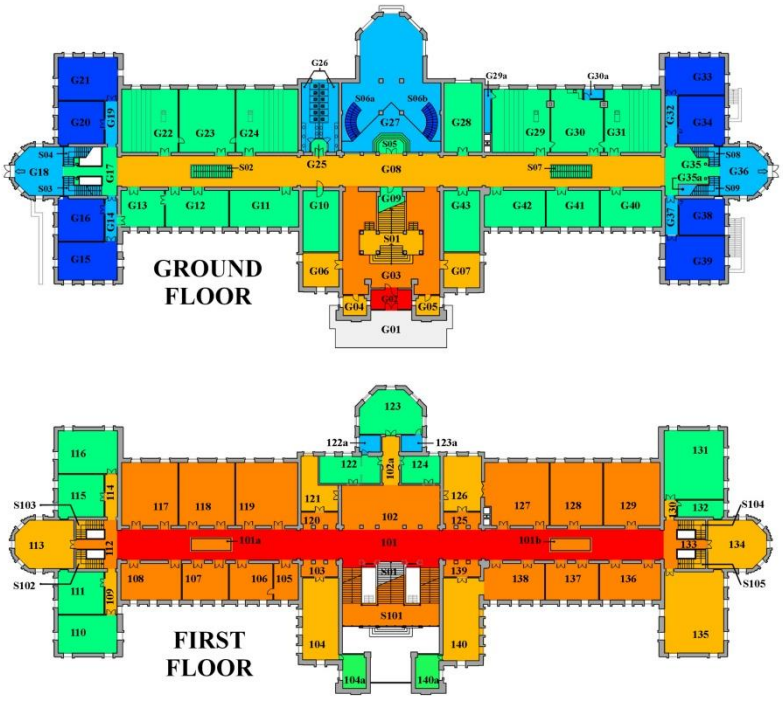


Figure 3. Convex maps presenting the convex space borders of each node (Colors are applied in accordance with Figure 4).

Step 2_Definition of measures: The configurational and visual measures are derived from two separate analysis.

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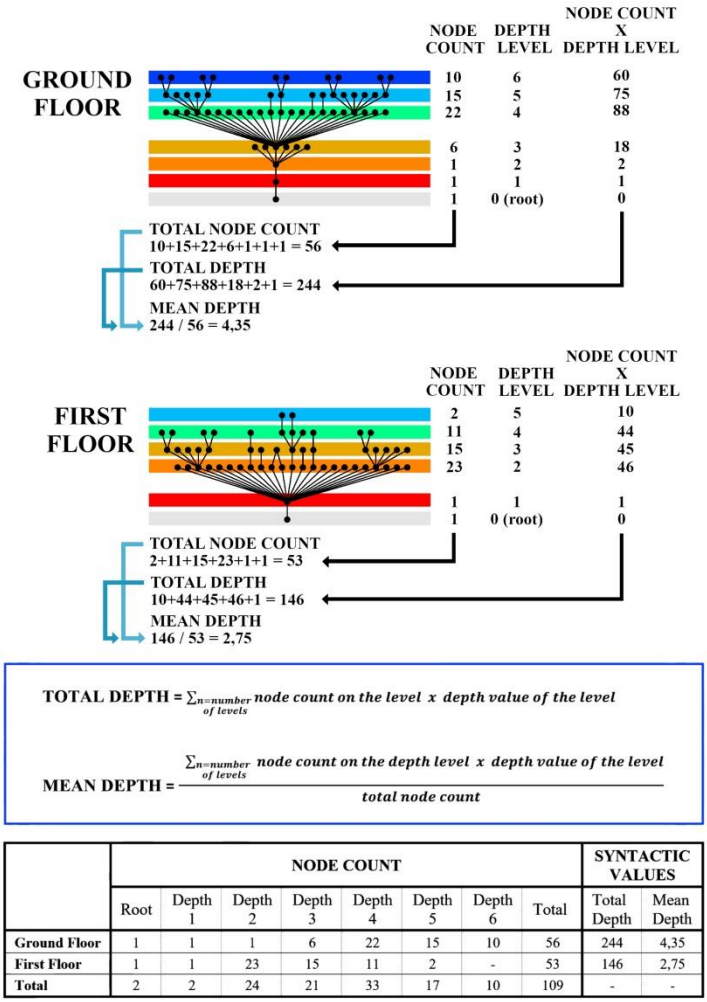
Step 2a_Generating configurational measures through syntactic analysis: Each floor's justified graphs are generated according to the convex maps. In these graphs every convex space is regarded as a syntactic node, and root nodes are identified as the entrances to the floor (G01 & S01). Then, each node's depth value is calculated as the number of connections between that node and the root node (Figure 4).



$$\text{TOTAL DEPTH} = \sum_{\substack{n=number \\ of\ levels}} \textit{node count on the level} \times \textit{depth value of the level}$$

$$\text{MEAN DEPTH} = \frac{\sum_{\substack{n=number \\ of\ levels}} \textit{node count on the depth level} \times \textit{depth value of the level}}{\textit{total node count}}$$

	NODE COUNT								SYNTACTIC VALUES	
	Root	Depth 1	Depth 2	Depth 3	Depth 4	Depth 5	Depth 6	Total	Total Depth	Mean Depth
Ground Floor	1	1	1	6	22	15	10	56	244	4,35
First Floor	1	1	23	15	11	2	-	53	146	2,75
Total	2	2	24	21	33	17	10	109	-	-

Figure 4. Justified Graphs presenting the syntactic analysis (Colors are applied in accordance with Figure 3). Syntactic formulas. Table presenting the distribution of node counts in each depth level, and syntactic values for both floors.

According to the justified graphs the ground-floor has six depth levels and 56 nodes, and the first-floor has five depth levels and 53 nodes (Figure 4). Both floors have only one node on the second depth level. However, most of these nodes belong to the fourth and fifth depth levels on the ground-floor, and the second and third depth levels on the first-floor (Figure 4). This is mainly due to the windbreak and the main hall in the ground-floor entrance that moved the ground-floor main corridor from the first depth level to the third, forming a deeper system. Two floors present two significantly different syntactic systems despite their node counts and depth levels being close to each other. Accordingly, first-floor's total depth and mean depth values (146; 2,75) are significantly lower than the ground-floor's (244; 4,35). This proves that the ground-floor has a less accessible, less integrated, and consequently more complex configurational system than the first-floor.

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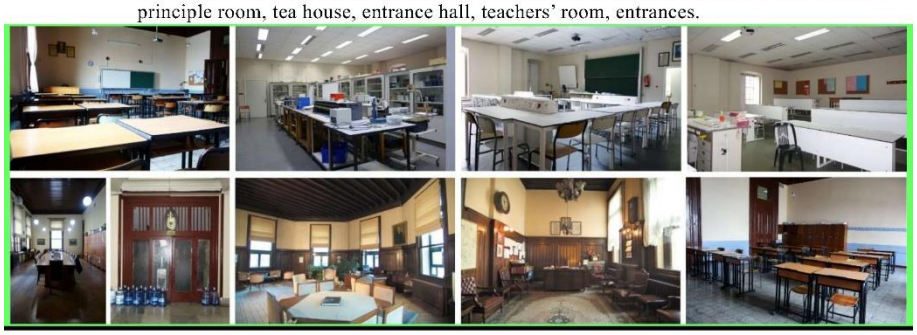
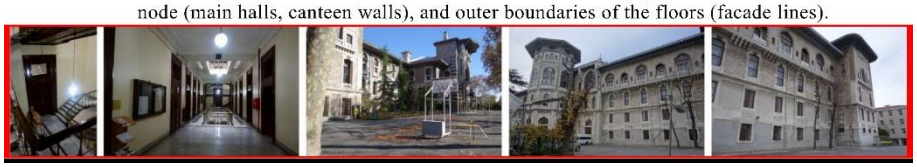
Step 2b_Generating visual measures through imageability analysis: Every node's imageability category is defined according to Lynch's classification. In addition to the nodes, 8 edges are defined for the ground-floor (long edges of the main corridor, the canteen's outer wall, walls that frame the three exit doors, the boundaries of the main hall, and the facade line of the whole floor) and 6 edges are defined for the first-floor (long edges of the main corridor, short edges of the main corridor, boundaries of the main hall and façade line of the whole floor). Table 1 presents how the categories are introduced to architectural scale via the visual, spatial, figural, formal and functional qualities. Figure 5 shows each node's and element's category on the floor plans. According to the analysis, there are 23 paths, 66 districts, 9 nodes, and 11 landmarks in total, and their distribution is quite similar for both floors (Figure 5).

Table 1. Adaptation of imageability categories to the case study space (Photographs by the authors; Tansel Atasagun (TA) and Levent Deniz (LD))

Paths:	The horizontal and vertical circulation axes, corridors, and stairs. 
Districts:	Spatial units/areas that are enclosed with walls and have a significant identity defined by its function, as classroom, laboratory, canteen, toilet, storage, administrative room, assistant principle room, tea house, entrance hall, teachers' room, entrances. 
Nodes:	Spatial units/areas that are strategic as an entrance/exit to the building, as a crossing of paths, or with their significant function and visual character: halls, canteen, octagonal entrance halls, library, octagonal classrooms. 
Landmarks:	Spatial elements that serve as reference points have unique visual characteristics - depending on their shape, scale, material, and color- and are visible from many distances: main stairs, canteen stairs, corridor stairs, windbreak, museum, photocopy room and galleries. 
Edges:	The wall lines that define long planar borders (corridor walls), endings for a continuous movement (corridor walls, corridor ends, entrance hall walls), boundaries of a significant node (main halls, canteen walls), and outer boundaries of the floors (facade lines). 

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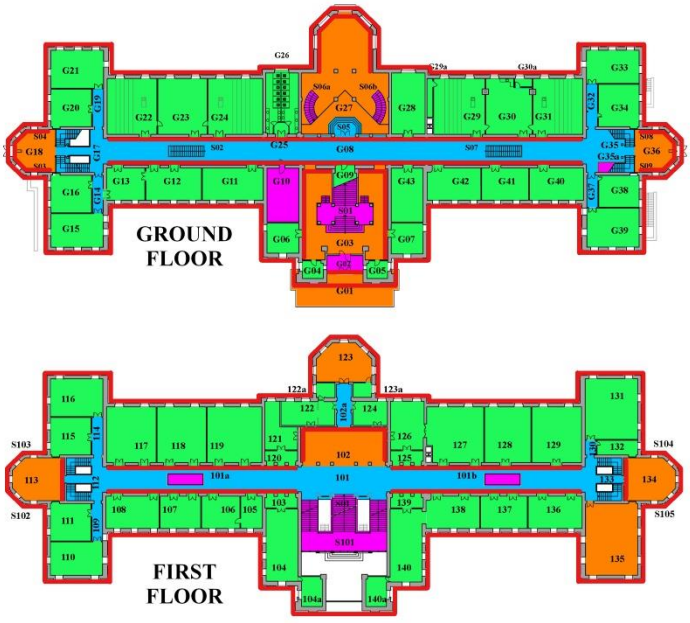

Paths
Districts
Nodes
Landmarks
Edges

	Ground Floor	First Floor	Total
Paths	12	11	23
Districts	32	34	66
Nodes	4+1(G01)	4	9
Landmarks	7	3+1(S01)	11
Edges	8	6	14
Total	63	58	123

Figure 5. Convex maps presenting the imageability category of each convex space. Table presenting distribution of convex space counts in each category.

Step 3_Data collection: The participants were asked to 'draw the plan schema of the ground-floor and the first-floor respectively, in a maximum of 10 minutes for each drawing' in face to face interviews (77+77=154 cognitive maps[1]). All cognitive maps presented different characteristics in their drawing techniques of spatial units (Figure 6).

[1] The term cognitive map is preferred depending on the scope's relation with cognitive theories.

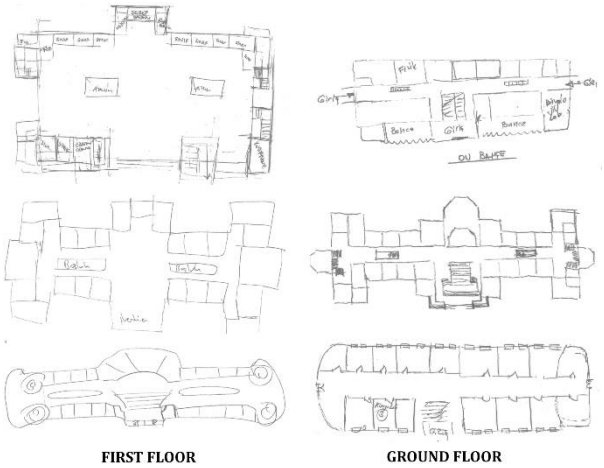

Figure 6. Sample Cognitive Maps (First-floor: F/34, M/41, M/29; Ground-floor: M/72, M/31, M/61)

Step 4_Data generation and analysis according to the defined measures: Due to the significant variation in the number of nodes/elements at each depth level and category in the real floor plans, nodes' appearance counts are not appropriate for a correct evaluation and comparison. To generate

comparable numerical data, the appearance rate of each measure is derived from a data transformation process (Figures 4 and 5). The process is designed on the assumption that the appearance of each node in cognitive maps corresponds to the appearance of its depth value (Step 2a) and its imageability category (Step 2b). Accordingly, the appearance count of nodes and elements is regarded as the appearance count of syntactic depth levels and imageability categories over this correspondence. For instance, G02 windbreak was drawn by 17 participants, and this caused the appearance counts of the second depth level and the landmark category to increase by 17. Consequently, the appearance rate of each measure is derived as follows:

First of all, each cognitive map is analyzed through content analysis, and the appearance of each node and element in all cognitive maps is counted. Based on those counts, **the appearance count** of **(a) each depth level** is derived from *the sum of the appearance count of nodes on that level*, and **(b) each imageability category** is derived from *the sum of the appearance count of nodes/elements on that category* (Figure 7). Secondly, the **maximum potential appearance count** in the condition where each node or element is drawn by all participants is calculated by *multiplying the total number of participants by the total number of (a) nodes on the same depth level and (b) nodes/elements in the same category*. Finally, the **appearance rate** of each depth level and each imageability category are calculated by *dividing the appearance count to their maximum potential appearance count*.

CALCULATIONS ON CONFIGURATIONAL MEASURES
(FOR EACH DEPTH LEVEL)

$$\textbf{appearance count} = \sum_{n=77} \begin{matrix} \text{appearance count of nodes on the same depth level} \\ \text{in a cognitive map} \end{matrix}$$

$$\textbf{maximum potential appearance count} = \text{count of nodes on the same depth level in the floor plan } \boldsymbol{X} \text{ count of participants}$$

$$\textbf{appearence rate} = \frac{\text{appearance count}}{\text{maximum potential appearane count}}$$

CALCULATIONS ON VISUAL MEASURES
(FOR EACH IMAGEABILITY CATEGORY)

$$\textbf{appearance count} = \sum_{n=77} \begin{matrix} \text{appearance count of nodes and elements} \\ \text{in the same category} \\ \text{in a cognitive map} \end{matrix}$$

$$\textbf{maximum potential appearance count} = \text{count of nodes and elements in the same category in the floor plan } \boldsymbol{X} \text{ count of participants}$$

$$\textbf{appearence rate} = \frac{\text{appearance count}}{\text{maximum potential appearane count}}$$

Figure 7. Formulas for calculating appearance rate of depth levels and imageability categories

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Step 5_Statistical evaluation tests: The relation between the configurational characteristics and spatial memory is searched statistically via a correlation test between the nodes' depth values and appearance rates. In addition, the relation between visual characteristics and spatial memory is evaluated via One-Way ANOVA test between imageability categories and their appearance rates (Figure 8).

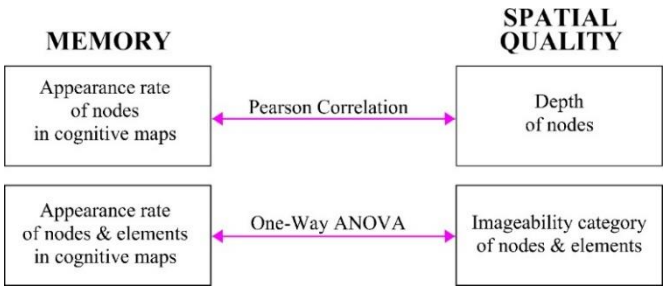

Figure 8. The correlations searching the relation of spatial memory to configurational and visual characteristics of nodes and elements.

FINDINGS AND RESULTS

The case study is conducted with 154 (77 ground-floor + 77 first-floor) cognitive maps. Four problematic areas that arose from expectable conflicts, such as human factors (age), spatial factors (the difference between floor schemas, building renovations, and space functions), and the study procedure are confirmed and evaluated as follows:

1. The first-floor is recalled more accurately than the ground-floor. This is interpreted over two factors. Firstly, the procedure in which the participants drew the ground-floor in the first order (a) raised the length of the recalling period of the first-floor and (b) enabled all participants to use the ground-floor map as a base in mind for the first-floor map. Current research indicates that replaying first-floor plan memory through thinking during the ground-floor plan drawing may lead to more accurate first-floor cognitive maps (Nelson, 1993; Nelson & Fivush, 2004; Piolino et al., 2009). Secondly, the entrance spaces on the ground-floor caused that floor to have a more complex configurational system than the first-floor. Based on previous research it is interpreted that the higher level of complexity of the ground-floor has led to the construction of more distorted cognitive maps that are likely to be less effective and less legible due to their lower compatibility with the actual layout (Moeser,1988; Wang et al., 2019; O'Neill, 1991).
2. 13 participants partially confused the ground-floor with the first basement floor, and 26 participants draw corridor and two classrooms on the second-floor instead of the library on the first-floor. Compatible with current research indicating memories can be transformed, thwarted, or replaced through various leads (Nelson, 1993; Goldstein, 2013) or human factors (Rubin et al., 1999; Levine et al., 2002; Grysman & Hudson, 2013; Smith & Kosslyn, 2014) these confusions are regarded as recall deficits at the target floor plan. Based on that, the first basement floor spaces represented (via naming) on the ground-floor, and the three extra spaces (a corridor

and two classrooms) represented instead of library are ignored and left out of the data.

3. 18 participants drew two classrooms, G38 and G39, as one space representing their common functional feature (biology lab, geography lab). The unrepresented spaces (with lines or writing) are regarded as a recall deficit and not included in the data.
4. Some participants represented laboratory G23 and classrooms G22 and G24 on its sides as one space. Similarly, some participants represented laboratory G30 and classrooms G29 and G31 on its sides as one space. These are regarded as a recall deficit and the three spaces are acknowledged as one total space in the data.

The most and the least represented nodes in cognitive maps are strong factors over the results. The most represented nodes are the first-floor corridor 101 by 77 participants, the ground-floor corridor G08 by 76 participants, the main hall G03 by 76 participants, and the classrooms 108, 117, 129 at the end of the first-floor corridor by 72/73 participants. In contrast, the upper canteen stairs, S05, and the additional entrance halls in front of the classrooms/toilets, G25, 103, 120, 125, 139, are the least represented ones (less than 4 participants), followed by the tea house, G09, represented by 10 participants. On the side, the private toilets, 122a, 123a; and classroom storages, 104a, 140a, G29a, G30a, were not represented in any cognitive map (See Figure 2 for the node locations).

Analysis on configurational characteristics

107 nodes are evaluated in total, and the root nodes of both floors are left out of the data. Nodes 122a, 123a, G29a, G30a at the fifth depth level, and nodes 104a and 140a at the fourth depth level had not appeared in any cognitive map. The most appeared nodes were G02 ($AC^{(2)}$: 17) and 101 (AC: 77) for the first depth level; G03 (AC: 76), 117 (AC: 73) , 108 (AC: 72), 129 (AC: 72) for the second depth level; G08 (AC: 76) and S01 (AC: 62) for the third depth level; 123 (AC: 69) and 122 (AC: 62) for the fourth depth level; G27 (AC: 61), G36 (AC: 56) and G18 (AC: 53) for the fifth depth level and G33 (AC: 47) for the sixth depth level.

The appearance rate of depth levels in ground-floor cognitive maps did not change respectively between the levels (Figure 9, Table 2). The highest appearance rate of the second depth level is %98,70 due to the recall count of G02. It is followed by the third depth level with %52,16, the fourth depth level with %47,34, the sixth depth level with %43,12, and the fifth with %40,17. Finally, G01, the only node at the first depth level on the ground-floor, was recalled only by %22,08 of the participants.

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Table 2. Configurational data

	Depth Value	Count On Layout	Appearance Count	Maximum Potential Appearance Count	Appearance Rate
Ground- floor	1	1	17	77	**22,08**
	2	1	76	77	**98,70**
	3	6	241	462	**52,16**
	4	22	802	1694	**47,34**
	5	15	464	1155	**40,17**
	6	10	332	770	**43,12**
First-floor	1	1	77	77	**100,0**
	2	23	1053	1771	**59,46**
	3	15	658	1155	**56,97**
	4	11	455	847	**53,72**
	5	2	0	154	**0,0**
Ground-floor + First-floor	1	2	94	154	**61,04**
	2	24	1129	1848	**61,09**
	3	21	899	1617	**55,60**
	4	33	1257	2541	**49,47**
	5	17	464	1309	**35,45**
	6	10	332	770	**43,12**

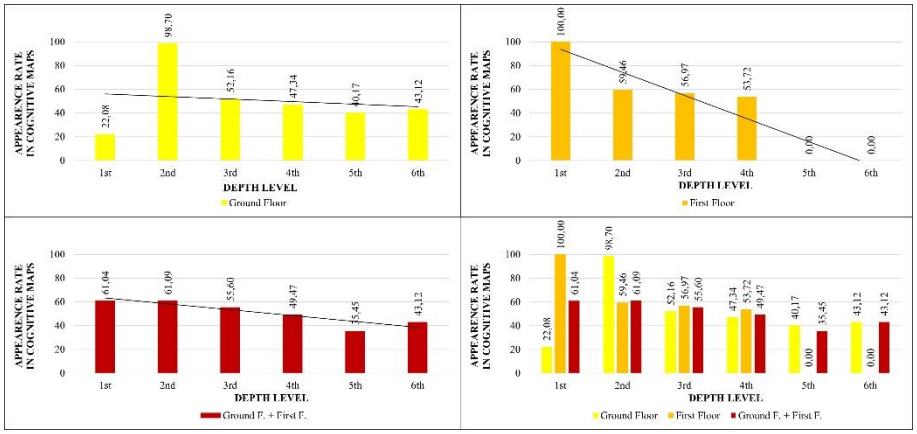

Figure 9. Appearance rate distribution graphic of depth levels.

On the other hand, the appearance rate of nodes on the first-floor declines respectively from the first depth level to the fifth depth level (Figure 8, Table 2). The main corridor 101 at the first depth level was recalled by all participants (%100). Following that, the appearance rate of the nodes at the second depth level is %59,46, the third depth level is %56,97, and the fourth depth level is %53,72. Neither of the participants recalled the two nodes at the fifth depth level.

When the two floors are evaluated together, a fairly regular decrease is observed from the first depth level to the fifth depth level. Nodes at the first two depth levels showed nearly equal appearance rates, 61.04% and 61.09%, although they had pretty different counts in the actual layouts as 2 and 24 (Table 2). Following that, the appearance rate of nodes at the third depth level was 55.60%, and at the fourth depth level was 49.47%, the sixth depth level was 43.12%, and the fifth depth level was 35.45%.

This distribution indicates that the appearance rates of nodes may decrease as the depth level increases, but this change is not linear and shows fluctuations between the two floors (Figure 8). This was

investigated with Pearson Correlation tests between the appearance rate of nodes on a depth level and their defined depth value from the justified graph in Step 2 (Table 3).

Table 3. Pearson correlation between the appearance rate and depth value of nodes

Correlation (Pearson)	**Depth level – Appearance Rate** The appearance rate of each node in cognitive maps	
Ground-floor cognitive maps	r = - 0,149	p = 0,278 > 0,05
First-floor cognitive maps	**r = - 0,304**	**p = 0,028 < 0,05**
Both floors cognitive maps	**r = - 0,292**	**p = 0,002 < 0,05**

As shown in Table 3, the ground-floor correlation test presents an insignificant (p = 0, 278) low correlation (r = -0,149) between the depth values and appearance rates of nodes. On the other hand, the first-floor correlation test presents a medium correlation (r = -0,351) that is significant (p = 0,028) in the 0,05 level. However, the integrated analysis of both floor's data shows that the nodes' appearance rate and depth value have a significant (p = 0, 002) low correlation (r = -0,292) in a negative direction. The significant results indicate that the appearance rate of a node in cognitive maps decreases as the depth of that node increases.

Analysis on visual characteristics

The relationship between the appearance of defined nodes and elements (edges) in cognitive maps and their imageability categories are searched with 121 items (Figure 10, Table 4). The most represented **nodes** were G03 (AC: 76), G18 (AC: 56), G36 (AC: 53), G27 (AC: 61) in ground-floor cognitive maps, and 102 (AC: 58), 113 (AC: 49), 134 (AC: 48) and 135 (AC: 35) in first-floor cognitive maps. The most represented **paths** are G08 (AC: 76) for ground-floor, and 101 (AC: 77) for first-floor. The most represented **edges** are the main corridor walls on the ground-floor (AC: 72), the first-floor (AC: 73), and the main hall walls (AC: 57, AC: 59). Six **districts**, G29a and G30a on the ground-floor, and 104a, 140a, 122a and 123a on the first-floor were not drawn by any participants. On the side, most represented **districts** are 108 (AC: 73), 117 (AC: 73), 129 (AC: 72), 123 (AC: 69), 128 (AC: 68), 136 (AC: 67), 107 (AC: 65), 118 (AC: 64) and 137 (AC: 64) on the first-floor. All of the **landmarks** were represented by less than forty participants in the cognitive maps, except the most represented main stairs S01 (AC: 62) and gallery stairs S07 (AC: 45) and S02 (AC: 46) on the ground-floor.

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Table 4. Visual data

	Imageability Category	Count On Layout	Appearance Count	Maximum Potential Appearance Count	Appearance Rate
Ground-floor	Paths	12	414	924	**44,81**
	Districts	32	1059	2464	**42,98**
	Nodes	4	246	308	**79,87**
	Landmarks	7	213	539	**39,52**
	Edges	8	432	616	**70,13**
First-floor	Paths	11	579	847	**68,36**
	Districts	43	1372	3311	**41,44**
	Nodes	4	190	308	**61,69**
	Landmarks	3	102	231	**44,16**
	Edges	6	350	462	**75,76**
Ground-floor + First-floor	Paths	23	993	1771	**56,07**
	Districts	75	2431	5775	**42,10**
	Nodes	8	436	616	**70,78**
	Landmarks	10	315	770	**40,91**
	Edges	14	782	1078	**72,54**

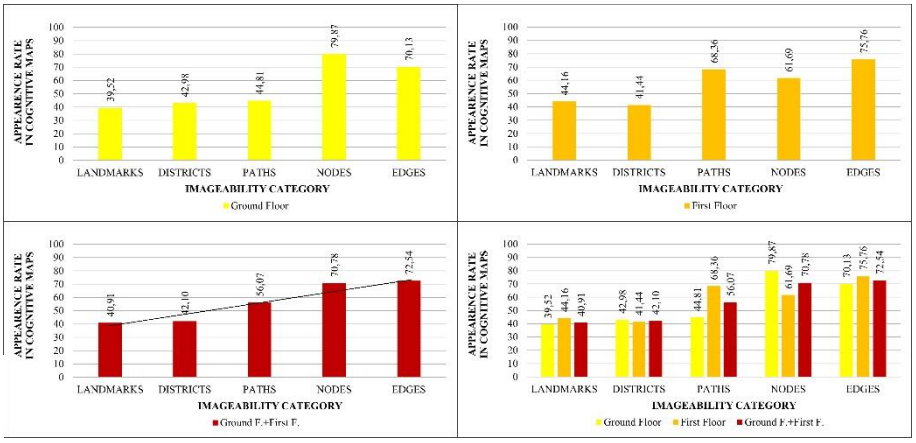

Figure 10. Appearance rate distribution graphic of imageability elements

The highest appearance rates are found for nodes (%79,87) and edges (%70,13) categories on the ground-floor, whereas paths (%44,81), districts (%42,98), and landmarks (%39,52) categories have the lowest rates in order (Table 4). Different from that, edges (%75,76) and paths (%68,36) categories have the highest appearance rates on the first-floor, followed by nodes (%61,69), landmarks (%44,16), and districts (%41,44) categories.

As both floors are evaluated together, **nodes** have the highest appearance rate as%70,78. Although **edges** have one common element (main corridors) with paths, their appearance rate is %72,54, which is much higher than the appearance rate of **paths**, %56,07. The districts' appearance rate is %42,10, whereas the landmarks' appearance rate is the lowest, %40,91. This gradation of the appearance rates is more similar to the ground-floor and the most recalled categories are edges, nodes, paths, districts, and landmarks, respectively (Table 4).

Even showing basic similarities, the distribution of appearance rates are different for each floor and their combination. One-Way ANOVA and post-hoc evaluation tests are applied to evaluate these differences and to specify which categories define the significant changes (Table 5, 6 and 7).

The mean appearance rates of imageability categories on the ground-floor changed between 30,42 and 61,50, and has shown a significant relation (F=4,387; p=0,002) (Table 5). The post-hoc test (Tukey) proved that the significant relations are between **nodes and districts (p=0,019), nodes and landmarks (p=0,036), edges and districts (p=0,021).**

Table 5. Statistical tests between the appearance rate and imageability categories, ground-floor

One-WAY ANOVA	**Imageability Categories – Appearance Rate** **Ground-floor** The appearance rate of each node & element in cognitive maps				
Imageability Category	**Node&Element Count (N)**	**Mean**	**Min.**	**Max.**	**Significance**
Paths	12	**34,50**	4	76	
Edges	8	**54,00**	31	72	df =62
Districts	32	**33,09**	0	60	F=4,913
Nodes	4	**61,50**	53	76	**p=0,002 < 0,05**
Landmarks	7	**30,42**	4	62	
Total	63	**37,52**	0	76	
POST-HOC (Tukey)	**Between Imageability Categories**				
Imageability Category	**Imageability Category**				**Significance**
Landmarks	Edges				**p=0,049**
Landmarks	Paths				**p=0,044**

The difference between the mean appearance rates of imageability categories of the first-floor change between quite close values (34 and 58,33) (Table 6). The ANOVA test presents an insignificant change between all categories (F=1,517; p=0,210), even though, the post-hoc test (Games-Howell) proved significant relation between **landmarks and paths (p=0,044), and landmarks and edges (p=0,049).**

Table 6. Statistical tests between the appearance rate and imageability categories, first-floor

One-WAY ANOVA	**Imageability Categories – Appearance Rate** **First-floor** The appearance rate of each node & element in cognitive maps				
Imageability Category	**Node&Element Count (N)**	**Mean**	**Min.**	**Max.**	**Significance**
Paths	11	**52,64**	43	77	
Edges	6	**58,33**	35	73	df =57
Districts	34	**40,35**	0	73	F=1,517
Nodes	4	**47,50**	35	58	p=0,210 > 0,05
Landmarks	3	**34,00**	27	38	
Total	58	**44,70**	0	77	
POST-HOC (Games-Howell)	**Between Imageability Categories**				
Imageability Category	**Imageability Category**				**Significance**
Landmarks	Nodes				**p=0,036**
Districts	Nodes				**p=0,019**
Districts	Landmarks				**p=0,021**

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In the integrated analysis of both floors, edges and nodes have significantly high minimum appearance counts, whereas landmarks have the lowest minimum appearance count and districts did not even appear in two cognitive maps (Table 7). Likewise, the maximum appearance rate for most paths, nodes, and edges is over %90, whereas it is around %78 for landmarks and districts. The difference between the closest mean values decreases with a pretty linear change and indicates a consistency. ANOVA tests presented a significant relation between the imageability categories and their appearance rate in cognitive maps (F=4,387; p=0,002) (Table 7), and post-hoc (Tukey) proved that the significant relations are between **edges and landmarks (p=0,011), and edges and districts (p=0,026).**

Table 7. Statistical tests between the appearance rate and imageability categories, combination of both floors

One-WAY ANOVA	**Imageability Categories – Appearance Rate Ground-floor and First-floor (combined)** The appearance rate of each node & element in cognitive maps				
Imageability Category	**Node&Element Count (N)**	**Mean**	**Min.**	**Max.**	**Significance**
Paths	23	**43,17**	4	77	
Edges	14	**55,86**	31	73	df =120
Districts	66	**36,83**	0	73	F=4,387
Nodes	8	**54,50**	35	76	**p=0,002 < 0,05**
Landmarks	10	**31,50**	4	62	
Total	121	**40,97**	0	77	
POST-HOC (Tukey)	**Between Imageability Categories**				
Imageability Category	**Imageability Category**				**Significance**
Edges	Landmarks				**p=0,011**
Edges	Districts				**p=0,026**

These significant results (ground-floor and both floors combined) indicate that the significant difference on the recall of these elements is mainly based on the most recalled edges category and least recalled landmarks category that both present significant relations in each test group. The following effective category is districts that have significant relations with nodes and edges on the first-floor, and with edges for the combination of both floors. The relation between nodes and districts and landmarks is also significant for the first-floor, still these relations are not enough to present a significant result between all categories on that floor. Paths, on the other hand, only have a significant relation with landmarks on the ground floor.

DISCUSSION

The results proved that architectural spaces' configurational and visual characteristics are significant factors on whether they are stored in cognitive maps.

To begin with, the outcome of the syntactic analysis proved a significant negative correlation between the depth and recall of

architectural spaces: the recall rate of a space decreases as the depth level of that space in the configurational system increases. In this frame, the difference between two floors is evaluated via the first problematic area regarding the first-floor's longer recalling period with a base map (Nelson, 1993; Nelson & Fivush, 2004; Piolino et al., 2009), and its less complex and less deep configurational system (Moeser,1988; Wang et al., 2019; O'Neill, 1991). The significant result for both floors indicates that first-floor data is the main factor that leads to that result, and the ground-floor data enhanced that correlation despite having a clearly different node count distribution and no significant result. Moreover, the classrooms inside the corner towers are less represented in cognitive maps than the classrooms along the corridors, whereas the closed/authorized spatial units (the storage rooms and private toilets) were not represented in any of the cognitive maps. The entrance point of the floor is the starting point of the spatial experience in the building, whereas the least represented spaces are located apart from entrance areas and main circulation axes. This evidently presents that the spatial units far from the floor's entrance are recalled less, and spatial units close to the floor's entrance are recalled more by the participants. That could be evaluated from two different viewpoints: (1) the quantity of the experience and (2) the course of the experience.

For the quantity of experience, the spaces at the deeper points of a configurational system are bodily or visually less experienced during the daily routine, and based on that lack of experience, they are recalled less by participants. For the course of the experience, the spaces encountered at the beginning of a spatial experience are recalled more, and the spaces encountered later on are recalled less by participants. Both of these viewpoints prove that the storing of a space in cognitive maps is affected by (1) the distance of its location from the starting point of experience, that is, the entrance point of the layout, and accordingly, (2) how much it is experienced behaviorally and visually compared to other units (Wagner, 2006; Evans et al., 1981; Schouela et al., 1980). These evaluations prove that human cognitive maps have a syntactic structure, and the components distant from the central movement axes, focal points and entrances are more loosely connected to it.

On the side, the second analysis results proved that visual qualities are significant factors on the recall of spaces. The edges and nodes in an architectural layout are the most represented categories in cognitive maps. This indicates that (1) spatial elements that define long planar borders and lead participants for a continuous movement or stop and (2) spaces that exhibit strategic entrance/exit/crossing points via their locations and form are primarily stored in cognitive maps. (3) Spaces that connect other spaces along movement axes (paths) and (4) closed spaces with particular visual characters (districts) are also stored in cognitive maps; however, their recall rates are at the midlevel. Nevertheless, landmarks are the least recalled elements, indicating that the reference points in the scale of objects or building elements are not primarily stored

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in cognitive maps despite their unique visual characteristics. Accordingly, in cognitive maps representing a building's layout, the primary structural elements are the continuous bordering walls of corridors, long and wide corridors connecting to multiple spaces, the halls at their intersections and entrance halls, whereas the secondary structural elements are the differentiated spaces via their location and form. On the other hand, building elements (such as statutes, columns, and wall clocks) that serve as reference points via their strong visual characteristics are insignificant structural components. This contradicts Lynch's (1960) theory, asserting a legible spatial organization is structured with the synchronic and relational existence of all five types of elements. Furthermore, it indicates that building layouts' legibility differentiates from urban layouts' legibility by using the main borders, axes and areas as references rather than singular visually compelling elements.

In the same frame, the statistical tests proved that the recall rate of imageability categories on cognitive maps significantly differs from each other and the edges, landmarks and districts have the strongest effect on this difference. Districts have appeared to be the second strongest factor by presenting significant relations with both of these categories. On the other hand, nodes are the third factor regarding their relation to landmarks and districts (on the first-floor), and paths appeared to be in a middle position which does not differentiate from any other categories. The significant correlations between the recall of edges and the recall of districts and landmarks indicate that cognitive maps are formed with the combined effect of edges that are recalled most and districts and landmarks that are recalled least, and nodes and paths have relatively less impact on this process.

CONCLUSION

The environments we experience possess a multicomponent and multidimensional nature that cannot be simply understood and evaluated. Similarly, our memory is a complex, multicomponent system running multiple concurrent operations such as perception, cognition, and memory. The complex structures of both systems necessitate the establishment of a narrow and clear framework when examining their relationships. Therefore, this study's theoretical background is structured on the well-known cognitive map, imageability, and space syntax theories, and the field study is limited to architectural scale. In addition, in order to obtain systematic and arguable results, the field study is focused on the measurable spatial components (spatial units), and accordingly, the most basic spatial analysis tools that can be adapted to cognitive map analysis were preferred. The results proved that the configurational and visual characteristics of spaces determine the selective processes of memory by leading participants' spatial experience routines and perception via their configurational, visual and formal qualities.

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Still, the complex structure of architectural spaces' requires these predictions to be tested with more comprehensive studies in various contexts. Based on this study's findings, it seems possible to conduct more advanced cognitive research on space-memory relations through cognitive maps, with more detailed categorizations of space and with various quantitative methods like space syntax. Moreover, many other visual qualities, such as the floor height, color, lighting, patterns, and symbolic forms; nonvisual qualities, such as smells, echoes, covering textures, and sloped floors, or even social characteristics should be investigated in innovative ways in terms of how they relate to memory.

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Resume

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Urban Climate Mapping Based on Structural Landscape Features: The Case of Ankara

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Abstract

The temperature difference between urban environments and urban areas also increases, along with the growing population and building volume in cities. This study aims to map the urban climate of Ankara based on structural landscape features. The method is based on calculating the negative and positive effects of the parameters that shape the urban form on the thermal load and dynamic potential in the city. The urban climate classes are mapped based on the structural landscape character of Ankara city for the purposes of this study. The results of the analysis revealed that the climate class with the highest percentage (Moderate Warming) covers 18.76% of the urban core, while the climate class with the lowest percentage (Very Strong Warming) covers 0.05% of the urban core. When the urban climate classes are evaluated based on districts, it is seen that the heating effect levels of the districts in the urban core are Çankaya (25%), Yenimahalle (18%), Mamak (15%), Etimesgut (14%), Keçiören (11%), Altındağ (8%), and Sincan (8%), respectively. Urban climate maps based on structural landscape character can be utilized in the preparation of spatial plans, particularly in the development of urban open and green space strategies aimed at improving urban climate. It is recommended that this method be applied by the Ministry of Environment, Urbanization, and Climate Change to develop Ankara, with studies conducted in cooperation with local administrations. Additionally, it is suggested that an urban climate branch be established to ensure continuity. Thus, this study can serve as a model for mapping the climate of all cities in the country, informing better planning decisions, and developing sustainable land-use policies.

Keywords: *Ecological indicators, Dynamic effect, Urban heat island effect, Thermal effect.*

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INTRODUCTION

We define urban climate as the local climate that results from the interactions between the regional climate and the settlement at a lower scale. Nowadays, the term "urban climate" also encompasses changes in the natural composition of the atmosphere, including air pollution, temperature, wind, and humidity, due to anthropogenic influences (Ng et al., 2012). Urban temperature, especially surface temperature, is one of the most important primary indicators of urban climate, regulating and controlling ecological processes (Blocken et al., 2007; Li et al., 2005; Pickett et al., 2001). One of the most well-known features of urban climate is the formation of urban heat islands (Koppe et al., 2004). In the early 19th century, the urban heat island effect was first measured and discussed by Lake Howard (Yang et al., 2016). Subsequently, many scientists worldwide have determined that the urban heat island effect is related to land cover and use, vegetation, population density, and weather conditions (Chen et al., 2006). Buildings, roads, and other structural elements can absorb and radiate solar heat more than green spaces and water bodies (Ng et al., 2012). In cities, buildings increase surface and air temperatures due to the solar energy they store, causing microclimatic effects (Elliason, 1990; Oke, 1987). High building volume not only increases the temperature of the area, but also reduces the "Sky View Factor" (SVF). The decrease in SVF is one of the main indicators that the cooling of the urban atmosphere slows down at night (Oke, 1981). Furthermore, long-wavelength radiation is blocked, and energy is released more slowly into the sky in areas with high building density. As a result, cooling tends to occur more slowly in urban centers than in the urban periphery (Ng et al., 2012). This is evident in urban areas, where buildings are densely packed and green spaces are limited, resulting in "islands" of higher temperatures compared to peri-urban areas. These pockets of heat are referred to as "heat islands". On the other hand, heat islands exhibit varying characteristics under different conditions, including day versus night, small versus large cities, suburbs, the Northern versus Southern Hemisphere, and seasonal differences (EPA, 2021). In other words, the concept of an urban heat island refers to the increased temperature in areas of a city with high building density compared to the surrounding rural areas (Koppe et al., 2004). These areas are defined as heat islands with warm cores (Yüksel, 2005). The urban heat island effect is defined as the accumulation of heat that emerges as the most prominent feature of urban climate due to construction and human activities in cities (Oke, 1973; Yang, 2014). The temperature is higher in areas with high building density in the city compared to other areas. On the other hand, there are also cold-core heat islands in green areas and water surfaces within the city, which are cooler than other types of urban areas (Yüksel, 2005).

Urban green spaces reduce the heat island effect in cities through their microclimatic effects, improve air quality and life quality, create habitats for fauna, and contribute to the protection of biodiversity. In addition,

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they provide spaces for both active and passive recreation, making positive contributions to urban aesthetics and image (Yıldız, 2017). Green spaces represent well-vegetated areas, including trees and grass surfaces. Plants cool their surroundings by absorbing the surrounding air (CO2) during both transpiration and photosynthesis. In general, tree canopies are cooler than their surroundings, as trees reflect a significant proportion of solar radiation with their mass. Vegetation absorbs a significant portion of infrared radiation and reflects most of the near-infrared radiation during the photosynthesis process (Dimoudi & Nikolopoulou, 2003). In this context, it is possible to state that vegetation helps reduce the formation of urban heat islands through its cooling effect. Trees can also influence the urban climate by affecting wind speed and direction (Givoni, 1998).

Every 100 m^2 of vegetation added to a park can decrease the air temperature by 1°C (Dimoudi & Nikolopoulou, 2003). Green areas contribute to a decrease of about 0.5°C in air temperature (Shashua-Bar & Hoffman, 2000). According to Gao's (1993) model, when the urban mass ratio is 600% and the road ratio is 20%, a 30% green area reduces the air temperature by approximately 1 °C, while a 50% green area reduces the air temperature by 2 °C. Dimoudi and Nikolopoulou (2003) stated that doubling the size of a park can reduce the air temperature by 1 °C, while tripling the size of a park can reduce the air temperature by 1.5- 3 °C. Therefore, green areas reduce the heat island effect in cities and have a "negative" effect on the thermal load. Therefore, increasing the amount of green space in urban planning and design studies is a crucial strategy for enhancing human comfort, especially in arid and semi-arid climates (Ng et al., 2012).

In general, temperatures in the atmospheric air above the Earth's surface and within the city vary. Therefore, two categories are expressed: surface heat islands and atmospheric heat islands. These heat islands differ in their formation, effects, detection, and measurement techniques, as well as the methods and techniques applied to mitigate their effects and provide some cooling (EPA, 2021). Surface heat islands occur because of higher rates of heat emission and absorption by surfaces such as roads, rooftops, and impermeable ground in cities compared to natural surfaces (Simmons et al., 2008). The impact of surface heat islands reaches its peak during the day when the sun shines. Heat islands that arise due to the presence of hot air in the urban core compared to cooler air in areas outside the urban core are defined as atmospheric heat islands (EPA, 2021). The factors and explanations of the urban heat island effect are presented in Table 1.

In the literature, there are many studies in which urban heat islands are determined at different scales using different parameters, methods, and techniques. Some examples of these studies are given in Table 2.

Table 1. Factors and explanations for the urban heat island effect (EPA, 2021)

Factors	Explanations
Decrease in Natural Landscape Areas in Cities	Green areas provide shade and tend to cool the air by evaporating surface water. However, artificial surfaces in cities such as roofs, sidewalks, roads, buildings, and parking lots provide less shade and moisture compared to natural landscape areas, leading to increased temperatures in the city.
Material Properties of Structures	Artificial materials used in cities, such as roads, sidewalks, or rooftops, tend to reflect more solar energy and absorb and emit less heat from the sun compared to trees and other vegetation and natural surfaces. Often, heat islands occur throughout the day and become more pronounced after sunset due to the slow release of heat from structural materials.
Urban Geometry	The volumes of buildings and the distances between buildings in a city affect wind movement and the ability of building materials to absorb and emit solar heat. Surfaces and structures located in areas with high building density transform into high-temperature thermal volumes that cannot easily release the heat they have absorbed. Cities with narrow streets and tall buildings can form urban canyons, which hinder natural wind flow and prevent the cooling effect that it would otherwise provide.
Heat from Human Activities	Vehicle traffic, heating and cooling systems in buildings, and industrial facilities all emit heat to their surroundings, contributing to the urban heat island effect.
Climate and Geography	Calm and clean air conditions maximize the solar energy reaching urban surfaces and minimize the amount of heat transferred into the atmosphere, leading to more severe heat islands within the city. Conversely, strong wind movements and cloud formations in the atmosphere help reduce the heat island effect. Geographical conditions also influence the urban heat island effect. The topographic structure of the city and its formation can hinder wind movement within the city or contribute to the formation of wind corridors.

Table 2. Studies on the determination of the urban heat island effect

References	Research Details
Duman Yüksel & Yılmaz, (2008)	Between 1985 and 2005, the study investigated surface temperature differences in the metropolitan area of Ankara, focusing on the changes in built-up areas and urban heat islands, using data from fixed meteorological stations.
Chen et al., (2012)	Air temperatures were measured at 80 stations belonging to parks in the city and compared with surface temperatures obtained from Landsat TM thermal bands. The results indicate a temperature difference of approximately 1.74 °C between the green park areas and the surrounding bare areas.
Xiong, et al., (2012)	Between 1990 and 2009, the relationship between NDVI and NDBI indices and heat island distributions were analyzed by regression analyses. The findings indicate that temperature anomalies are particularly high in regions with high construction, population density, and industrial activity.
Tan & Li, (2013)	Multiple regression analyses were performed to examine the relationship between LST values and NDVI in 98 green areas within the city. The findings obtained from the NDVI differences between green areas and areas with high building density show that the cooling effect of green areas varies according to the size and shape of green areas.
Alavipanah et al., (2015)	The effect of surface temperature and land use was determined by comparing MODIS 8-day composite MYD11A2 coded surface temperature images with land use data obtained from the CORINE (2002-2012) database.
Aslan & Koc-San, (2016)	With the help of Landsat 7 ETM+ and Landsat 8 OLI/TIRS data and land cover maps obtained using a random forest classifier, NDVI maps and surface temperature maps obtained from thermal bands, the relationship between land cover and surface temperatures was analyzed.
Canan, (2017)	In four different regions, the maximum urban heat island effect resulting from the geometrical formation of the urban fabric was determined. The findings suggest that the maximum heat island effect may occur at high values in densely urbanized areas with low sky clearances (SVF).
Dihkan et al., (2018)	In a study conducted in the cities of Istanbul, Bursa, Ankara, Izmir, Gaziantep, Erzurum, and Trabzon, the urban heat island effects observed in these cities between 1984 and 2011 were determined and modeled using surface temperature images obtained from the thermal bands of the ASTER satellite.

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When studies on the urban heat island effect are examined, they can be categorized into three main headings based on their method and scale (Duman Yüksel & Yılmaz, 2008). (1) Upper scale (city and its immediate surroundings) and satellite imagery studies. (2) Observation studies covering the city (all or only a part of it) and rural areas, and comparing the data obtained from meteorological stations with the data obtained from the established stations. (3) Lower scale (housing or building island) and numerical modelling studies.

Upon evaluating the information presented in this section, it becomes apparent that numerous parameters contribute to the urban heat island effect, including ecological and land-use-related factors resulting from human impact. These parameters introduce the concepts of 'indicator' and 'ecological indicator', which are used to determine the urban heat island and express the estimation using quantitative methods. Voghera (2011) defines the concept of ecological indicator as 'a set of tools used to measure and evaluate the sustainability and quality of a landscape'. The aim of using these indicators is to characterize the current situation, monitor and/or predict significant changes (Jackson et al., 2000). In short, by using each ecological indicator that affects the urban heat island, quantitative information can be provided about the integrated effect of the elements of the landscape structure on one another. In this way, the integrity of all indicators affecting the urban heat island is ensured, making significant contributions to sustainability.

This study calculated the urban climate of Ankara by considering the negative and positive effects of the parameters that shape the urban form on the thermal load and dynamic potential indicators within the city. Within the scope of the research, six sub-indicators, namely "building volume", "topography", "green areas", "ground coverage", "natural landscape" and "proximity to open space", were evaluated adapted from Ng et al. (2012) and the relatively different climate zones of the city were mapped. The study primarily consists of three stages: (1) exploring national and international literature, (2) determining the urban core boundary in Ankara, and (3) mapping the urban climate. This study is the first national research to map the urban climate in Turkey. Therefore, this study, conducted for the urban core of Ankara, can be regarded as a starting point for other studies in Turkey that map urban climate and develop land-use policies. For this reason, the methods and techniques employed in this study differ from and are unique to other studies in literature. We expect that the study can contribute to the development of practical steps in the process of preparing spatial and strategic plans within the framework of sustainability goals.

MATERIALS AND METHODS

The materials and methods section are described under the headings of study area, data sets, and methodology.

Study Area

The main material of the study is the urban core of Ankara, located between 39°14′46″-40°13′35″ northern latitude and 32°14′24″-33°09′49″ eastern longitude. The city of Ankara consists of central districts including Etimesgut, Altındağ, Çankaya, Keçiören, Pursaklar, Mamak, Gölbaşı, Yenimahalle, and Sincan, while to the east of the city are Elmadağ and Bâlâ, to the west are Haymana, Polatlı, and Ayaş, and to the north are Kazan, Çubuk, and Akyurt districts. The reason for choosing Ankara city as the study area is that the population of the central districts of the city (Etimesgut, Altındağ, Çankaya, Keçiören, Mamak, Gölbaşı, Yenimahalle and Sincan) increased by 52% from 2000 (3.296.337) to 2023 (5.003.857) (TUIK, 2024). Pursaklar district is also one of the 9 central districts of Ankara, but it is not included in the population growth calculation since it gained district status in 2008. In the 23-year period, this population growth in the central districts has also led to an increase in the building density in the city. Therefore, the primary objective of this study is to investigate the impact of urban development in Ankara on the urban climate and to analyze the findings.

In line with the aim and scope of the study, to determine the boundary of the research area, the urbanization levels (urban-rural distinction) of Ankara City were investigated, and a two-stage boundary study was conducted. In the first stage, the 9 central districts of Ankara city determined by the Development Agency were taken into consideration. In the second stage, urbanization levels were analyzed based on land cover for the borders of the 9 central districts, and the obtained urbanization levels were categorized into three classes: "urban core", "urban fringe", and "rural area". Figure 1 shows the geographical location of the study area and the urban core boundary.

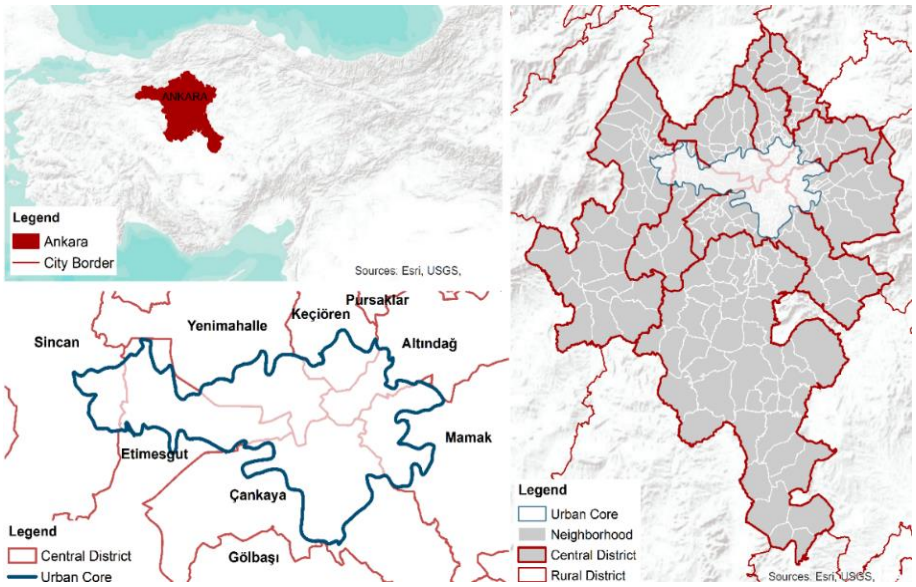

Figure 1. Geographical location map of Ankara

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Data Sets

Table 3 presents the datasets used in this study, their source, and intended use. The projection system of the data sets used in Geographic Information Systems and Remote Sensing analyses is organized as "WGS_1984_UTM_Zone_36N".

Table 3. Data sets and their characteristics

Data Set	Source	Intended Use	Data Type - Type - Resolution - Date
Provincial and district administrative boundaries	HGM (General Directorate of Mapping)	Geographical Location	Data type: Vector Data Type: Polygon
2016 Neighborhood Boundaries	Ankara Metropolitan Municipality Department of Zoning and Urbanization Map Branch Directorate	Geographical Location	Data type: Vector Data Type: Polygon
Building Volume Data	Ministry of Environment, Urbanization and Climate Change, General Directorate of Geographic Information Systems, Department of Geographic Information	Building Volume	Data Type: Raster Resolution 100m x 100m
Digital Elevation Model (DEM)	Copernicus Land Monitoring Service (https://land.copernicus.eu/)	Topographic Elevation Slope	Data Type: Raster Resolution 25m x 25m
2012 Imperviousness Density Data	Copernicus Land Monitoring Service (https://land.copernicus.eu/)	Ground Coverage	Data Type: Raster Resolution 100m x 100m
Geometrically and radiometrically corrected satellite image (2020)	U.S. Geological Survey (USGS)	Green Space Map Natural Landscape Proximity to Open Spaces	Data Type: Raster Satellite: Landsat 8 OLI-TIRS Resolution 30m x 30m Image Date: 29/08/2020

Methodology

The study was conducted in three stages: (1) The study area was identified by the research objectives and scope. A literature review was conducted on theoretical foundations, methods, and research findings, and numerical, verbal, and visual data were collected. (2) To determine the study boundary, the urbanization levels of Ankara City were identified, and the study area boundary was defined using the urban core boundary. (3) Measurement techniques were determined for urban climate mapping, and indicator analysis was completed.

Analyses that will enable urban climate classification within the scope of the methodology are the existing thermal load and dynamic potential of the area. For this purpose, six different sub-indicators are analyzed as structural landscape features: "building volume", "topography", "green areas", "ground coverage", "natural landscape", and "proximity to open space" (Figure 2). The mapping of the city's climate is based on the evaluation of the thermal load, which is determined according to "negative" factors such as building volume that will increase the building volume and "positive" factors such as green areas that will cool the air, together with the dynamic potential (airflow potential) determined

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according to positive and negative factors. Table 4 presents the negative and positive factors that affect the urban climate.

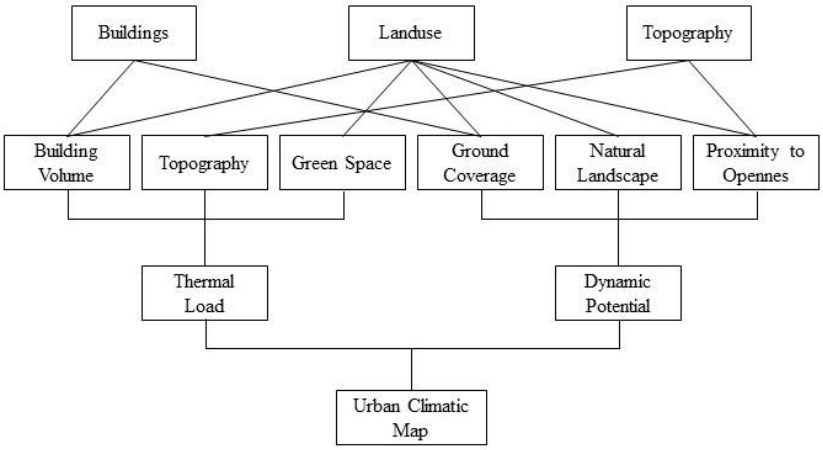

Figure 2. Schematic of the methodology used to determine the urban heat island effect (adapted from Ng et al. (2012))

Table 4. Parameters affecting urban climate (Ng et al., 2012)

Indicators	Effect	Detail	Sub-indicators
Thermal Load	Negative	Building masses	Building Volume
	Positive	Altitude and Elevation	Topographical Height
		Bioclimatic effects	Green Space
Dynamic Potential	Negative	Urban permeability	Ground Coverage
	Positive	Bioclimatic effects / Cold air movement Air mass exchange and Neighbourhood effects	Natural Landscape Proximity to Opennes

RESEARCH FINDINGS

The research findings are presented under three main headings: thermal load, dynamic potential, and mapping of urban climate. Each sub-indicator map for thermal load ((a) Building Volume, (b) Topographical Height, (c) Green Space) and dynamic potential ((a) Ground Coverage, (b) Natural Land, (c) Proximity to Open Space) is shown in Figure 3.

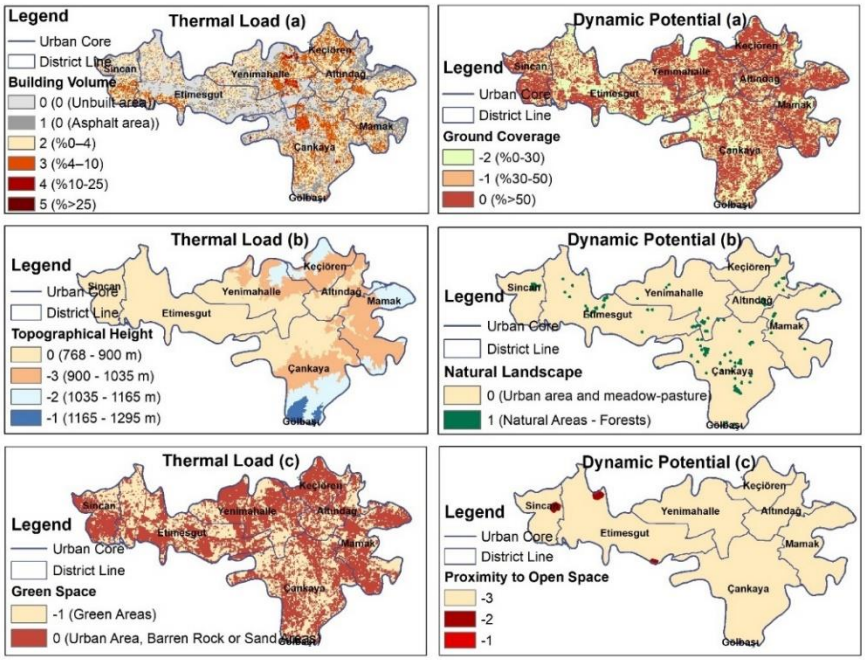

Figure 3. Thermal Load: (a) Building Volume, (b) Topographical Height, (c) Green Space
Dynamic Potential: (a) Ground Coverage, (b) Natural Land, (c) Proximity to Open Space

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Thermal Load

Thermal Load has two important effects on the creation of climate maps. If the area contains high heat stores, such as large stacks of buildings, they have a "negative" effect on the thermal load as they will cause a temperature increase, while differences in height above sea level and green areas have a "positive" effect on the thermal load. The positive and negative effects of building volume, height, and green areas on the thermal load were calculated.

Building Volume: The higher the building volume, the higher the heat capacity and the higher the thermal load. The building density and building volume of the city are key indicators in determining the ventilation conditions and urban temperature. Generally, an urban area with a higher building density will exhibit lower ventilation performance (Givoni, 1998; Hui, 2001; Ng et al., 2012). The building volume data used in this study have a spatial resolution of 100 m x 100 m and contain building volume data (m^3). Building volumes are expressed as a percentage of the highest volume value in the study area and are categorized into six groups in the GIS model. As the building density increases in areas with high building volume, the SVF value decreases, and the associated thermal load increases. In this context, in order to calculate the thermal load due to building density, the building volume data was expressed as a percentage. These values were expressed in six different classes: 0 (areas without buildings), 1 (paved areas), 2 (0-4%), 3 (4-10%), 4 (10-25%), and 5 (greater than 25%) (Table 5).

Table 5. Thermal load values of the building volume (Ng et al., 2012)

Thermal Load	Building volume (Percent)	Classification
Zero	0 (Unbuilt area)	0
Very Low	0 (Asphalt area)	1
Low	% 0 – 4	2
Middle	% 4 – 10	3
High	% 10 – 25	4
Very High	% 25	5

In the building volume map shown in Figure 3, Thermal Load (a), it is possible to say that the building volume has a density of 4% and above in almost all of Çankaya, Keçiören, Altındağ, and Çankaya Districts, south of Etimesgut and Sincan, east of Yenimahalle, and west of Mamak.

Topographical Height: We know that air temperature varies according to altitude. The temperature of a topographically high area is generally cooler than that of a lower area. Topographic height is a crucial indicator in determining the thermal load in cities with rugged topography (Yıldız, 2022). In this study, the EU-DEM v1.1 digital elevation model, with a spatial resolution of 25 m x 25 m, provided by the European Environment Agency (EEA), was used to create the

topographic elevation map. Since the study area does not differ significantly in terms of topography, this factor was taken into consideration when classifying the digital elevation model, and the values in Table 6 were accordingly reinterpreted.

Table 6. Topographic elevation classes (adapted from Ng et al. (2012))

Topographic Height	Topographic Elevation (m)	Class
Very High	1600-1872	-3
High	1300-1600	-2
Middle	1000-1300	-1
Low	713-1000	0

In the topographic height map shown in Figure 3, Thermal Load (b), it is evident that the highest region of the city core (1295 m) is located in the southern parts of the Çankaya district. East of Mamak, north of Keçiören and Yenimahalle, and south of Çankaya, the topographic height ranges from 1036 m to 1165 m.

Green Space: The most significant success indicator that has a negative effect on the thermal load in cities is the amount of green area (Yıldız, 2022). In this context, the Normalized Vegetation Index (NDVI) obtained from the Landsat 8 OLI/TIRS satellite image was used to calculate the amount of green area. The NDVI equation is given in Equation 1, and the NDVI value resulting from the analysis varies between -1 and 1. The value with the lowest plant density is expressed with "-1", while the value with the highest plant density is expressed with "1". While negative values represent clouds, water, and snow, values close to zero represent rock and bare soil. Very low values of NDVI (-1 and 0.2) correspond to rock, sand, or bare areas; medium values (0.2 to 0.3) represent shrubs and grasslands; and high values (0.3 to 1) indicate trees (ESRI, 2016). Within the scope of the study, for the city of Ankara, areas with a value greater than 0.2 are considered green areas, and areas with a value less than 0.2 are considered as rock and bare soil.

$$NDVI=((NIR-R)/(NIR+R)) \quad (1)$$

To achieve a spatial resolution of 100m x 100m for the obtained data, the cell size of the raster data was first reduced to 1 m x 1 m using the "resample" command in ArcGIS software. Then, the cell size was adjusted to 100 m x 100 m using the "aggregate" command. The raster data, with a spatial resolution of 100 x 100 m, was reclassified into two categories: "-1" and "0", adapted from a study conducted by Ng et al. (2012) for Hong Kong (Table 7).

Table 7. Cell value and classification for green spaces (adapted from Ng et al. (2012))

NDVI Value	Vegetation	Class
-1 – 0.2	Structure, Bare Soil, Rock	0
0.2 – 1	Green Area	-1

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When Figure 3 Thermal Load (c) is analyzed, it becomes clear that the areas outside the structural zones in the city core are designated as green areas. It is possible to say that there are areas with NDVI values between 0.2 and 1 in the east of Etimesgut and Sincan, west of Yenimahalle, inland and north-west of Çankaya, and north-east of Altındağ, which represent green areas. Unfortunately, the findings show that the amount of green areas in Keçiören and Mamak districts is almost negligible.

Calculation of Thermal Load: The values obtained with the "building volume", "topographic height" and "green areas" maps with a spatial resolution of 100 m x 100 m were summed for each pixel with the "raster calculator" command in ArcGIS software and the "Thermal Load" was obtained (Figure 4).

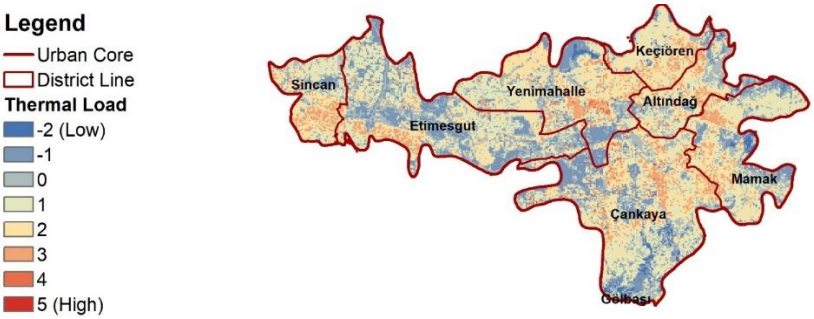

Figure 4. Thermal load map

When 'building volume', 'topographic height', and 'green areas' are evaluated integrally, it becomes apparent that the thermal load generated by the city is high in regions where the building volume is high. The amount of green areas is low. In summary, it can be said that the thermal load is high in the south of Sincan and Etimesgut, as well as in the west, east, and inner parts of Yenimahalle, all regions of Altındağ except the northeast, the west, and south regions of Mamak, and the entire Keçiören district.

Dynamic Potential

Dynamic Potential is also an important performance indicator for climate impacts. Within the scope of this indicator, the ground coverage, natural landscape, and proximity to open spaces of the research area were evaluated. Dynamic potential has two important effects on the creation of climate maps. If the research area contains areas with high ground coverage, it has a negative effect on dynamic potential, whereas if it contains natural landscape areas and is close to open areas, it has a positive effect on dynamic potential (Yıldız, 2022).

Ground Coverage: Ventilation is a key issue in urban planning and building design. Built areas in cities interfere with local-scale wind both horizontally and vertically, negatively affecting air circulation (Perry et al., 2004; Ng et al., 2012). Therefore, a reliable assessment of

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the aerodynamic characteristics of cities is essential for predicting and guiding urban wind movements (Grimmond & Oke, 1998). There are numerous morphological prediction models developed in the international literature on the subject, which help urban planners determine surface roughness in cities. The ground coverage indicator refers to the ratio of the ground coverage of buildings to their actual physical floors in a region (Ng et al., 2012). The ground coverage ratio is an indicator of the urban permeability, as well as the density of residential areas, and its impact on the urban heat island effect and wind speed. The higher this ratio, the lower the wind speed (Yoshie, 2006).

The "Imperviousness" data produced by the Copernicus Land Monitoring Service was used to determine soil impermeability. Imperviousness data shows the percentage of soil impermeability and its state of change. As is well known, built-up areas result from the replacement of semi-natural land cover or water surfaces with artificial, usually impermeable cover. Imperviousness shows the spatial distribution of artificially covered areas, including the level of soil impermeability per unit area. The degree of impermeability is calculated using a semi-automatic classification based on NDVI and expressed as a percentage (1-100%) (Anonymous, 2020). Within the scope of this study, the imperviousness data should have a spatial resolution of 100 m x 100 m. For this purpose, the cell size of the raster data was first reduced to 1 x 1 m using the "resample" command in ArcGIS software, and then the cell size was reorganized to 100 x 100 m using the "aggregate" command. The ground coverage values of the obtained raster data were classified into three categories as "-2", "-1", and "0" (Table 8).

Table 8. Ground coverage degrees and classes (Ng et al., 2012)

Ground Coverage Status	Ventilation Potential	Ground Coverage Degree (%)	Classification
Low	High	0-30	-2
Middle	Middle	>30-50	-1
High	Low	>50	0

In the ground coverage map shown in Figure 3, Dynamic Potential (a), it is seen that the ground coverage is also high in areas with high building density and impervious surfaces. Unfortunately, it is possible to say that ground coverage is 50% and above in a large part of the urban core.

Natural Landscape: Natural vegetation cover is a crucial indicator of dynamic potential, as it has a cooling effect on the atmosphere and facilitates the movement of cold air. Numerous studies have investigated the impact of surface roughness on wind speed in urban areas. Wind speed is slower in areas with a high degree of roughness and faster in areas with a low degree of roughness. For this reason, it

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can be said that green areas have a lower degree of roughness than residential areas. Therefore, wind speed is higher in green areas than in cities (Oke, 1987). In this study, NDVI data was utilized to determine the natural landscape. In the NDVI data, areas with a value of "<= 0.6" were categorized as "0" and areas with an NDVI value of "> 0.6" were categorized as "1". The obtained data was organized to have a spatial resolution of 100 m x 100 m using the "resample" and "aggregate" commands. Considering the 75% threshold value in the study conducted by Ng et al. (2012) for Hong Kong, the raster data were reclassified into two categories: "0" and "1" (Table 9).

Table 9. Classification used in the identification of natural landscape areas (Ng et al., 2012)

Natural Landscape	Classification
Forests	1
Urban area and meadow-pasture	0

Figure 3. Dynamic Potential (b) shows the natural landscape map. Natural areas refer to natural forest lands in the urban core. Unfortunately, there is almost no forest land in the urban core of Ankara.

Proximity to Openness Map: Buildings in cities influence wind speed and direction, thereby negatively impacting natural ventilation within the city. Open spaces in the city, on the other hand, not only contribute to ventilation but also regulate other climatic conditions and reduce the thermal load. When assessing dynamic potential, proximity to the open sea or lakes, as well as slope indicators, should also be taken into consideration. Therefore, within the scope of the research, proximity to open spaces was evaluated with three different indicators: "proximity to water", "proximity to open spaces", and "slope".

Proximity to waterfront map: At this stage, since there is no sea in Ankara City, only lakes were considered. Settlement areas were zoned as 70 m, 140 m, and >140 m according to their distance to the lake shore, and the obtained data was converted into raster data with a resolution of 100 x 100 m. When evaluating the proximity indicator to the water coast, it should be considered in conjunction with the ground coverage indicator, as it affects wind speed and direction. For this purpose, the proximity to water and ground coverage data were overlaid using the "mosaic" command in ArcGIS software and classified into 3 categories as "-2", "-1" and "0".

Proximity to Open Space Map: At this stage, the proximity to open spaces indicator was evaluated by interpreting the building volume and ground coverage indicators together. For this purpose, the ground coverage data was first divided into three classes: "<= 30% (-2)", "30-50% (-1)", and ">50% (0)". Then, the raster data was

organized with the "resample" and "aggregate" commands with a spatial resolution of 100m x 100m. Since an area with a ground coverage value below 5% is considered an open area, areas with a ground coverage value below 5% are given a value of "-1", and areas with a ground coverage value above 5% are given a value of "0". Similarly, areas with a building density value below 5% were assigned a value of "-1", and areas with a building density value above 5% were assigned a value of "0". The two reclassified raster data were converted into polygons and merged with the "union" command. In the obtained data, areas with a value of "-2" represent "open areas", areas with a value of "-1" represent "areas adjacent to open areas", and areas with a value of "0" represent "non-open areas".

Slope Map: Steep slopes with vegetation cover (>= 40%) have the effect of increasing wind movement and air circulation in the area. In the Hong Kong study, a threshold value of 75% was used to determine the presence of green space (Ng et al., 2012). In this study, for raster data with a spatial resolution of 100x100 m, if the slope is above 40% and the presence of vegetation is 1, these areas have a positive effect on dynamic potential. To determine the slope condition of the study area, a digital elevation model (DEM) was utilized, with a spatial resolution of 100 m x 100 m. Then, using the "reclassify" command, areas with a slope value of less than 40% were reclassified as "0", and areas with a slope value of greater than 40% were reclassified as "1".

Calculation of Proximity to Open Space: "Proximity to water shore", "Proximity to open area", and "slope" maps with a spatial resolution of 100x100 m were calculated with the help of the "mosaic" command in ArcGIS, and the "Proximity to Open Area" map was obtained. Here, in the merging of layers, the layer with the highest value for a cell was taken into consideration, and a new value was assigned; the other two layers were ignored. This means that only the indicator with the maximum value is selected from the three sub-indicators for each pixel to represent the dynamic potential value for the proximity to open space indicator. For example, suppose the proximity to the waterfront indicator has the most significant dynamic potential value for a pixel. In that case, the values of proximity to open space and slope for that pixel are not taken into account.

Figure 3 Dynamic Potential (c) shows the proximity to open space map. The findings show that there is no area with a slope group of 40% and above in the urban core of Ankara. In addition, the natural water surface is unfortunately almost non-existent within the urban core.

Calculation of the Dynamic Potential: The values obtained with the "ground coverage", "natural landscape" and "proximity to open space" maps with a spatial resolution of 100 m x 100 m were summed

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for each pixel with the "raster calculator" command in ArcGIS software and the "Dynamic Potential" map was obtained (Figure 5).

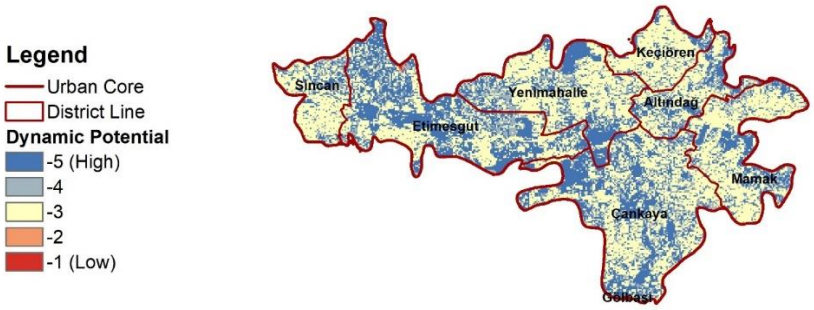

Figure 5. Dynamic potential map

When 'ground coverage', 'natural landscape', and 'proximity to open space' are evaluated in an integrated manner, it would not be wrong to say that ground coverage is the sub-indicator with the highest effect on urban ventilation among the three sub-indicators. Therefore, it is understood that in areas with high ground coverage, the cooling effect of the city is also low. In summary, the ventilation effect of the urban climate is very low in the south of Sincan and Etimesgut, the west, east, and inner parts of Yenimahalle, all regions of Altındağ except the north-east, the west, north, and south regions of Mamak, and the entire Keçiören district.

Urban Climate Map

The heat island effect method applied in the city core is based on a balanced evaluation of the positive and negative impacts on the thermal load and the positive and negative effects on the dynamic potential. At this stage, to map the urban climate, the values obtained from the "thermal load" and "dynamic potential" maps were summed for each pixel using the "raster calculator" command in ArcGIS software, resulting in a new map. Figure 6 shows the urban climate map of Ankara.

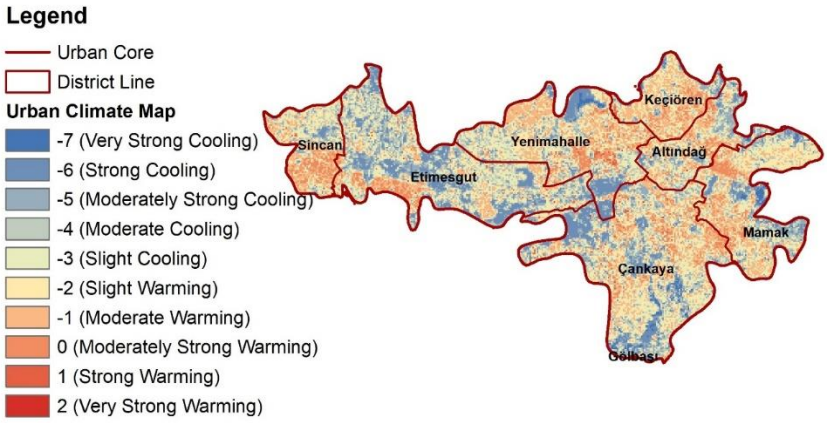

Figure 6. Climate map of Ankara city

Table 10 shows the descriptions and areal magnitudes of the urban climate classes. These climate classes were adapted from Ng et al. (2012) and applied to the urban core of Ankara. The climate classes

of Ankara are categorized into 10 classes, ranging from "Very Strong Warming" to "Very Strong Cooling". Very strong warming refers to areas with a very high thermal load and low dynamic potential. In contrast, very strong cooling refers to areas with a very high dynamic potential and a low thermal load. In Table 11, urban climate classes and their areal sizes (ha) based on districts are given in detail.

Table 10. Urban climate classes and their descriptions

Code	Urban Climate Classes	Description	Area (ha)	Perc. (%)
-7	Very Strong Cooling	Very Highly Dynamic Potential and Low Thermal Load	337.8523	1.02
-6	Strong Cooling	High Dynamic Potential and Low Thermal Load	3641.021	11.00
-5	Moderately Strong Cooling	Moderately negative Thermal Load and Good Dynamic Potential	3833.344	11.58
-4	Moderate Cooling	Slightly negative Thermal Load and Good Dynamic Potential	4542.896	13.73
-3	Slight Cooling	Low Thermal Load and Good Dynamic Potential	5913.692	17.87
-2	Slight Warming	Some Thermal Load and Some Dynamic Potential	6034.499	18.23
-1	Moderate Warming	Moderate Thermal Load and Some Dynamic Potential	6210.073	18.76
0	Moderately Strong Warming	Moderately High Thermal Load and Low Dynamic Potential	2436.127	7.36
1	Strong Warming	High Thermal Load and Low Dynamic Potential	130.8792	0.40
2	Very Strong Warming	Very Highly Thermal Load and Low Dynamic Potential	16.32505	0.05

Table 11. Urban climate classes based on districts

District	Urban Climate Classes	Area (ha)	Total Area (ha)
Altındağ	Very Strong Cooling	17	2463
	Strong Cooling	158	
	Moderately Strong Cooling	367	
	Moderate Cooling	344	
	Slight Cooling	428	
	Slight Warming	418	
	Moderate Warming	490	
	Moderately Strong Warming	234	
	Strong Warming	4	
	Very Strong Warming	2	
Çankaya	Very Strong Cooling	149	8741
	Strong Cooling	1035	
	Moderately Strong Cooling	1046	
	Moderate Cooling	1181	
	Slight Cooling	1575	
	Slight Warming	1670	
	Moderate Warming	1466	
	Moderately Strong Warming	563	
	Strong Warming	48	

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District	Urban Climate Classes	Area (ha)	Total Area (ha)
	Very Strong Warming	8	
Etimesgut	Very Strong Cooling	0	7479
	Strong Cooling	1278	
	Moderately Strong Cooling	1191	
	Moderate Cooling	1347	
	Slight Cooling	1537	
	Slight Warming	941	
	Moderate Warming	845	
	Moderately Strong Warming	322	
	Strong Warming	15	
	Very Strong Warming	4	
Sincan	Very Strong Cooling	0	2189
	Strong Cooling	73	
	Moderately Strong Cooling	166	
	Moderate Cooling	292	
	Slight Cooling	407	
	Slight Warming	405	
	Moderate Warming	554	
	Moderately Strong Warming	284	
	Strong Warming	9	
	Very Strong Warming	0	
Keçiören	Very Strong Cooling	23	2199
	Strong Cooling	99	
	Moderately Strong Cooling	144	
	Moderate Cooling	137	
	Slight Cooling	236	
	Slight Warming	564	
	Moderate Warming	753	
	Moderately Strong Warming	231	
	Strong Warming	11	
	Very Strong Warming	0	
Mamak	Very Strong Cooling	87	4351
	Strong Cooling	343	
	Moderately Strong Cooling	438	
	Moderate Cooling	568	
	Slight Cooling	693	
	Slight Warming	991	
	Moderate Warming	879	
	Moderately Strong Warming	351	
	Strong Warming	0	
	Very Strong Warming	0	
Yenimahalle	Very Strong Cooling	54	5499
	Strong Cooling	615	
	Moderately Strong Cooling	444	
	Moderate Cooling	640	
	Slight Cooling	1010	
	Slight Warming	1029	

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District	Urban Climate Classes	Area (ha)	Total Area (ha)
	Moderate Warming	1212	
	Moderately Strong Warming	448	
	Strong Warming	44	
	Very Strong Warming	3	
TOTAL	Very Strong Cooling	338	33097
	Strong Cooling	3641	
	Moderately Strong Cooling	3833	
	Moderate Cooling	4543	
	Slight Cooling	5914	
	Slight Warming	6035	
	Moderate Warming	6210	
	Moderately Strong Warming	2436	
	Strong Warming	131	
	Very Strong Warming	16	

DISCUSSION

The urban climate mapping method is an applicable information and evaluation tool that considers structural landscape features in the preparation of spatial plans and the determination of future projections. Two main components, thermal load and dynamic potential, were used to determine the urban climate. The Urban Climate Map (UC-MAP) encompasses a process in which the relationships and effects of land use, topography, vegetation, and these structural landscape features on thermal comfort are spatially evaluated.

In the national literature, there are remote sensing studies (Alp, 2021; Duman Yüksel & Yılmaz, 2008) and statistical analyses using climate parameters (Çiçek & Doğan, 2005; Bilgili, 2009), which determine surface temperatures for micro-regions in Ankara and inform land use policies. However, these studies do not consider indicators that shape the urban form and climate, such as building density, height, and slope. The resulting urban climate map covers a process in which structural landscape features are evaluated at the boundary of the study area.

Formation of the heat island effect in areas of the city with different landscape characteristics; in other words, different regions of the city in terms of temperature were relatively revealed within the scope of thermal load analyses. The wind generation potential within the city was revealed through the calculation of dynamic potential. Therefore, there is no need to use the wind parameter in determining the city climate classes.

For the calculation of thermal load, "building volume", "topography," and "green areas" indicators were taken into consideration. Within the scope of the research, the urban heat island effect was also found to be high due to the "positive" effect of areas with high building volume, such as the northeast of Çankaya, the southeast of Yenimahalle, and the south of Keçiören, on the thermal load. However, areas with high elevation or green areas, such as the southeast of Çankaya, have a "negative" effect on the thermal load. Therefore, the urban heat island effect is low in these

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areas. In calculating the dynamic potential, three different indicators were used: "ground coverage," "natural landscape," and "proximity to open space." In the city core, especially in Yenimahalle and Keçiören districts, the amount of ground coverage is also high due to the density of buildings. These areas have a "negative" effect on the dynamic potential, and air circulation is very low in these areas. On the contrary, areas with natural landscapes and close proximity to open spaces in and around Eryaman have a "positive" effect on the dynamic potential. Therefore, air circulation is higher in these areas compared to areas with high ground coverage. In this context, it can be said that the urban heat island effect is reduced in areas with high air circulation.

In the study titled "Urban Climatic Map and Standards for Wind Environment" conducted by Ng et al. (2012) and whose method is adapted to this study, it is experimentally stated that the temperature increases in areas where the building volume increases because the "Sky View Factor" decreases, through an algorithm related to the building volume ratio-SVF-temperature value. In this study, the proportional classification of Ng et al. (2012) for building volume, as well as the histogram of Ankara building volume data, were evaluated and interpreted together to classify building volume data in terms of increasing urban temperature. There is a need for research that can be used to classify the building volume by calculating the temperature impact of the building's presence in a given volume. There are studies (Wang et al., 2017; Yao et al., 2020) that divide the city into different structural zones, considering factors such as building density, form, and volume, and interpret the temperature differences in these zones using general statistics and landscape metrics. The fact that different structural regions of the city are either side by side or far apart may alter the impact of building volume or height on temperature. On the other hand, there is a clear need for artificial intelligence and machine learning in the time series analyses of satellite images to be used in surface temperature calculations and time series analyses that will include long-term data.

CONCLUSION & SUGGESTIONS

Table 12 presents the total areas of warming and cooling (in hectares and percentage) by district. When the urban climate classes are evaluated based on districts, it is seen that the heating effect levels of the districts in the urban core are Çankaya (25%), Yenimahalle (18%), Mamak (15%), Etimesgut (14%), Keçiören (11%), Altındağ (8%), and Sincan (8%), respectively. However, when the cooling areas of the districts are analysed, it is understood that Keçiören (4%) has the lowest cooling area among the seven districts.

When the difference between the warming and cooling areas of the districts is evaluated, it is found that the warming area in the Keçiören district is 3226 ha more than the cooling area. Therefore, it can be said that Keçiören has the highest temperature in terms of urban climate among all districts. The reason for this is that although the building

volume and the building surfaces that hold the radiation from the atmosphere are high in the Keçiören district, green areas and natural surfaces with a cooling effect are almost non-existent throughout the district.

Table 12. Total warming and cooling areas by districts

District	Warming Area (ha)	Percentage (%)	Cooling Area (ha)	Percentage (%)	Warming & Cooling Area Difference (ha)
Altındağ	1149	8	1315	7	-166
Çankaya	3754	25	4987	28	-1233
Etimesgut	2127	14	5353	30	-3226
Sincan	1251	8	938	5	313
Keçiören	1558	11	640	4	918
Mamak	2221	15	2130	12	91
Yenimahalle	2736	18	2736	15	-27
Total	14796	100	18099	100	-3330

The findings from the study were evaluated, and a proposed map was created to mitigate the heat island effect in the city and enhance the urban climate's cooling effect (Figure 7). In this map, areas with low building density in the city core are suggested as 'afforestation zones', and areas where 'green roof and surface' applications can be made are suggested for regions where building density is high. The amount of green space is limited, and in areas where new green spaces and parks cannot be created, such as Keçiören.

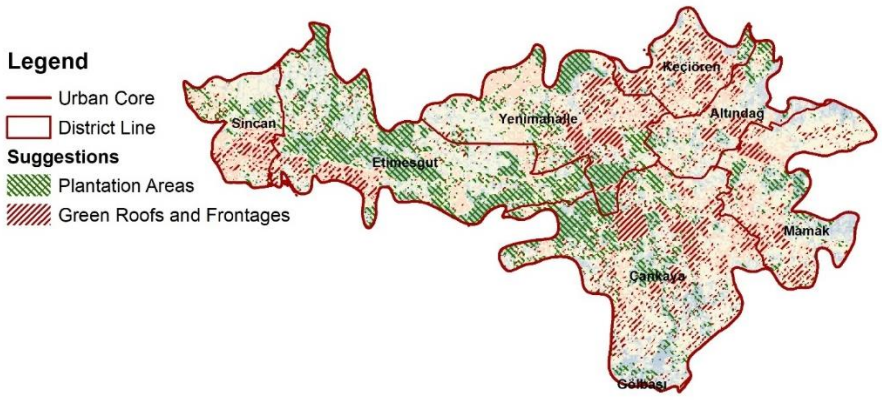

Figure 7. Suggestions to optimize urban climate

Urban climate is a complex issue that is relatively new in Türkiye. Therefore, it has not been fully incorporated into the planning process that determines urban land use policies. Mapping, proper reading, and interpretation of urban climate are crucial, and climate scientists should be consulted when necessary. Although the urban climate map of Ankara is based on a 100 m x 100 m grid, the resulting map should not be interpreted pixel-by-pixel. On the contrary, the pattern, clustering, and extent of pixels provide a better understanding of the general characteristics of a region/district.

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This method can be applied in the calculation of urban climate classes in landscape planning science, where advancements in technology have led to increased scientific knowledge, and in structural landscape characterization studies that build upon this science. At the same time, it sheds light on studies in which climate classes in cities, shaped according to the structural landscape characteristics of other urban landscape areas, such as Ankara's city core, are modeled, and land use policies are developed.

Sustainable development goals, which came into force in 2016 by the United Nations member countries, focus on "ending poverty", "protecting the environment", "taking measures against the climate crisis", "fair sharing of welfare and peace" based on the problems faced by Türkiye and other societies in the world (United Nations, 2024). In line with the objectives of the United Nations, the urban climate mapping method developed in this study will also contribute to the creation of action plans and climate maps at different scales for each city with integrated policies for environmental protection, adaptation to climate change, and increasing resilience against disasters. Improving Ankara's urban climate for the planning of high-quality, comfortable cities is just one aspect of sustainable development in Ankara. In urban planning, other important aspects should be balanced, and synergies should be created as much as possible.

Scientific studies on urban climate are progressing rapidly, particularly in light of the recent 3rd World Climate Conference held in Geneva. The World Meteorological Organization (WMO) emphasizes that, with increasing global warming and climate change, there is a growing need for scientific research on urban climate. Therefore, this study for the urban core of Ankara can be considered a starting point for other studies to be carried out in Türkiye, where urban climate is mapped and land use policies are developed. It is recommended that the urban climate mapping method applied for Ankara should be developed by the Ministry of Environment, Urbanization and Climate Change, that studies should be carried out in cooperation with local administrations and an urban climate branch should be established to provide continuous and up-to-date information for mapping the climate for each city, making better planning decisions and developing sustainable land use policies.

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Resume

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Development of Design in Landscape Architecture Education

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Başak Aytatlı **

Abstract

The study aims to contribute to professional disciplines and literature through the design approach in visual arts-based education, especially architectural education. Visual perception is important in the design process. However, in professions related to architecture, design, and art, the perception selectivity of people should be developed and well-prepared products should be offered to users. The research aims to determine how perception theory changes depending on the education students receive. Visual quality analysis, which forms the basis of our study, was used to determine how effective perception management is, which is important for landscape architecture students and in many visual arts branches such as painting, sculpture, and stage design. In the study, students of all courses were asked to evaluate different planting designs implemented in a single structural project simultaneously, based on the basic five design principles. The data taken based on a visual survey was analyzed with Chi-Square and Frequency Analyses in the Social Sciences Program Statistical Package and examined whether the design courses taken by the students for 4 years were related to their visual perception experiences. To the analyses, it has been determined that there are differences between first-year and final-year students in their interpretation of these principles, that the education received enriches the student's visual production area, and that the use of technology in design also contributes greatly. As a result, it was revealed that the needs of the students in their landscaping arrangements and designs both practical and theoretical education should be updated according to the student's interests and skills. Thus, the contributions of visual perception in landscape education in analyzing, appreciating, and creating visually interesting and functional landscapes will be discussed, and suggestions will be offered to improve their education and designs in their future professional lives.

Keywords: *Design principles, Landscape architecture, Visual perception, Visual skills, SPSS.*

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INTRODUCTION

Studies on the concept and methods of design began in the 1950s and 1960s (Jones 1992; Le Masson and Weil 2013). Concepts related to design have emerged over time as different ideas, theories, and theories about the concept of design (Cross 1993; Akdemir 2017). With the effect of factors such as logic, intelligence, and talent in the design process, the paths followed during the design phase have been defined in different ways. Throughout the history of the design process, the form approach has been interpreted with factors such as psychological, sociological, and religious (Norman 2017; Acırlı and Kandemir 2020). It is especially important to present sustainable environmental designs that will improve environmental conditions (Coccolo et al. 2018). In this context, one of the most important occupational groups dealing with sustainable environmental design and focusing on working subjects is the professional discipline of landscape architecture. Landscape architects should ensure that the design and planning studies they focus on meet important needs such as the demands of the users, the comfort of the space to be created, and active/passive usage conditions (Onur 2009; Doğan 2019, Soydan 2020). It is seen that the concept of visual perception, one of the most important parameters of landscape architecture studies, stands out in designs (Daniel 2001; Polat et al. 2012). The constant change of environmental conditions and the necessity of living in harmony with these conditions; require recognition of objects and perception of the environment to meet individual needs. For this reason, the concept of perception is very important for human life (Aydınlı 1986; Barness and Papaelias 2021). While the integrity of space and perception is ensured by the integrity of the width-height-depth 3-dimensional object criteria, the 4th dimension which is time is very important for these studies.

Landscapes that change over time e.g. plant growth, flowering, fruiting, etc. Temporal concepts such as the change of seasons allow the perception to change in the same space (Aslan et al. 2014). The concepts of perception and sense should not be confused with each other. While the sense expresses the data that we feel with our sense organs but is not yet defined; perception can be defined as the process of making sense of the existence and events around us by interpreting sensory data (Cüceloğlu 1991). According to Genç and Sipahioğlu (1990), perception is the phenomenon that gives us identity information about the qualities of objects, and the mind has nothing to think about without materials that will create perception. Myers (1989), on the other hand, defines perception as the awareness of an object or situation with the help of the senses by focusing attention on a phenomenon or object. Perception is the interpretation and comprehension of information about the world around us gathered by sense organs. According to some, perception is what the stimuli coming from the external environment are collected by the senses, while according to some people, it includes all kinds of information that can be obtained in a situation belonging to the outside

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world (Katırancı 2014). Perceptions are fed by three sources such as experience, biological structure, and knowledge (Myers 1989; Van Jaarsveld 2010). According to Arnheim (2012), visual perception can be evaluated by looking at the presence of a small object or the effect of its location on the visual environment. Visual perception structures the interaction between the perceived and the perceiving individual according to some visual stimuli (Behrens 1984). The sense of aesthetics resulting from perception is the order created by the harmony of nature and the sense of satisfaction that this order creates in the user. In landscape aesthetics, this perception can be defined as the feeling that the whole landscape creates in the person. The whole formed by the elements that make up the landscape strengthens the visual perception. The philosophy created by the evaluation of visual perception must be associated with design (Beyoğlu 2015). The beauty of the landscape consists of the perception that the whole creates in the user, rather than individual elements (Beza 2010). The concept of beauty is the user's sense of satisfaction (Richard et al. 1990). In the perception process, many factors enable the perception of the individual in the environment. The natural and socio-cultural environment of the individual affects the perception process (Kotler 2016). Although the perception depends on the personality and culture of the user, the visual features that make up the landscape are also important (Bishop et al. 2001). The criteria of the factors that make up the landscape affect the aesthetic quality of the space and increase the satisfaction of the user. The way the geometric features that make up the form of the space are brought together increases the aesthetic quality (Lang 1988). Understanding human perception and quantitative parameters that characterize the visual quality of the landscape in urban open green spaces is important to identify these links (Ma et al. 2021). While designing, determining the visual perception qualities of individuals will ensure that the design is made for the solution of the problems. (Smeulders et al. 2000). The design criteria and elements constitute the perception in the visual perception process (Eidenberger 2004). Basic elements such as form, texture, size, light, etc are formed by bringing together factors such as harmony, repetition, symmetry, unity, dominance, hierarchy, and balance with different relations (Wong, 1993; Wender and Roger 1995). Features such as order, repetition, rhythm, and form used in the design facilitate the user's perception of the environment and strengthen the perception (Yılmaz et al. 2018).

Improving the visual perception of architecture students during their education is essential for their development as skilled and innovative designers. Here are several strategies to enhance visual perception in architecture education:

- Visual Training Exercises: Incorporating regular visual training exercises into the curriculum. These exercises can include sketching, drawing, model making, and other hands-on activities that help students develop their observational skills and spatial awareness.

- Exposure to Diverse Architectural Styles: To expose students to a wide range of architectural styles, from historical to contemporary, through case studies, field trips, guest lectures, and architectural tours. This exposure helps broaden their visual vocabulary and allows them to analyze and appreciate different design approaches.
- Studio Critiques and Feedback: Conduct regular studio critiques where students present their design projects to peers and faculty for feedback. Encourage constructive criticism and discussions about visual composition, proportion, scale, and other elements of design.

This feedback loop helps students refine their visual perception and design skills over time.

- Integration of Technology: Integrating digital tools and software, such as computer-aided design (CAD), Building Information Modeling (BIM), and visualization software, into the curriculum. These tools allow students to explore and manipulate architectural forms in three dimensions, enhancing their spatial understanding and visualization abilities.
- Interdisciplinary Collaboration: To encourage interdisciplinary collaboration with other fields such as art, psychology, sociology, and environmental science. Collaborative projects provide students with diverse perspectives and insights, fostering a deeper understanding of the social, cultural, and environmental factors that influence architectural design.
- Study of Human Perception: Introducing students to the principles of human perception, including visual perception, cognitive psychology, and environmental psychology. Understanding how people perceive and experience space can inform design decisions and help students create more user-centered environments.
- Exploration of Materiality and Sensory Experience: To encourage students to explore the sensory aspects of architecture, including materiality, texture, light, and sound. Hands-on experiments with different materials and sensory simulations can deepen students' understanding of how design choices impact the human experience of space.

Encouragement of Creativity and Experimentation: Fostering a supportive environment that encourages creativity, experimentation, and risk-taking. Allow students the freedom to explore unconventional ideas and push the boundaries of traditional design concepts, promoting innovation and originality in their work. By incorporating these strategies into architecture education, institutions and universities can effectively enhance the visual perception of students, preparing them for successful careers as skilled and visionary architects (Efland 2002; Nolan 2009, Asl and Mizban 2016, Lisińska-Kuśnierz and Krupa 2020).

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The quality of design courses is determined by the suitability of design process factors to students' perception levels and how student perception is formed. It is also very important that the design principles of the spaces that people will use in common are realized according to the theories of visual perception. İpek (2003), emphasized that visual learning techniques in schools should be included in the design process as they facilitate learning. many perception theories affect the development of design such as Gestalt, computational, constructivist, and probabilistic perception theory in the design process. The design teaching technique takes place between two different approaches. The first of these approaches focuses on the development of student's abilities that will enable them to produce original ideas. The second approach, on the other hand, focused on the definition of form and the development of a critical view, concentrating on the professional discipline (Lizondo-Seville 2020). The theory of perception has a very important place in the development of this dual concept and concrete thinking ability (Erdem 1968; Minez 2013). Gestaltism, which emerged especially in the early 20th century, is a psychological theory that focuses on "perception" and "perceptual organization" within cognitive processes. Gestaltism tries to understand the underlying laws that enable us to have a meaningful perception in a seemingly chaotic world. At the same time, gestalt psychology is a mental management organization that directs the way we interpret visual perception based on design (Zanforlin 2004; Pinna 2013, Erdal 2006, Pinna 2013, Spagnuolo 2016, Guberman 2017, Hamlyn 2017, Mungan 2020, Sandal 2022). Also, Gestalt psychology suggests that we should not focus on every little component when trying to make sense of the environment we exist in.

The relationship between design and perception psychology is examined in depth and many ways. This theory, which examines how people perceive and organize visual information, also offers valuable principles that designers can apply in various design disciplines, including graphic design, industrial design, architecture, and more. In this way, individuals become aware of how they perceive visual elements and organize them into meaningful patterns and structures. Designers use this understanding to create layouts, compositions, and structures that are visually consistent and easy to understand. These people can arrange elements in a way that supports intuitive perception and understanding, considering factors such as proximity, similarity, continuity, and closure. In this way, they can better observe and analyze the environment they live in. They also use techniques such as contrast, scale, color, and typography to create focal points and hierarchy in a design. They manage to convey the hierarchy of information by directing the viewer's gaze by controlling the visual weight and emphasis on every living or inanimate element. On the other hand, it provides important information about how people perceive and interpret visual information, which can be applied to landscape design to create environments that are not only visually appealing but also functional, comfortable, and emotionally resonant

(Suman 2009; Stoica 2013, Zhao 2013, Kenaan 2015, Bondarko et al. 2023). By incorporating Gestalt and similar principles into their design processes, landscape designers can create outdoor spaces that delight the senses and enrich the human experience. In landscape design, this principle can be used to create designs that invite exploration and discovery. By strategically hiding or revealing certain elements, designers can create landscapes that capture the viewer's imagination and encourage them to explore more. To understand how people, perceive outdoor spaces and to make sense of them from a creative perspective, landscape designers arrange elements (Amorim et al.2009; Ahmad Nia and Atun 2016, Trebacz 2019, Heft 2021) such as plants, paths, and structures to create a harmonious and visually pleasing composition (Figure 1, Figure 2).

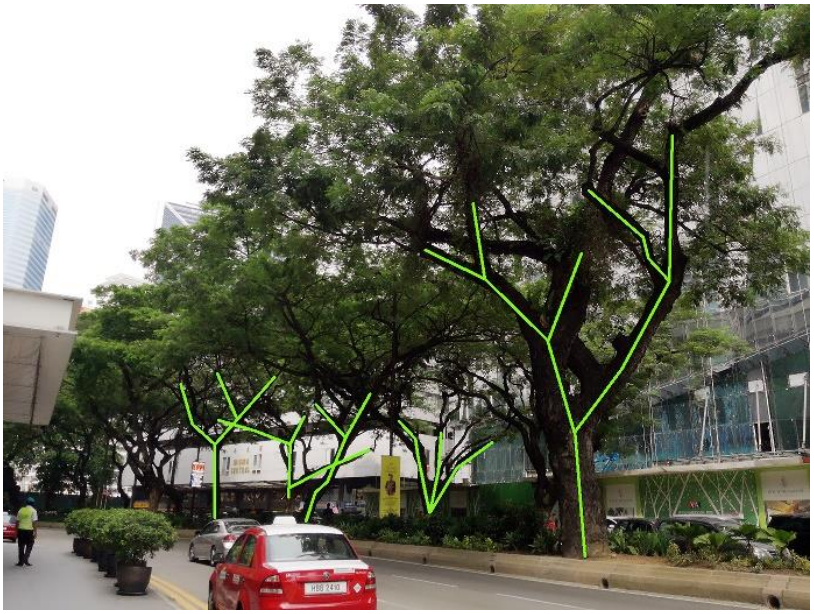

Figure 1. Unity - Continuity in Design (Original Photo).

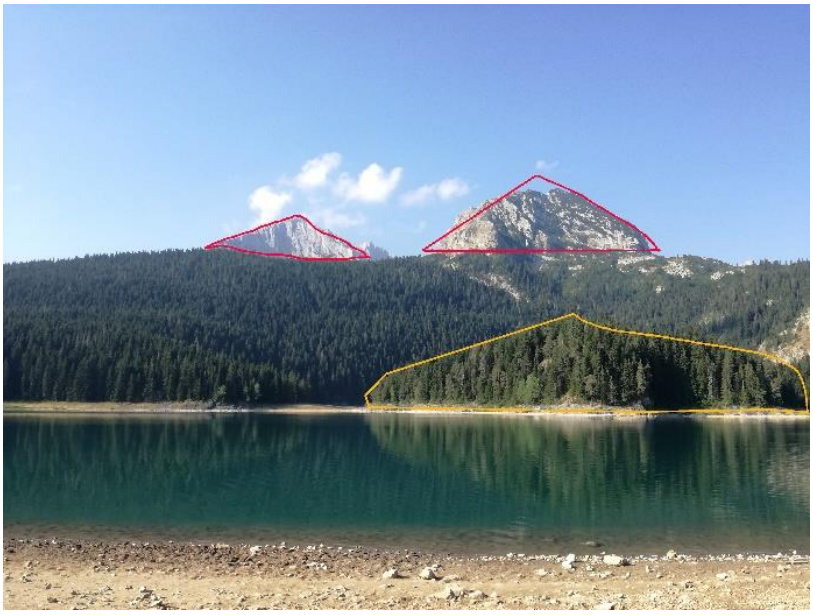

Figure 2. Shape ground - Harmony in Design (Original Photo).

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Considering that the individual is an integral part of the environment that exists in this design cycle and is concerned with needs, it can be said that design exists for human beings and human beings exist to design (Figure 3, Figure 4).

Figure 3. Repetition – Proximity in Design (Original Photo).

Figure 4. Balance-Closure in Design (Original Photo).

In short, the perception process is summarized as focusing on the target, creating concepts, and identifying shapes. In addition, in the process that creates the perception, it is possible to strengthen the perception by building a bridge between the past and the present. Elements and indicators in the visual perception process determine the quality of the perceived concept (Erişti & Urgun 2016). The factors below change for the person who perceives:

- Perceptual choices
- Interests and qualifications
- Trends around
- The space in which the perceived concept takes place and interacts
- It varies depending on the socio-cultural structure and environmental conditions.

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The main purpose of this study is to examine the perception change of the individual in the landscape architecture education process. The main elements of this study are the source researches on the subject, the questionnaire study to question the existing assumptions, and the determination of the approaches that can be effective in the future landscape architecture education of the findings obtained as a result of the research. The study, which was prepared with the assumption that perception change is possible in landscape architecture education, aimed to develop different strategies in education. As a result, the data to be formed in the light of the data obtained will reveal useful results for education and especially for the development of landscape architecture education. For this reason, this study, which was carried out in the Department of Landscape Architecture, was applied simultaneously in a holistic way to cover whole classes of the education program. Landscape Architecture students take design courses throughout the 4-year education period. These courses are increasing every year at different levels and scales. At the end of four years, they took all courses related to landscape design and completed their training. The courses students take regarding design are included in the curriculum as follows table 1.

Table 1. Design-related courses in landscape architecture to years.

Class	Courses
1st grade	Graphic design, Sketching and Drawing Technique
2nd grade	Basic Design, Landscape Design Studio I-II
3rd grade	Planting Design, Construction I-II, Landscape Design Studio III-IV

In parallel with the purpose of the study, some hypotheses were put forward for the study to determine the effect of design on visual perception in landscape architecture education.

H1: The quality and quantity of landscape architecture education affects the perception of design.

H2: As the number of design-related courses increases each year, students can read landscape designs more accurately at the end of 4 years.

RESEARCH METHOD

The study was carried out to determine how students of department of landscape architecture perceive visual perception theory techniques and landscape design principles. For this study, an existing area was chosen considering that it will be implemented by local governments in the future. A neighborhood park located in Erzurum Province Palandöken district, which currently has a children's playground operation, was preferred. In the landscape design shown to the students in the survey, the park was created with formal lines and includes a water surface, seating benches, shaded and semi-open spaces, and pavement details chosen in a way and color that will not interfere with the planting design. On the other hand, vegetal designs were created with tree and shrub combinations of varying size, density, variety, color and composition to

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attract the student's perception and attention. It is aimed to measure the functionality and aesthetic value of the design at the park scale, especially the effective use of color and contrast, as well as features such as texture and pattern diversity. In this direction, it will be possible to achieve a new landscape design approach for the park area as well as aesthetics and functionality (Figure 5). The method is based on correlating students' perceptions through visual quality analysis of planting on a single design according to the number and quality of design-related courses they take each year.

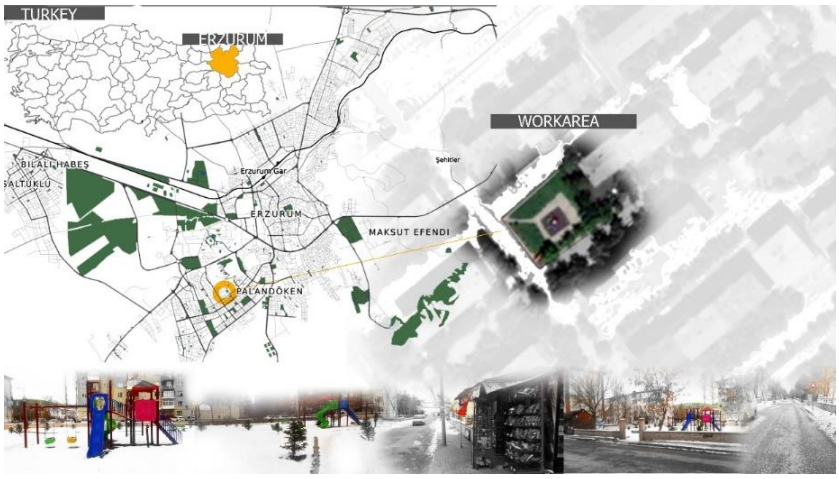

Figure 5. Location of the study area in Erzurum City Center.

The subject of the research is to determine whether the students of landscape architecture, in terms of image and concept selectivity differ according to the class they study, based on the idea that individuals' thinking abilities can be improved by visual perception or visual education.

Study includes:

- Deciding on the study area where the landscape design will be applied in the research,
- Conducting research in the field and scanning the relevant literature,
- Taking photos of the working area,
- Developing different alternatives to determine visual perception changes,
- Preparation and implementation of the survey questions containing the landscape design principles.

The study was conducted with the students of the landscape architecture department, consisting of 1-2-3 and 4th-grade students simultaneously to determine the dominant or most common element of the design principles "dominance, balance, unity, emphasis and repetition" in 5 different plant design projects on the same hardscape design. It is survey research that includes the evaluation of the groups randomly, on the plan, section, and three- dimensional project visuals of the area, and by allocating equal time to each visual in terms of design principles (Figure 6). 310 active students are studying in the department of landscape architecture. The sample size of the survey was calculated as 174 people according to simple random sampling in the Equation 1. (Baltacı 2018).

Equation 2. Sample size calculation formula

$$n = \frac{N.\sigma^2.Z\alpha}{(N-1).d^2}$$

n: Sample size, N: Number of universe units,
P: Observation rate of X in the universe,
Q (1-P): Rate of not observing X,
Zα : 1.96, 2.58, and 3.28 values for α= 0.05, 0.01, 0.001 d= Sampling error
The survey results were analyzed with Frequency analysis in SPSS, One Way ANOVA, and CHI-square tests.

Figure 6. A view from the moment of the survey conducted in the studio.

A few explanations and guidance were given to the students to evaluate these principles through the design.

- Dominance: Evaluating which of the elements you see in the botanical design is visually more dominant,
- Balance: Compliance of the design with different types of balance such as symmetry, asymmetry or radial and measuring the mass-void ratio,
- Unity: Pay attention to how different elements of the design are related to each other and brought together,

(For example, statements such as "If the landscape elements in the park are harmoniously brought together with the structural elements, this provides unity and integrity" were made).

- Emphasis: They were asked to indicate which elements in the design stand out and attract attention.

RESULTS

As a result of the survey, the rate of first-class participants was found to be 39%, while the rate of 4th-grade participants was found to be 29% (Figure 7). The rate of participation in the survey and class sizes vary.

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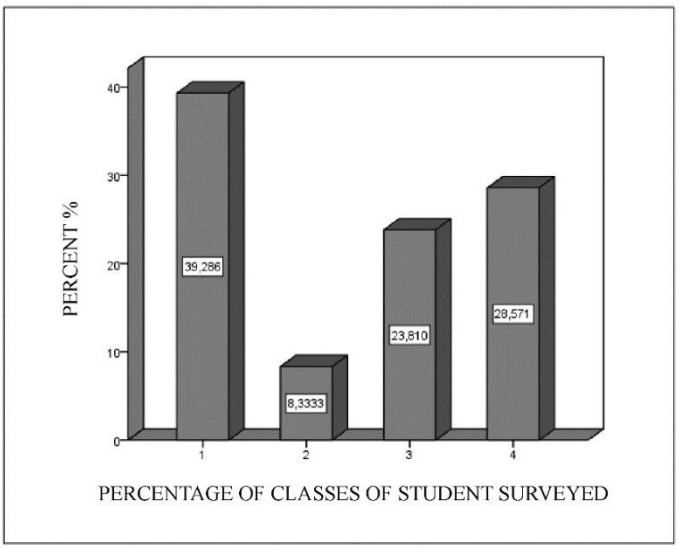

Figure 7. The overall percentage of students surveyed

For the first design project shown in the survey, visual evaluations of each class were expected (Figure 8). The first graders were 66 people during the survey, and they were asked to examine the plan, section, and three-dimensional perspectives of the design by the principles stated for the first design shown. The students stated that the principles of "unity and repetition" were mostly dominant in this arrangement. Sophomores, on the other hand, stated that they saw the principle of "unity" in the same design to a large extent (64%). While the majority of the third-year students stated that the principle of "repetition" was more pronounced, last year's students stated that the principle of "balance and unity" was perceived more (Table 2).

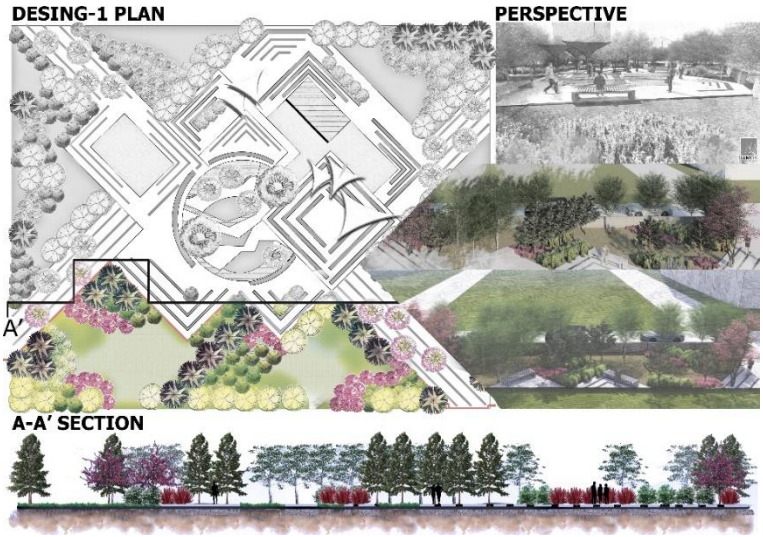

Figure 8. Design-I Plan, section, and three-dimensional views

Table 2. Student evaluation in terms of Design-I planting project design principles

Design-I	The first grader		Sophomore		Third grade		Fourth grade	
Principles	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %
Dominance	9	12.7	1	7.1	2	4.8	5	9.3
Balance	7	9.9	2	14.3	4	9.5	24	44.4
Unity	28	39.4	9	64.2	7	16.7	15	27.8
Emphasis	3	4.2	1	7.1	9	21,4	5	9,3

Repetition	19	26.8	1	7.1	18	42,9	5	9,3
Total	66	93.0	14	100.0	40	95.2	54	100,0

When the second design alternative was presented to the surveyed students (Figure 9), first-year students stated that they saw the principles of "dominance" in the first place and unity in the second place design. 50% of the second-year students stated that "balance", third-year students "balance and repetition" and senior students stated that "dominance" was the most dominant principle in design (Table 3).

Figure 9. Design-II Plan, section and three-dimensional views

Table 3. Student evaluation in terms of Design-II planting project design principles

Design-II	The firstgrader		Sophomore		Third grade		Fourth grade	
Principles	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %
Dominance	22	31.0	3	21.4	8	19.0	21	38.9
Balance	4	5.6	7	50.0	13	31.0	8	14.8
Unity	17	23.9	1	7.1	2	4.8	10	18.5
Emphasis	10	14.1	2	14,3	2	4,8	5	9.3
Repetition	13	18.3	1	7.1	15	35.7	10	18.5
Total	66	93.0	14	100.0	40	95.2	54	100.0

The visual questionnaire was asked of the students for the third plant design project (Figure 10). First-year students stated in the questionnaires that "emphasis and repetition", second-year students "emphasis", third-year "emphasis and repetition", and fourth-year "repetition" was more dominant at a rate of approximately 40% (Table 4).

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Figure 10. Design-III Plan, section and three-dimensional views

Table 4. Student evaluation in terms of Design-III planting project design principles

Design -III	The first grader		Sophomore		Third grade		Fourth grade	
Principles	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %
Dominance	7	9.5	2	14.3	4	9.5	6	11.1
Balance	4	9.5	3	21.4	4	9.5	7	13.0
Unity	17	11.9	2	14.3	5	11.9	8	14.8
Emphasis	10	21.4	4	28.6	9	21.4	11	20.4
Repetition	13	42.9	3	21.4	18	42.9	22	40.7
Total	51	95.2	14	100.0	40	95.2	54	100.0

Student evaluations were made on the visuals in terms of the principles stated regarding the fourth design shown to the students (Figure 11). Accordingly, first-year students stated that they mostly saw the principle of “balance and repetition” in the fourth design, second- year students mostly “repetition", the majority of the third-year students stated that they saw "repetition” and nearly 50% of the senior students stated that they saw the principle of “repetition” (Table 5).

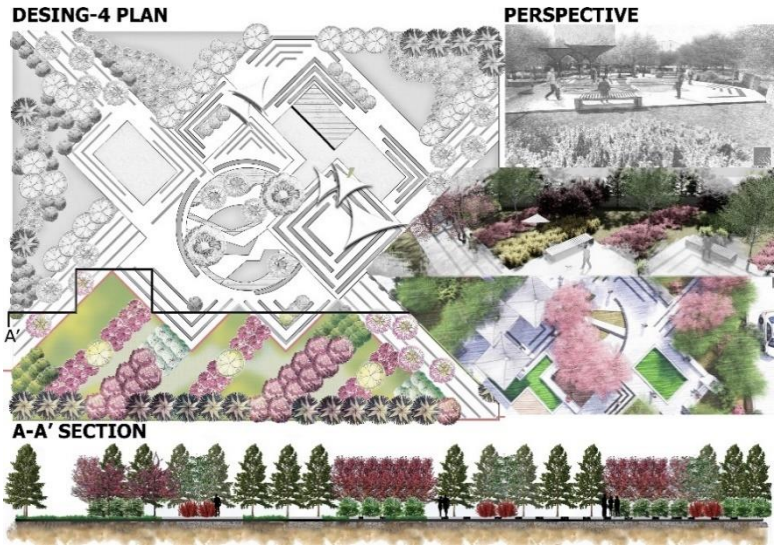

Figure 11. Design-IV Plan, section, and three-dimensional views

Table 5. Student evaluation in terms of Design-IV planting project design principles

Design-IV	The first grader		Sophomore		Third grade		Fourth grade	
Principles	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)
Dominance	7	9,9	3	21.4	5	11.9	4	7.4
Balance	25	35.2	2	14.3	4	9.5	12	22.2
Unity	5	7.0	2	14.3	7	16.7	5	9.3
Emphasis	10	14.1	1	7.1	7	16.7	4	7.4
Repetition	18	25.4	6	42.9	17	40.5	29	53.7
Total	65	91.5	14	100.0	40	95.2	54	100.0

Finally, the design principles asked about the fifth design prepared for the study area were evaluated (Figure 12). For this design, first-year students preferred "balance and unity" out of the five design principles, second-year students mostly (42%) "balance", third-year students "unity", and senior students in the fifth design. They stated that the principles of "balance and repetition" were dominant (Table 6).

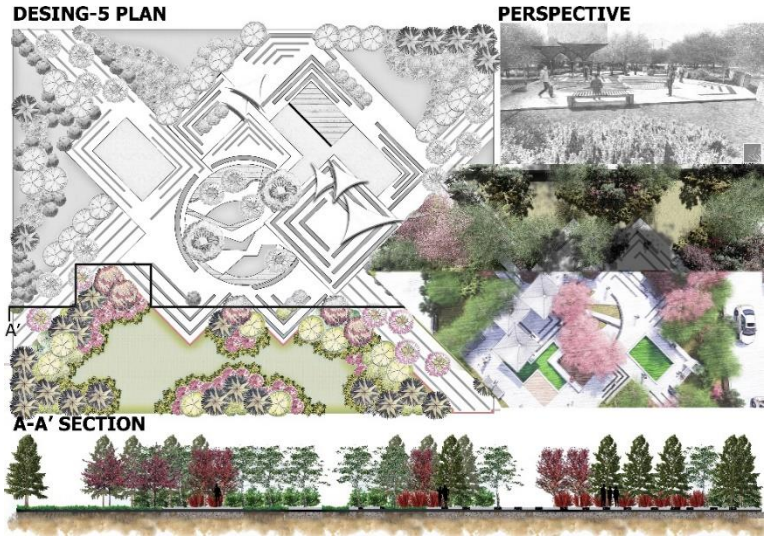

Figure 12. Design-V Plan, section, and three-dimensional views

Table 6. Student evaluation in terms of Design-V planting project design principles

Design-V	The first grader		Sophomore		Third grade		Fourth grade	
Principles	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)	Percent %	Number (N)
Dominance	9	12.7	3	21.4	7	16.7	5	9.3
Balance	19	26.8	6	42.9	5	11.9	21	38.9
Unity	32	45.1	2	14.3	17	40.5	9	16.7
Emphasis	6	8.5	1	7.1	6	14.3	6	11.1
Repetition	5	7.0	2	14.3	5	14.3	13	24.1
Total	71	100.0	14	100.0	40	97.6	54	100.0

The most important difference between people's learning status is the change they show in perception. The development of perception can be changed by identifying and directing people's abilities. The assumption

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that perception change changes during the education process have been confirmed by the examinations and analyses made. In his study, Katrancı (2017) also tried to determine different factors such as the student's area of interest, the time spent in the space, the type of intelligence and the extent to which the visual images were frequently encountered, and how much he adopts the space is important in the stages of noticing, understanding and comprehending the objects around in visual perception education. Alvino (1985), on the other hand, states that training in visual perception strengthens the right lobe of the brain. The study, it was aimed to systematize the concepts created in the perception of all students with designs made with different principles and to determine the technique they perceive in each design by taking these principles into account. Within the scope of the questionnaire, 5 different planting designs were asked to the students simultaneously on the same one hardscape design. As a result of the survey, different answers were found between the classes (Figure 13).

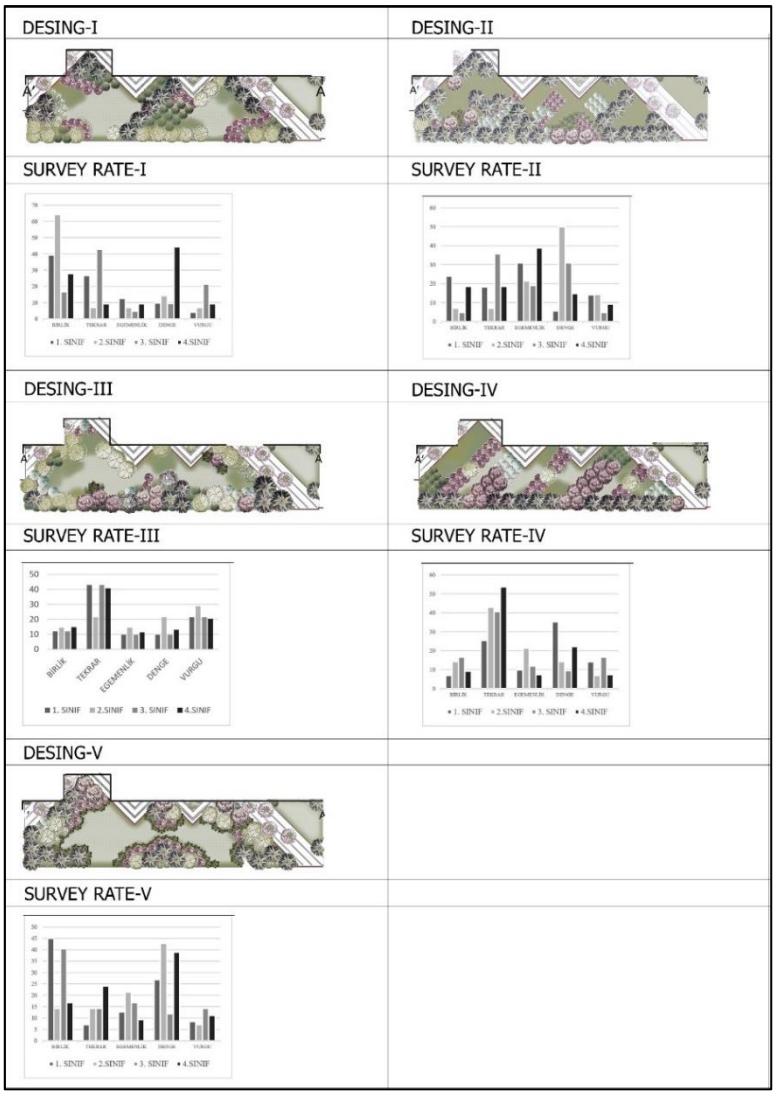

Figure 13. Comparison of the designs according to the perception change in the education.

In general, although the dominant principles perceived and observed in the design were partially similar in the evaluations of the students in each class, it was observed and analysed that there were serious differences in

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some responses. First-year students learn design principles and design in two dimensions in the "basic design" course. In the third and fourth grades, they apply these principles in three dimensions in their project courses. This reveals that students' professional knowledge and experience affect their design interpretations. As a result, significant differences in perception in different classes on the same design were determined by Chi-Square analysis. According to analysis, it was determined that the student's perception of education differed in terms of balance, unity, and repetition principles, but did not change in other principles (Table7).

Table 7. Chi-square Analysis Table

Chi-Square Tests				
Pearson Chi-Square	The first grader	Sophomore	Third grade	Fourth grade
	Asymp. Sig. (2-sided)	Asymp. Sig. (2-sided)	Asymp. Sig. (2-sided)	Asymp. Sig. (2-sided)
Dominance	.870	.020	.093	.499
Balance	.002	.005	.357	.072
Unity	.000	.353	.013	.137
Emphasis	.335	.216	.472	.986
Repetition	.516	.135	.186	.093
a. 2 cells (25.0%) have an expected count of less than 5. The minimum expected count is 2.99 p≤0.005				

One Way ANOVA and Chi-square analyzes were conducted to determine which principles were most important and effective in the projects (Table 8). According to the One-way ANOVA test, it was found that the principle of “Dominance and Balance” is very important as the most meaningful design criterion in the submitted projects (sig ≤0.005).

Table 8. ANOVA Analysis Table

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Dominance	Between Groups	7.203	2	3.601	27.604	.000
	Within Groups	9.785	75	.130		
	Total	16.987	77			
Balance	Between Groups	8.851	3	2.950	23.902	.000
	Within Groups	11.479	93	.123		
	Total	20.330	96			

Chi-Square analyzes whether there is a relationship between students' evaluations of design principles according to their education level, the balance principle of the fifth design differs according to the grade level. First graders stated that the principle of balance was emphasized more. Therefore, it has been determined that the balance principle, one of the design principles, differs according to students (Table 9).

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Table 9. Chi-Square Analysis Table

Design-V	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.229a	3	.000
a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.99.			

It has been determined that the principle of dominance is a more meaningful relationship in the first design among the designs shown to the students in the differences seen in the determination of the principles specified in the designs (Table 10).

Table 10. Chi-Square analysis Table

Design-I	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.072a	2	.000
a. 3 cells (50,0%) have an expected count of less than 5. The minimum expected count is 1.60.			

DISCUSSION

During this study in which Faculty of Architecture and Design, Landscape Architecture students participated, it has been observed that the final year students, who have received both theoretical and applied basic programs and training for landscape design and planning for 4 years, take more accurate and professional approaches when examining designs, especially than first-year students who have not yet mastered these training. Ercan (2009) aimed to determine the effect on the development of visual-motor coordination of students with and without visual perception training in a study he conducted. It has been determined that the prepared education program supports children's visual perception and motor coordination skills and is consistent with previous studies in this field. Considering this study, it has been concluded that visual perception has positive effects on students and that studies encouraging this education have increased. Therefore, the style and methods that will complement the creative processes of students are also important elements for the professional discipline of landscape architecture (Casakin & Timmeren Van 2015). It has been observed that the color used, and the formal perception of the plant representations have an important contribution to visual perception. In addition, as a result of the surveys conducted in the classrooms, it has been revealed that landscape architecture education affects visual perception. Especially since first-grade students have limited visual perception and knowledge of design, it is more difficult than third and fourth-grade students to use their imagination to read the forms and turn this abstract phase into a concrete process. To increase the perceptual development of students, besides various three-dimensional studies and model work by addressing visual perception theories, visual perception competitions between classes can be held to contribute to the development. Eken (2021), explains the project example of the gradual and applied expression of design elements and principles given within the scope of Basic Graphic Education course

within the scope of Basic Graphic Education course in the Faculty of Fine Arts Graphics Department curriculum. At the point where design workshops are insufficient in traditional landscape architecture education, 3D virtual world software is now used effectively in education (Gül 2011). In the study, it has been determined that students who have started to take architectural education for the first time may have insufficient design knowledge and thinking skills, and it has been determined that these students have difficulties in transforming the abstract process into concrete. In the digital time we live in, educators have started to share their knowledge and experiences in academic circles and on some platforms by using this software. These developments create suitable environments for students to increase their perception and creativity in the design process. In parallel with the increase in technological developments, effective use of information technologies in landscape architecture and similar professional disciplines based on visual perception and design skills is an extremely necessary element in the learning process. As confirmed by the chi-square analysis of the class level and the difference in perception on the same design as a result of the survey in the study, the increase in the number and content of design-related courses every year and the expansion of their scope provide positive contributions to design. However, since the student's effective success and grade level in design courses are not known in the study, it may not provide complete accuracy in interpreting the designs. For this reason, H1 hypothesis has been partially confirmed.

In this context, students were shown 5 different plant design studies on a single structural hardscape design. The reasons such as the color of the plants, plant density, forms, positioning in the field, linearity, formal or informal layouts used in these designs directed the students' visual perceptions differently in the designs. Statistical analyzes also confirmed the difference. Five landscape plant design projects prepared for this study were randomly asked to a few of the faculty scholar of the landscape architecture department and it was determined orally that the results were parallel to the results of the final year students' evaluation of design principles. Accordingly, hypothesis H2 is partially confirmed. Düzenli and Alpak (2016) surveyed to determine the effect of the elective course named "Natural Structures and Design" given in the landscape architecture department on the visual perception and creativity of the students. It was tried to determine the differences in the creativity levels of the students who took this course and those who did not choose the course. They found that students who did not take the course had more difficulty in making creative designs. Yıldırım (2019) conducted a survey to determine the design principles and user needs of the parking lots in the SDU (Süleyman Demirel University) campus and examined the current situation of each parking lot on the campus according to the landscape design criteria, and presented the problems and solution proposals related to these areas. In contrast, Taneri and Doğan (2021), in

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their study on architectural students' perceptions of design and the transformation of educational processes, investigated students' perceptions of experiential learning, design and design process, and design education, and whether these perceptions differ according to the class they study. According to their study, students think that design is a concept aimed at eliminating more problems, and these thoughts remain constant for 4 years. Although there are exceptions, they observed that there is no linear progression in the change in perceptions of design between classes in general.

CONCLUSION

In the end it has been determined that the theoretical knowledge that students learn at school limits their designs unless it is supported by experiential, critical and reflective elements. Transforming the educational outcomes of the students into practice in the future, the social and cultural dimensions of the architectural and urban designs they make will come to life on a human scale, and the desire for social benefit in the profession will be encouraging factors in the development of urban culture and urban planning decisions on a large scale. Thus, in the future, the active elements of design in the built environments in cities will be determined, the idea of society will be brought to life again, and the social and cultural welfare in the city and its relationship with architecture will be given more importance. It is aimed that the resulting product will be an example for similar studies to be done in the future. A student, studying in professional disciplines that designs, reproduces, forms and creates 3-dimensional products in order to realize the visual perception in design more accurately should learn the basic rules and principles of design well, and use design components effectively with a holistic approach and must have completed an important part of education by learning to construct the perception correctly. In the case of landscape architecture students, updating their current education on design will enable them to improve their visual perception, enrich their perspective and understand natural environments more deeply. Thus, it will enable them to create more effective and sustainable landscape designs. An effective diversity can be created by modernizing the educational content for the future and ensuring that the relevant courses are taken directly. For example; Nature and landscape painting classes that allow students to visually observe natural environments and express them through drawing, botany courses, where students can understand the characteristics of plants, their growth habits, colors and textures, at a level where they can grasp the psychology of evaluating them as a visual object, and can directly benefit from the selection and use of plants in landscape designs, regular rural or urban field trips, color theory and color application courses, architectural photography, spatial perception and user experience courses, techniques of artistic expression courses can help landscape architecture students develop their visual perception and increase their design skills. This allows them to create more creative,

functional and aesthetically pleasing landscape designs. By cultivating their visual perception abilities, architectural students develop the essential skills and sensibilities required to practice architecture effectively and responsibly in a diverse and dynamic world. In this way, the importance of visual perception for architecture students should be emphasized in every aspect of design practice and actively implemented to provide students with a deep understanding of the perception and experience of spaces. The importance of visual perception should be constantly emphasized to students throughout their education, and students should be provided with practical experiences on how to integrate visual elements. This enables students to gain a deep understanding of the perception and experience of spaces and makes them more effective and sensitive designers. Integrating visual perception as well as other sensory elements into the design process helps spaces create a holistic impact on users and enables architecture students to grow up as versatile and sensitive designers. In this way, architectural education will provide students with the ability to create not only aesthetic but also human-centered and functional spaces.

As a result, each graduate will be able to create modern approaches to the formation of more livable and healthy designs, especially by actively participating in the city-related decision-making mechanisms of local governments. That's why visual perception is integral to every stage of the landscape design process from conceptualization and planning to implementation and maintenance. By understanding how people perceive and interact with their environment visually, landscape designers can create spaces that are not only beautiful but also functional, sustainable, and meaningful.

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A Mamdani-Based Fuzzy Logic Model for Evaluating the Design Quality of Urban Squares

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Abstract

Urban squares are essential elements defining public interactions, cultural manifestations, and urban social characteristics. The spaces function as central meeting areas where citizens participate in civic duties, connect and serve to maintain urban design unity. The evaluation process of design quality proves challenging because it combines the personal interpretation of many complex variables, which standard assessment techniques struggle to measure. The researchers present a Mamdani-based fuzzy logic model that evaluates urban square design quality through eight core parameters: imageability, meaning, legibility, time, enclosure, dominance, diversity, and comfort. Fuzzy logic is an approximation system that converts evaluative statements based on linguistic expressions into numerical arrangements, which excel at interpreting multi-faceted urban design evaluations. The model underwent calibration through evaluations from 1,044 architecture professionals, planners, and landscape architects, and it was used to analyze 20 internationally recognized urban squares with various spatial designs across different cultural settings. The quantitative model demonstrated its accuracy by matching expert-aggregated scores when measured against predictions, with a precision of ±1.5% pin predicting outcomes. All examined variables confirmed that enclosure and comfort are the key factors influencing perceptions of design quality. The model provides practical applications for urban planners, decision-makers, and educators through its ability to create a standardized evaluation process for current and future urban interventions. The framework offers a distinctive approach that integrates design thinking-oriented methods with evaluative measures, rendering it practical for contemporary urban design practice.

Keywords:
Fuzzy logic, Public space, Urban square.

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INTRODUCTION

Cities incorporate urban squares as their most significant public areas, shaping community schedules and reflecting the social and cultural transformations or urban environments. Outdoor and multi-purpose settings with spatial anchors offer accommodation for various activities in addition to their use in gatherings, circulation, celebrations, and protests. Open spaces serve physical needs while satisfying symbolic expectations through their diverse functions and design features, which determine how people perceive and interact with them. Traditional urban square planning adheres to established principles, although the interweaving of space relationships tend to be irregular. Significant aspects exist in a network structure that transforms according to contextual and morphological variations and temporal changes.

Multiple publications present lists of the world's most successful urban squares while refraining from defining the specific characteristics that make them successful. Academic researchers have stepped in to address this knowledge gap through investigations aimed at discovering and assessing the important physical elements and perceptual characteristics of design excellence. Research identifies tactical and abstract design qualities through form, shape, enclosure, and perception-based factors such as imageability, meaning, and temporal sense. From antiquity to present day, various theorists, including Vitruvius (1960a, 1960b), Alberti (1986), Sitte (1986), and Zucker (1959a), have identified essential design criteria that define a well-designed square. Design quality analysis methods remain subjective, as these assessment models continually in response to prevailing cultural and temporal preferences. Different theorists employ the same concept of enclosure, interpreting it as a either a mathematical framework of rules or an intuitive signal.

Because defining essential design criteria remains a complex task, assessing design quality becomes inconsistent. Several urban settings exhibit such complexity, making it challenging to measure them using standard scoring systems. The inadequacy of these systems is evident in their inability to capture the characteristics that make up urban character during evaluation procedures. The evaluation method of public squares requires consideration of spatial arrangements, as well as an investigation of human reactions and cultural significance and time-based changes. A more flexible evaluation method becomes essential during this period of rapid urban development, as static and one-dimensional tools often fail to accommodate the dynamic and multi-layered nature of public squares.

Such conceptual confusion demonstrates that classical logic fails to grasp design quality because it typically involves a simple yes-or-no categorization. Research methods for urban design must adapt because this field includes multiple complexities, ambiguous elements, and subjective interpretation factors. Fuzzy logic is an alternative evaluation system that transforms verbal and ambiguous qualitative assessments into structured numerical outputs (Zadeh, 1965). Approximate reasoning

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forms the basis for fuzzy logic to operate effectively on systems that display non-linear substance and partial or indefinite data. Urban space is an appropriate subject for evaluation through fuzzy logic, as it combines physical experiences with emotional impressions resulting from both quantitative and qualitative attributes. Research shows that public environments succeed by combining structured physical elements with sensory elements, which help create psychological depth.

Such a model improves urban design practice by combining computer precision with human-based perception variability. The model is an essential connection that merges numerical processing with human observation by integrating specialist insights and place-specific factors during the evaluation process. As a system, fuzzy logic shows versatility in receiving diverse spatial interpretations associated with public spaces during contemporary globalization. The model demonstrates enhanced applicability across various sociopolitical and geographic settings, including historic European squares and current Middle Eastern and Asian public urban areas.

This research develops and implements a Mamdani-based fuzzy logic system to analyze the spatial quality of urban squares through physical variables and experiential parameters. A literature study by Alkan Bala and Üstüntaş (2014), Ferdous (2013), Mehta (2014), and Zawidzki (2016) enabled the identification of eight essential parameters: imageability, meaning, legibility, time, enclosure, dominance, diversity, and comfort for use in the model framework. The criteria represent fundamental assessment measures that specialists use in their evaluations of urban spaces, drawing both instrumental and holistic distinctions. According to Tibet (2024), the inclusion of perceptual sensitivity in computational models receives further evidence as the researcher demonstrates how fuzzy evaluation frameworks capture the symbolic and textural aspects of urban environments. MATLAB's Fuzzy Logic Toolbox was utilized to create the model through evaluation data obtained from 1,044 experts who reviewed 20 globally distinguished urban squares. Architects, urban designers, and landscape professionals rated the parameters using standardized visual materials and contextual descriptions during the evaluation process.

The model's basic assumption demonstrates how fundamental urban square design features affect users' perceptions, which can be evaluated using a fuzzy logic system analysis. Analysis was conducted using two evaluation methods: evaluating 179 expert professional surveys and a fuzzy logic protocol that employed identical parameters. The high correlation between expert perception and fuzzy modeling approaches demonstrates that expert intuition can be precisely predicted through the fuzzy modeling method while enhancing assessment scalability and reproducibility. This model accepts subjective spatial evaluation processes while generating evaluation data that specialists, designers, education professionals, and policymakers can understand.

The proposed evaluation method accepts both quantitative measurements and qualitative elements to provide an assessable solution for conventional evaluation systems. The system enables the creation of advanced assessment capabilities by recognizing quality gradations beyond binary success or failure results while establishing rankings through expert knowledge. The evaluation strategy shows particular value for cases where experiencing a sense of place, combined with perceptual enclosure, is equally essential as spatial maintenance and pedestrian activity. As a result, this established model serves as a tool for developing new urban squares and evaluating existing ones with the potential to guide academic training and urban policy development. This research employes a fuzzy logic model to resolve ambiguous meanings into quantifiable terms for structured decision-making processes.

The validation system for the spatial arrangement of an urban square provides a new multiscale evaluation based on expert panel agreement, utilizing concepts from fuzzy theory. This method serves as a crucial bridge, integrating the perception of design concepts with formal design attributes into a coherent system for evaluating key urban open spaces. The research combines theoretical frameworks with computer algorithms and empirical evidence collection to enhance current knowledge about measuring public domains in cities and their improvement methods. Researchers should capitalize on the developed foundation to build combination assessment systems that integrate AI systems with environmental analytics and public participant evaluations.

URBAN SQUARES AND RELATED DESIGN FEATURES IN THE LITERATURE

In literature, many theorists have defined and examined urban squares with different concepts and terms, revealing the characteristics that define the urban square across different interfaces. Although they are expressed differently in various languages, such as an agora, forum, plaza (Spanish), campo, piazza (Italian), or platz, when the design qualities are listed, a common language is complemented, binding and, connected (Özer & Ayten, 2005). In this common language, it is sometimes impossible to distinguish between concepts, a concept is often defined by incorporating many of them. In this context, it is difficult not to mention measurement when discussing form, measurement when discussing enclosure, order when discussing balance, and balance when discussing the layout. Definitions complement each other and establish a relationship network.

In the 1960s, Vitruvius defined the urban squares that he called the ‘forum’ through size, specific dimensions, and ratio relationships. Cullen (1971) defined them as “a place for everything“ based on function, while Paul Zucker (1959a), who supported this statement, described the square as “a psychological parking place in public-on-public land. At another point, Lynch (1960), who referred to the urban square as the city's node, considered the square an element of the city to understand and recognize

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it and saw it as a strong image of the city. Alexander (1987) described this powerful image as a center for every city. He considers the square, one of the two elements described by Krier (1979), the city, as the first tool in using urban space, and refers to Jan Gehl (2011) as an open space surrounded by structures such as open space. Krier (1979) gave examples of the squares of the agora, mosque courtyards, and monastic courtyards of the city as an example of a city image. While creating the layout of urban space, the principles of implementation can be revealed by using principles such as order, form, symmetry, shape, and rhythm (Ching, 1979). A square feeling is created when these principles come together in the urban squares. This concept, mainly based on formal characteristics, is directly proportional to the feeling of siege/circumference. It is essential that there is an uninterrupted continuity in the surrounding structures or that the spaces are placed so that they do not disturb the feeling of closeness (Oktay, 2007; Sitte, 1986). It also relates to the scale. Width-height, width-length, and length-height are the most critical inputs in catching the scale, and this makes up the size of the urban square (Alkan Bala & Üstüntaş, 2014). Vitruvius (1960a) noted the necessity to consider the size of the urban square and the number of users.

The urban square design concepts were studied in two main topics in the literature. Studies in the first topic focus on the physical conditions of urban squares and try to formulate the main definitions and the essential components of an urban square. The second main study topic focuses on the perceptions of users about the urban square design (Alberti, 1986; Acar et. al., 2021; Alexander et al., 1977a; Alkan Bala & Üstüntaş, 2014; Altınçekiç & Kart, 2000a; Altay et. al, 2023; Ashihara, 1981; Bentley et al., 1985; Bostanci & Ocakçi, 2011; Çakmaklı, 1992; Çolakkadıoğlu &Büyüköztürk, 2024; Carmona et al., 2003; Carmona et al., 2010; Carmona, 2021; Carr et al., 1992; Ching, 1979; Cullen, 1971; Damayanti & Kossak, 2016; DETR/CABE, 2000; Ewing & Clemente, 2013c; Ferdous, 2013; Francis, 2003; French, 1978b; Gehl, 1987; Gibberd, 1959; Gold, 1980; Grammel et al., 1977; Jacobs & Appleyard, 1987; Köseoğlu & Erinsel Önder, 2010; Kostof, 1992; Kostof et al., 1992; Krier, 1979; Lang, 1987; Lefebvre & Régulier, 2004; Li et. al. 2024; Lovene et al., 2019; Lynch, 1960; Marcus & Francis, 1997; Mehta, 2008, 2014; Memlük, 2013; Moughtin, 2003; Nasar, 1998; Oktay, 2007; Önder & Aklanoğlu, 2002; PPS, 2000; Proshansky et al., 1983; Rapoport, 1977; Reis et al., 2003; Relph, 1976; Romano, 2004; Sepe, 2021; Sitte, 1986; Stamps, 2005; Stubben, 1924; Terzi et al., 2019; Trancik, 1986; Tunnard & Pushkarev, 1963a; Vitruvius, 1960b; Wang, 2002; Whyte, 1980; Zawidzki, 2016; Zucker, 1959a, 1959b). There are also lots of studies that consider both physical and perceptional dimensions of an urban square design. These studies research the ideal environmental conditions of an urban square primarily to identify and measure the design value of urban square design quantitatively and qualitatively (Figure 1). Numerous studies were

examined, and essential and prioritized resources were presented in the literature review table (Table 1).

Figure 1. Frequency of urban square design features in the literature (Özyılmaz Küçükyağcı, 2020)

Table 1. Literature review for urban square design criteria (Özyılmaz Küçükyağcı, 2020)

		DESIGN PARAMETERS																																					
		Meaning	Upkeep	Style	Size	Vitality	Diversity	Enclosure	Balance	Dominancy	Order	Disorder	Accessibility	Function	Form	Permeability	Width/Height Ratio	Visual Appeal	Visual Order	Safety	Hierarchy	Imageability	Character	Identity	Comfort	Centrality	Legibility	Proportion	Scale	Panoramic	Colour effect	Rhythm	Symmetry / Asymmetry	Continuity	Shape	Definiteness	Balance	Emphasis	Orientation	Time
	1924 J. Stubbon													X																									
	1959 Paul Zucker			X	X			X		X	X			X	X		X								X														
	1959 Frederick Gibberd				X						X			X	X												X	X											
	1960 Vitruvius				X												X											X						X					
	1960 Kevin Lynch	X			X						X		X									X		X			X				X		X				X	X
	1963 Tunnard ve Pushkarev																					X		X															
	1971 Gordon Cullen					X								X												X													
	1976 Relph	X																																					
	1977 Grammel et.al							X									X											X											
	1977 Alexander et.al.			X	X			X	X								X							X															
	1977 Michael Trieb							X									X																						
	1977 Rapaport								X																														
REFERENCES	1978 Jere Stuart French			X				X			X			X											X														
	1979 Francis DK, Ching	X						X					X		X						X					X					X	X	X						
	1979 Rob Krier			X											X												X							X					
	1980 Whyte					X	X					X													X														
	1980 Gold													X																									
	1981 Ashihara				X																																		
	1983 Prushansky	X																																					
	1985 Bentley et.al.						X									X		X	X																				
	1986 Camillo Sitte			X			X	X	X	X		X				X	X	X							X		X	X						X					
	1986 Alberti						X							X	X		X																						
	1986 Trancik				X	X				X								X				X			X											X			
	1987 Jan Gehl				X		X				X			X				X				X															X		
	1987 Lang							X																															
	1987 Jacobs et.al.	X					X						X	X										X			X												
	1992 Carr et.al.	X											X	X											X														
	1992 D. Çakmaklı			X		X	X	X			X			X				X																					
	1992 Kostof			X							X				X													X											
	1997 Marcus and Francis				X		X							X				X																	X				
	1998 Jack Nasar		X																X										X						X				
	2000 Altınçekiç ve Kart																																						X
	2000 DETR/CABE						X	X					X										X				X						X						
	2002 P. Wang													X								X																	
	2002 PPS		X				X						X	X										X	X		X												
	2002 S. Önder, F. Aklanoğlu			X							X		X	X	X							X						X											
	2003 Cliff Moughtin					X	X	X						X	X			X																					
	2003 Carmona et.	X					X	X		X			X		X										X			X								X	X		X	X
	2003 Reis et.al.							X																	X															
	2004 Lefebvre ve Régulier																														X								X
	2004 Romano													X	X																								
	2005 Stamps																																						
	2007 Derya Oktay							X																															
	2008 V.Mehta													X												X													
	2010 Carmona et. al	X															X									X		X											X
	2010 Köseoğlu ve Erisel Önder																										X												
	2011 Bostancı ve Ocakçı						X		X		X			X	X				X												X					X			
	2013 Ewing and Clementine	X						X																			X	X										X	
	2013 Ferdous							X																															
	2013 M.Memlük				X			X						X	X																								
	2014 V. Mehta	X											X	X							X				X														X
	2014 H. A. Bala & ÜŞtüntaş						X	X						X		X	X	X				X			X			X				X		X			X		
	2016 Damayanti ve Kossak																																					X	
	2016 M.Zawidski			X				X			X																												
	2019 Lovene et.al							X									X											X											
	2019 Terzi ve dig.				X	X	X						X	X										X															
	2021 Sepe					X							X												X														
	2021 Carmona	X											X												X									X				X	
	2021 Acar et.al.					X	X						X																										
	2023 Altay et. al.						X	X	X		X		X	X	X	X					X					X		X		X				X				X		
	2024 Li et. al.					X	X							X																									X
	2024 Çolakkadıoğlu &Büyüköztürk		X					X						X	X						X			X	X														X

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The study aims to establish a clear framework, a necessity given the subject's complexity and the need to analyze multiple variables. The parameters under study were derived from a thorough literature analysis, ensuring their relevance and applicability to theoretical and practical fields. Istanbul's historical center has been a key area of analysis, drawing on Çınar and Çermikli's studies (2018,2019), which explored urban form interpretation to understand spatial memory and identity from a cognitive perspective. The researchers (Çınar & Çermikli, 2019) employed point density analysis in cognitive mapping to show how users' perceptions influence the spatial quality within historic urban configurations. As in this study, perceptual and physical parameters were used conjunction with this research (Çınar & Çermikli, 2019; Yıldız and Çağdaş, 2019).

In this context, urban squares, as public open spaces, underwent a detailed review, identifying imageability, meaning, legibility, time, enclosure, dominance, diversity, and comfort as the primary design attributes for the fuzzy logic model. Theoretical concepts related to square design evaluation are recurrent in academic literature, underscoring their status as fundamental elements (Yıldız and Çağdaş, 2020). Complete with sub-parameters, the model elucidates how each criterion contributes to the urban square experience within its conceptual framework. Since the subject focuses on urban squares as urban open spaces, the results of a detailed literature study indicate that eight basic parameters of squares have been identified for the proposed model. These have been chosen with consideration for the fact that numerous design features are included in many studies in the literature, emphasized and highlighted by theorists. The eight selected design attributes are; imageability, meaning, legibility, time, enclosure, dominance, diversity, and comfort. The sub-parameters of these parameters are also defined in the context of what they mean, what they cover, and their relationship with the urban square.

Imageability

Imageability, as proposed by Lynch (1960), is the quality that makes a place recognizable and memorable. This concept is heavily influenced by the legibility of spatial elements such as identity, structure, and meaning, as suggested by Damayanti & Kossak (2016). Their well-regulated design and distinct features often characterize cities with high imageability. Creating a strong urban image involves physical elements that attract attention and evoke emotions. Notably, landmarks and architectural arrangements play a significant role in this process, as Ewing and Clemente (2013b) discussed. Notable urban squares such as Piazza San Marco, serve as city focal points and symbolic references, as highlighted by Önder & Aklanoğlu (2002).

Meaning

The meaning of a space is defined by personal experiences and historical events (Relph, 1976; Lynch, 1960). It is a concept that is closely related to perception, identity, and structure (Proshansky et al., 1983), sparking our curiosity. The meaningfulness of a place is enhanced by its historical and political significance, which influences how spaces are perceived and utilized (Mehta, 2014; Lang & Marshall, 2016).

Legibility

Legibility, the ease of navigating and understanding urban space, is influenced not only by sensory experiences but also by spatial properties (Bentley et al., 1985; DETR/CABE, 2000). This emphasis on spatial properties provides the audience with a sense of being informed and knowledgeable.

High legibility, which depends on pedestrian movement and reference points, is significantly impacted by building scale, density, and orientation. These factors play a crucial role in user satisfaction and spatial understanding (Krier, 1979; Bostanci & Ocakçi, 2011; Samavati & Ranjbar, 2017), making the audience aware of their practical implications.

Time

Time is closely related to the meaning of space and its historical and political context (Carmona et al., 2010; Mehta, 2014). It is experienced through rhythmic or progressive changes and affects the continuity and development of urban spaces (Lynch, 1972; Altınçekiç & Kart, 2000). Temporal cycles, cultural heritage, and daily life rhythms influence the city's formation and architectural space (Lefebvre & Régulier, 2004).

Enclosure

The enclosure is a crucial aspect of urban spaces, defining the visual aspect of the urban space. It is defined by vertical and horizontal elements that limit the user's field of view. The enclosure's corner points and edges are crucial in defining the place (Moughtin, 2003). Jan Gehl created the behavior map in Piazza del Popolo in 1965, noting that people prefer to sit and rest on the edges of the square, the most frequently used area (Gehl & Svarre, 2013). The degree of enclosure is determined by the character of the surrounding elements, which are influenced by the height and width of the space. The degree of enclosure, dependent on the ratio between the surrounding buildings' height and the urban square's width, creates the feeling of enclosure (Dee, 2004; Gehl, 1968; Lovene et al., 2019). The ratio should decrease or increase linearly to avoid losing the sense of an urban square, while a higher ratio can cause the feeling of being surrounded to disappear entirely. The quality of the elements, the level of the enclosure, and the order of the surrounding aspects affect the spatial quality of the urban square (Alkan Bala & Üstünbaş, 2014; Altay

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et. al, 2023; Çakmaklı, 1992; Çolakoğlu and Büyüköztürk, 2024; Sitte, 1889)

Dominance

Urban squares have evolved in response to religious beliefs and political influence, with administrative or religious buildings often being the most dominant structures. These structures host various activities and events, revealing the power of administration and defining unique spatial contexts (Wolfrum, 2014). The "dominated square" type in Zucker's (1959b) urban square identification states that the square is shaped around a center, with all other structural elements associated with this structure. Dominance in space refers to the character of one or more structures or physical elements that contrasts with the surroundings and is situated at a prominent point, thereby ensuring readability and orientation (Carmona et al., 2010). Features such as size, design, location, quality, and function affect dominance and contribute to the identity and image of the space (Trancik, 1986). The dominance effect created by buildings in squares encompasses the contrast between the building's size and that of the surrounding buildings, which interferes with perception of shape, color, texture, form, and size (Lynch, 1960). (Figure 2)

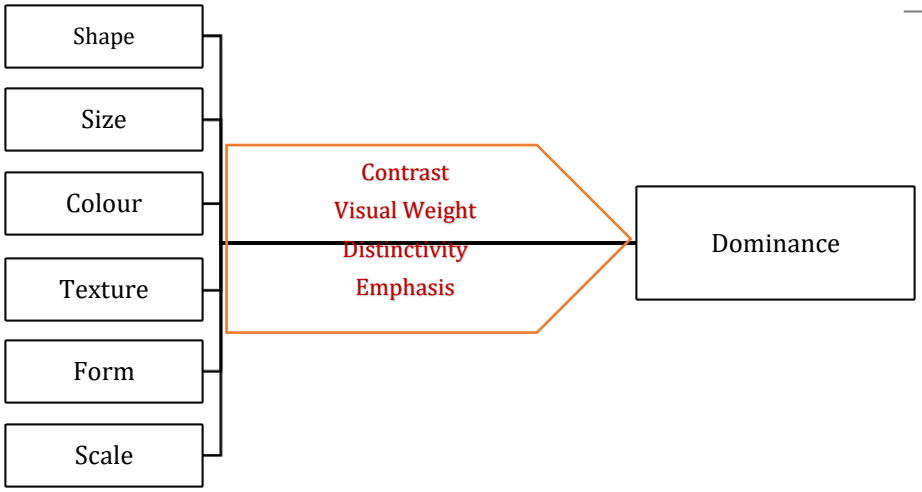

Figure 2. The qualities of principles that create dominance (Özyılmaz Küçükyağcı, 2020)

Diversity

Rapoport (1977) emphasizes the importance of 'noticeable differences' in place design, as they create diversity in urban spaces. This study focuses on the diversity in urban squares through physical texture and activities. Camillo Sitte (1986) emphasizes the importance of building blocks, street widths, and connections to ensure diversity in spatial design. Diversity can be achieved through various factors, such as contour effects, vertical and horizontal elements, forms, facade colors, building functions, elevations, and activities (Sitte, 1986). The diversity in squares can also be achieved through increased variety and density of activities, which increase livability and visual appeal. These also provide

social benefits, such as reducing loneliness and providing recreational opportunities (Acar et. al, 2021; Altay et.al. 2023; Bostanci & Ocakçi, 2009; Çakmaklı, 1992; Gehl, 2011; Li et. al. 2024; Marcus & Francis, 1997; Moughtin, 2003; Tönük & Barkul, 1999).

Comfort

Comfort in public spaces is a fundamental user need, allowing users to enjoy their time outside without physical or mental concerns (Carmona et al., 2010). It depends on various parameters, including safety, security, and spatial arrangements (Carr et al., 1992). Urban squares, with facades and entrances, provide a sense of security, while windows in houses, cafes, and shops increase social control (Alfonzo, 2005; Mehta, 2008; Reis et al., 2003). Safety in urban equipment is closely linked to people's confidence, while optimum climate conditions and suitable spatial arrangements increase comfort. Protected areas from sun and rain increase space use, and quality spaces contribute to climatical comfort.

Thus, this study aims to evaluate the design value of urban squares with different physical and perceptional conditions. Regarding spatial design's fuzzy and complex nature, fuzzy logic modeling and fuzzy sets theory are integrated into the research. This study focuses on urban square design, examining factors such as imageability, meaning, legibility, time, enclosure, dominance, diversity, comfort, and related sub-parameters. (Table 2.)

Table 2. Design parameters and sub-parameters of urban square (Özyılmaz Küçükyağcı, 2020)

IMAGEABILITY	The presence of image buildings in the urban square. Attractive color effect The fact that the city is located at the focal points (city symbol) Remarkable land uses Presence of steering axles Important reference points (fountain / sculpture) The original value of the square (Form-Material-Construction Technique)
MEANING	Presence of historic preservation structures Being a political symbol Elements with meaning/value/image/story in the square Important historical events in the square
LEGIBILITY	The existence of symbol structures Defined areas in the square Surrounded and continuous texture Having the defined geometric form of the square Oriented tracks and axles Symmetry effect
TIME	The existence of the time sequence of the buildings Having traces of historical periods of the square Periods of important events and attractions in the urban square (during the year)
ENCLOSURE	Having a closed shape The presence of image buildings in the square Attractive color effect Width/length ratio (plan level)
DOMINANCE	The dominant structure / structures in the square Effect of dominant structure/structures in the surrounding texture of the square The effect of the dominant structure/structures in the focus/center of the square

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DIVERSITY	Movements in line (Contour effect) Variety of vertical items Variety of horizontal items Structures in different forms (geometric/organic) Facade colors Variety of functions on the buildings Variety of functions in the entrance floors Different floor levels Annual activity/ event variety
COMFORT	Percentage of non-deaf fronts The proportion of buildings facing the entrance Percentage of abandoned / vacant / abandoned buildings The proportion of good quality structures Ground slope Illuminated places Sitting places on the square Precautionary areas against climatic conditions

A FUZZY MODEL FOR EVALUATION OF URBAN SQUARE DESIGN

The urban square design is often evaluated using various research methods based on classic theory, providing a crisp, deterministic, and precise foundation. However, to accommodate the subjective nature of design concepts, fuzzy interpretations are incorporated for different levels of spatial designs. Despite these efforts, achieving clarity in design concepts remains challenging, as spatial design is intuitive, and the interpretation of design concepts is subjective. Consequently, identifying a definitive truth for every design concept is problematic. So fuzzy logic is closer to the real world as an approach considering multivariate and intermediate values (Baykal & Beyan, 2004). In binary logic, a subject is black or white between black and white sets, while in fuzzy logic, it takes a value in a range that transitions from black to white; it helps to take a more accurate result in decision-making. Additionally, it has advantages such as facilitating the conversion of linguistic data to numerical data, enabling flexible modeling of multivariate concepts, and simplifying the analysis of subjects with ambiguous and unclear information.

This approach is widely used in various disciplines, particularly in engineering. Although there are studies in the literature that address urban area issues using a fuzzy logic approach, they are limited in number (Özyılmaz Küçükyağcı, 2019). The results of the studies on the applications of the FLM in urban areas, including how it was handled, the findings reached, and the contribution of the approach to the studies were evaluated. According to this, since a fuzzy model can be established with the multivariate structure of the concept of design, which is the subject of the study, it has been included in the research.

The research integrates fuzzy logic and fuzzy sets theory instead of classical logic due to the variability in concept definitions. It explores how urban squares reflect design characteristics based on imageability, meaning, enclosure, dominance, time, legibility, comfort, and diversity. A parameter sequence was developed to explain and evaluate the scope of the sub-parameters.

In the context of the structure and characteristics of the spatial design concept, the fuzzy logic approach, which is suitable for evaluating this

concept, has been used. The established research model was integrated into the fuzzy logic model, one of the methods compatible with working with multivariate concepts. The reason for choosing this method is that it enables the flexible modeling of design features, incorpating both verbal and linguistic elements, as well as physical and quantitative values. While the model was being built, it was seen that it was necessary to be sensitive in measuring all the attributes, especially meaning and time. To measure the value of a design attribute of the square on a scale ranging from 1 to 100, it has been observed that using a system with high permeability between clusters, rather than clusters with a clear range, helps to receive and process data more accurately.

Research methodology for evaluating design parameters of urban squares

To assess the model designed to measure the design value of urban squares, the study examined twenty squares from various countries. These squares, frequently mentioned in literature and widely recognizable as successful or unsuccessful, were chosen for their originality and diverse morphological features.

The study develops an integrated method for analyzing twenty urban squares. To reach valid results and thoroughly present the design value of urban squares, the study starts with a literature review of the design parameters of urban squares and the methods used to evaluate the design quality of open spaces. The steps of the methodology are:

1) An in-depth literature review - determination of relevant parameters of urban squares

2) A fuzzy logic modeling through parameters

3) Testing the fuzzy logic model on selected urban squares

The MATLAB Fuzzy Toolbox was used in conjunction with Simulink software to implement and set up the model. The model design process for fuzzy logic utilized MATLAB Fuzzy Logic Toolbox in conjunction with Simulink as its execution platform. The toolbox provides a visual interface that simplifies the design of fuzzy inference systems through step-by-step processes for defining linguistic variables and constructing membership functions and rule sets. This system functions with Simulink, which allows users to conduct real-time simulations to test the adjustability of their model structure. This system provides adaptable conditions for converting professional expertise into machine-based algorithms. The model employs Mamdani-type fuzzy inference systems, a popular approach for decision-making applications that compute outputs through combined human-based reasoning patterns. Mamdani systems excel in problems with imprecise information because they allow both linguistic variable handling and controlled state shifting between input and output data. The system utilizes fuzzy values to characterize urban design qualities like "comfort" and "legibility" through this process. As a result, it did not need strict binary classification. The eight input variables were represented using triangular membership functions that define

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linear geographically shaped assignments for measuring degrees of membership in fuzzy sets. These were chosen for their computational efficiency and ease of interpretation. The reference to "triple membership functions" denotes the three linguistic categories assigned to each input: low, medium, and high. These categories allowed the model to capture subtle gradations in expert judgment. On the output side, the design value was expressed through five fuzzy categories ranging from "very low" to "very high," providing a broader resolution in the evaluation scale. The fuzzy rule base comprised 6,561 rules derived from all possible combinations of the eight input variables. This combinatorial structure ensured that the model accounted for the full design parameter interactions. The FLM includes blurring, rule-based creation, refinement, and extraction. The main elements of a fuzzy model are input-output sets and fuzzy 'if–then' rules. The study employed eight inputs and one output and established 6561 rules for the system. In this study, the input variables of the fuzzy model are 'imageability, meaning, legibility, time, enclosure, dominance, diversity, comfort', while the output variable is design quality (Figure 3).

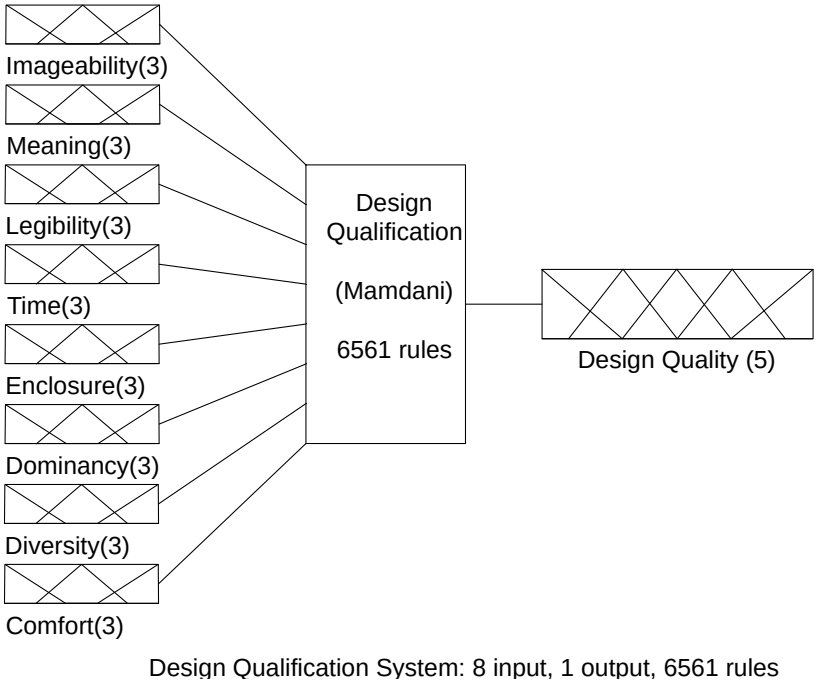

Figure 3. A Mamdani-type fuzzy model for design qualification (Özyılmaz Küçükyağcı, 2020)

A triple-membership function (mf) for eight inputs and the five-member function (mf) for one output has been created. The triangular membership function was used as it is one of the most common membership functions used in rule-based fuzzy modeling. Being easier to interpret and analyze, the Mamdani fuzzy inference system was the model of choice for design qualification purposes. The parameters of the membership functions represent input and output variables in the constructed fuzzy design qualification model. While the input variables consist of three fuzzy sets with low, average, and high values, the output

variables comprise five fuzzy sets: "very low, low, average, high, and very high."

The final stage of constructing a fuzzy model is to define fuzzy if-then rules. The 6561 if-then rules were generated and introduced to the fuzzy model. While creating the rule base, a 6561-rule base is created by entering the values that eight parameters will take for each condition. Thus, a model was established to measure the design quality of the urban square, utilizing eight parameters similar to those of an expert designer.

The architecture of the fuzzy logic model was deliberately structured using eight input variables, each represented through three linguistic categories—low, medium, and high—resulting in a total of 6,561 fuzzy inference rules (3^8 combinations). This expansive rule base was necessary to capture the full complexity of interrelationships among the design parameters. Each rule was constructed to reflect a plausible, logical interpretation of how combinations of qualities (e.g., high enclosure with low legibility) influences overall design value. The decision to employ three membership functions per input parameter was guided by two key criteria: interpretability and computational efficiency. A tripartite structure allowed nuanced differentiation while maintaining readability for human experts who validated the rule sets. On the output side, five membership categories were used to reflect more granularity in the model's final design quality index. This provided a broader scale to distinguish spaces with marginal or exceptional performance, which would not have been adequately represented with fewer output classes. Rule validation was conducted through iterative expert feedback sessions and simulation testing, ensuring that each rule produced logically consistent and contextually appropriate outputs across a diverse sample of urban squares.

Testing the model

To test the model an empirical study was conducted to test the proposed model through selected urban squares that have different qualifications from different countries (Italy (6), Germany (1), France (2), Iran (1), Spain (1), Sweden (1), Belgium (1), from the Czech Republic (1), the UK (1), Portugal (1), United States (1) and Turkey (3)).

During the implementation phase, surveys were conducted with 179 experts from different occupational groups, including architects, landscape architects, and city planners, for twenty (20) urban squares. A balanced distribution was provided for the survey study, as a ratio of more than 30% from each discipline was reached in the distribution of occupations. Sixty-three architects, 62 urban planners, and 54 landscape architects responded to the survey; they are mostly (% 85) academic. The eight criteria determined in the questionnaire were scored using the information from the selected urban squares.

The experts answered the questionnaire by selecting at least five known urban squares. The data obtained from each expert were analyzed

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using fuzzy logic with MATLAB software, and the total design value of each square was determined.

In the survey, participants chose at least five squares, scored between 1 and 100 points for each criterion, and provided a total score within the design value of each square. A total of 1059 survey results were collected for 20 squares. The collected 1059 data was used to check whether the fuzzy logic system works. It was also tested whether the system gave results like the experts, and the findings were compared and evaluated. To support methodological transparency and replicability, the expert questionnaire was structured to collect evaluations across eight key urban design criteria: imageability, meaning, legibility, time, enclosure, dominance, diversity, and comfort. Each criterion was rated on a 100-point scale, and participants were provided with consistent visual and textual references for each urban square to ensure uniform interpretation. The format allowed for numerical scoring and optional qualitative input, though only the quantitative data were used to calibrate and validate the fuzzy logic model. The instrument's design followed established perceptual evaluation practices, allowing for consistent and scalable application across diverse spatial contexts.

Considering the number of surveys, it is evident that Piazza San Marco is the square that experts evaluate the most, while Naqsh-e Jahan Square is the least answered. Based on the data in the context of the survey numbers, it is possible to assess the recognition and awareness of the urban squares. However, 4 out of 20 squares have stayed under 30: Piazza Della Cisterna, Hötorget Square, Place Vendome, and Naqsh-e Jahan Square. According to this study, urban squares with fewer than 30 survey results can have low recognition although it has good qualifications. (Figure 4).

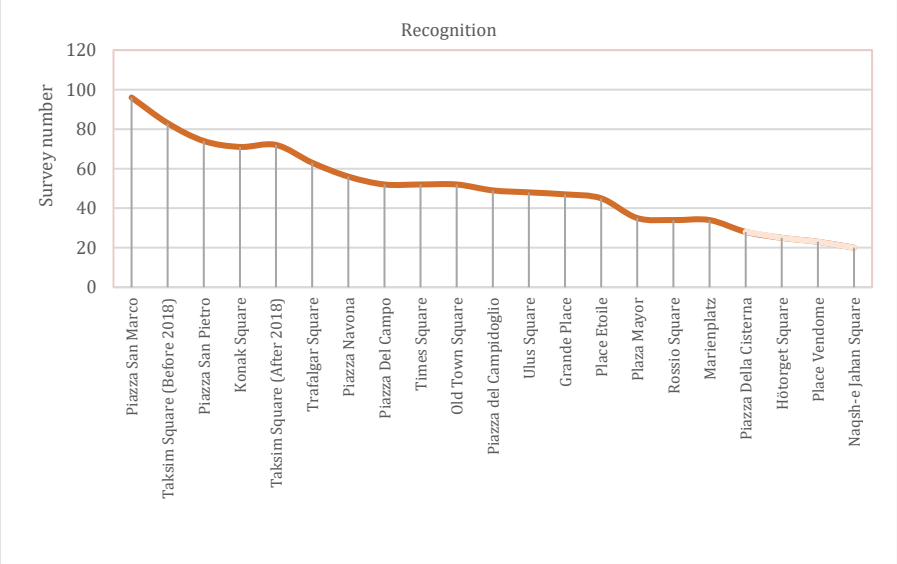

Figure 4. Recognition level of urban squares according to survey data (Özyılmaz Küçükyağcı, 2020)

General findings of the research

The findings of twenty case studies are as follows. First, this study shows a clear relationship between the selected criteria and urban square

design value. According to the result of the correlation analysis, the relationship between each variable and the design is positive and significant. Enclosure and comfort parameters have the highest relationship with design value (Table 3).

Table 3. Correlation between design value and design parameters (Özyılmaz Küçükyağcı, 2020)

Design parameters	Correlation	Design Value
Comfort	0,82742192	
Enclosure	0,81021671	
Legibility	0,78712576	*High Level Relationship*
Imageability	0,77836856	
Dominance	0,73186045	
Time	0,70474427	
Meaning	0,60603522	*Moderate Level Relationship*
Diversity	0,57989401	

According to the findings, the relationships are constructed correctly in the model. In the survey results, while the famous, well-known urban squares, shown as exemplary in terms of successful design, received high scores for each criterion, squares with inadequate qualifications received low scores from experts. A proportional result was observed when the study results were examined according to each design criteria of the urban squares. When a general evaluation is made of the results obtained, it is seen that the results of the fuzzy logic model overlap with a slight difference when the scores given by the experts are compared. The difference between the fuzzy logic results and the total design value varies between -18.9% and 3.12%, while the difference between the arithmetic mean values is between -3.8% and 0%. The difference between the arithmetic means values and fuzzy logic results is less, with an average of 1.49%. In this context, the model works like artificial intelligence by creating similar results to experts with a slight deviation in decision-making (Table 4).

Table 4. Comparison of fuzzy logic results with survey data (Özyılmaz Küçükyağcı, 2020)

Urban Squares	Total Design Value	Fuzzy Logic Model Results	Standard Deviation		Arithmetic Average Values	Fuzzy Logic Model Results	Standard Deviation	
Piazza del Campidoglio	0,882	0,867	1,7%		0,857	0,867	-1,2%	
Piazza San Marco	0,892	0,864	3,2%		0,865	0,864	0,1%	
Piazza San Pietro	0,871	0,860	1,3%		0,861	0,860	0,1%	
Old Town Square	0,867	0,858	1,0%	**-2,4%**	0,851	0,858	-0,9%	**-1,49%**
Piazza Del Campo	0,873	0,857	1,9%		0,846	0,857	-1,3%	
Piazza Navona	0,874	0,856	2,1%		0,847	0,856	-1,0%	
Marienplatz	0,811	0,840	-3,4%		0,814	0,840	-3,1%	

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Piazza Della Cisterna	0,856	0,834	2,7%		0,826	0,834	-0,9%
Grand Place	0,833	0,831	0,2%		0,825	0,831	-0,8%
Rossio Square	0,840	0,831	1,1%		0,819	0,831	-1,5%
Place Vendom	0,827	0,827	-0,1%		0,818	0,827	-1,1%
Trafalgar Square	0,806	0,814	-1,0%		0,791	0,814	-2,9%
Plaza Mayor	0,801	0,807	-0,7%		0,807	0,807	0,0%
Naqsh-e Jahan Square	0,778	0,794	-2,1%		0,786	0,794	-1,0%
Place Etoile	0,732	0,778	-5,9%		0,773	0,778	-0,7%
times Square	0,708	0,739	-4,3%		0,729	0,739	-1,4%
Hötorget Square	0,667	0,700	-4,7%		0,675	0,700	-3,5%
Konak Square	0,663	0,688	-3,7%		0,663	0,688	-3,8%
Nation Square	0,587	0,655	-10,4%		0,640	0,655	-2,4%
Taksim Square (before 2018)	0,575	0,636	-9,6%		0,619	0,636	-2,7%
Taksim Square (after 2018)	0,397	0,490	-18,9%		0,483	0,490	-1,5%

The fuzzy logic model generated outputs that closely aligned with the expert evaluations across the 20 selected urban squares. The comparison revealed a mean absolute error of ±1.5%, confirming the model's reliability in translating qualitative spatial judgments into consistent quantitative scores. This alignment was powerful in squares that exhibited apparent morphological coherence and active edge conditions, supporting the long-standing emphasis in urban design literature on enclosure and comfort as key determinants of spatial quality. Notably, these two parameters consistently registered the highest correlation with the model's overall design quality index, reinforcing observations made by Gehl (2011) regarding the importance of framed space and human-scaled environments in fostering vibrant public life. Principal component analysis further grouped the evaluated squares into three broad performance categories. High-scoring examples such as Trafalgar Square and Piazza del Campo demonstrated strong enclosure, clear spatial legibility, and diverse functional layers. At the same time, mid-range cases, such as Place de la République, scored well in comfort and imageability but exhibited weaker coherence in terms of meaning and temporal dimensions. Lower-scoring squares, such as Hassan II Square in Casablanca, tended to lack perceptual continuity or spatial dominance, aligning with Lynch's (1960) theory on the importance of identity and readability in public environments. While some overlaps between variables were expected due to the interdependent nature of spatial experience, the fuzzy logic model preserved distinct weighting across all eight parameters. The resulting evaluation scores offered a nuanced yet statistically stable distribution, with no single parameter overly skewing the outcome. These findings confirm that the model can accommodate

subtle variations in square typologies while preserving conceptual clarity and internal consistency.

Like the average of the experts' total design scores, the fuzzy logic model also gave results in a linear line. In the fuzzy system, urban squares with low values give a low overall result, and when the high values are entered, the total is close to 1 or higher in the fuzzy logic model. Since the average of the result for each square is similar to the result of the fuzzy logic model, it can be said that the rule base was appropriately written in the fuzzy logic model. It is observed that this proposed model evaluates the design of the square using design criteria similar to those of an expert. The main distinguishing feature of this fuzzy modeling is that the intermediate values can be modeled in different clusters simultaneously, and the clusters can vary in different qualities according to the theory. The model, designed with eight criteria, proved successful in evaluating design success; however, it provided a limited framework for an integrated design value.

When the rankings of the squares are determined based on the three results obtained, they are ranked similarly according to the design value of the squares, although there is a slight difference between the rankings (Figure 5.) Although the breaks are noticeable in Marienplatz and Trafalgar Square, the squares are ranked similarly on each curve when a general evaluation is made.

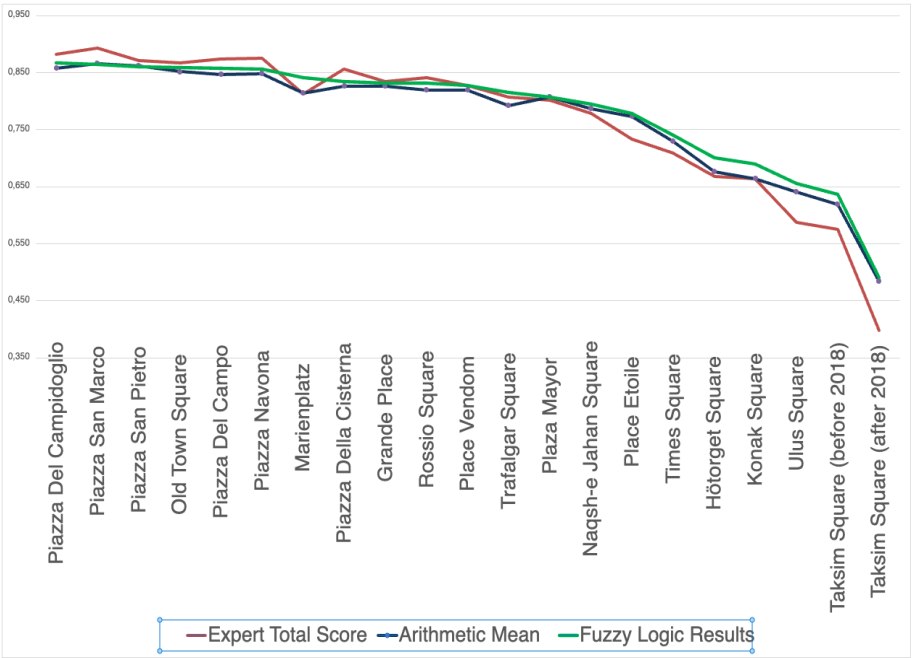

Figure 5. Comparison chart of the results (Özyılmaz Küçükyağcı, 2020)

The design success ranking of the squares, evaluated based on the results of 1049 questionnaires for 20 urban squares, completes the empirical aspect of the model. In the examples, the urban squares, built in the Middle Ages, possessed the characteristics of a typical urban square design and came to mind first, ranking at the top. Although there are significant differences between squares such as 'Piazza San Marco, Piazza San Pietro, and Piazza del Campo,' each is the most successful in the

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world. The fuzzy model results determined the nuance differences between the characters of these squares. In particular, an immeasurable value such as 'meaning' has been integrated into the model and evaluated by considering the range of values given by the expert instead of 'meaningful or not meaningful.' With the three results obtained, the design values of the urban squares were ranked in order from the highest to the lowest value. In the rankings, in the group with the highest design value, Piazza San Marco, Piazza Del Campidoglio, Piazza Navona, Piazza Del Campo, Piazza San Pietro, and Old Town Square make up the top six. According to the three rankings, although the urban squares' order changes, the squares' design level is the same. The other group comprises Piazza Della Cisterna, Rossio Square, Grande Place, Place Vendome, Marienplatz, Trafalgar Square, and Plaza Mayor. These squares are located between the 7th and 13th rows between 20 urban squares. The last group consists of Naqsh-e Jahan Square, Place Etoile, Times Square, Hötorget Square, Konak Square, Ulus Square, and two situations of Taksim Square. The last eight rows of the ranking (between 14 and 21) have the same order according to all three results as in the other groups. When these groups are evaluated within themselves, the urban squares within each group exhibit many characteristics, and these evaluations confirm that the survey results and the model yield accurate results.

Table 5. Design value rankings of the urban square (Özyılmaz Küçükyağcı, 2020)

	Ranking by Total Design Values	Ranking by Arithmetic Mean Values	Ranking by Fuzzy Logic Results
I. Group	Piazza San Marco	Piazza San Marco	Piazza Del Campidoglio
	Piazza Del Campidoglio	Piazza San Pietro	Piazza San Marco
	Piazza Navona	Piazza Del Campidoglio	Piazza San Pietro
	Piazza Del Campo	Old Town Square	Old Town Square
	Piazza San Pietro	Piazza Navona	Piazza Del Campo
	Old Town Square	Piazza Del Campo	Piazza Navona
II. Group	Piazza Della Cisterna	Piazza Della Cisterna	Marienplatz
	Rossio Square	Grande Place	Piazza Della Cisterna
	Grande Place	Rossio Square	Grande Place
	Place Vendome	Place Vendome	Rossio Square
	Marienplatz	Marienplatz	Place Vendome
	Trafalgar Square	Plaza Mayor	Trafalgar Square
	Plaza Mayor	Trafalgar Square	Plaza Mayor
III. Group	Naqsh-e Jahan Square	Naqsh-e Jahan Square	Naqsh-e Jahan Square
	Place Etoile	Place Etoile	Place Etoile
	Times Square	Times Square	Times Square
	Hötorget Square	Hötorget Square	Hötorget Square
	Konak Square	Konak Square	Konak Square
	Ulus Square	Ulus Square	Ulus Square
	Taksim Square(Before 2018)	Taksim Square(Before 2018)	Taksim Square(Before 2018)
	Taksim Square (After 2018)	Taksim Square (After 2018)	Taksim Square (After 2018)

Unlike the order made in three groups, for twenty-one squares, fifteen are clustered as one group and the other six as a separate group. The squares with low design values were separated from the others in these groups and gathered in the same group (Table 5).

DISCUSSION

While designing a place, a designer intuitively synthesizes knowledge, experience, and skill on paper. The integration of the designer's interpretation with different principles creates distinct values. Each element's relationship, position, and effect influence the design's success and user value. Achieving appropriate space design for all urban functions is essential. Urban-related subjects are often specific and complex, making fuzzy logic a valuable approach. For example, regulating city traffic involves many factors which fuzzy logic can effectively address.

The success of a well-designed place depends on various design parameters, which are hard to measure objectively. Typically, users and experts assess it. While classical logic employs pair-wise comparison, fuzzy logic offers a more plausible and rational evaluation method.

Fuzzy logic allows truth values between 0 and 1, handling partial truths, unlike Boolean logic, which uses binary values of 0 or 1. It reflects how people make decisions based on imprecise, non-numerical information. Fuzzy models represent and manage vagueness and uncertainty, recognizing, interpreting, and using imprecise data. (Baykal & Beyan, 2004; Ödük, 2019).

Fuzzy logic has been applied to many fields, from control theory to artificial intelligence. It has several strengths, such as its ability to handle imprecise data and model complex systems. However, it also has some weaknesses, such as its inability to handle uncertainty in a systematic (Ödük, 2019). In addition, since "humans" determine the membership functions and rule bases used in fuzzy logic, these functions and rule bases must be selected correctly. Otherwise, incorrect results may be obtained (Özdemir & Kalınkara, 2020; Zadeh, 1965). One of the disadvantages of fuzzy logic systems is the difficulty of designing the model. There is no specific method for selecting membership functions used in fuzzy logic; the most suitable function is typically found through trial and error. This prolongs the study process. This study aims to discuss "design," an intuitive concept with its parameters, using the strengths of the fuzzy logic method.

In this context, this study proposes a fuzzy logic-based model that operates similarly to the reasoning of architects, landscape architects, city planners, and city designers, enabling them to evaluate design through logical analysis. This model focuses on urban squares and aims to draw a frame on the scale of urban squares using the FLM and to measure design success using urban design parameters as an expert.

With the determined criteria, the design value of urban squares has been evaluated using the advantages and flexibility of the fuzzy logic method. The eight input parameters—imageability, meaning, legibility, time, enclosure, dominance, diversity, and comfort—can be modified, expanded, or reduced depending on the availability of data and the focus of the assessment. While each parameter was weighted equally in this study, the model allows for customization by assigning different weights

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based on priority, thereby generating alternative outcomes under varied design assumptions.

Although the present model is built around these eight criteria, it remains adaptable to include additional or more context-specific design features such as walkability, spatial continuity, or environmental comfort. Likewise, output variables can be adjusted to reflect different interpretations of success, enabling the model to simulate multiple outcomes using alternate rule structures. The modular design structure enables objective and uniform outcomes from the model irrespective of domain specialist input. Urban perception evaluation becomes possible through this systematic approach for quantifying complex architectural traits in urban settings.

The fuzzy logic model developed in this research demonstrates extensive practical application potential across various urban design settings due to its methodological and theoretical framework. Municipal governments and public agencies can implement the model as a standardized evaluation system for assessing both present and new proposed urban squares. The model's ability to convert intricate qualitative observations into measurable results enables planners and decision-makers to support their interventions and funding decisions while establishing performance targets for public space initiatives. Especially in contexts where public realm investments must demonstrate measurable social impact, the model is a diagnostic tool that complements more conventional regulatory and aesthetic criteria.

In educational settings, the model can be used as a pedagogical framework in architecture and planning studios to introduce students to systems thinking and decision-support tools. By engaging with fuzzy logic principles, design learners can better understand how qualitative judgments—often central to early-stage concept development—can be formalized and interrogated through structured reasoning. The model also supports the comparative evaluation of design proposals in academic juries, enabling a more consistent and objective assessment process without eliminating the value of critical discourse.

From a policy perspective, the model's ability to reveal which spatial attributes are most closely linked to perceived quality could inform the development of context-sensitive design guidelines and quality assurance protocols. As cities worldwide adopt increasingly data-informed approaches to urban governance, integrating fuzzy logic into evaluation workflows could help close the gap between abstract design principles and actionable policy tools. The model's adaptability to different cultural and morphological contexts makes it especially suitable for application in international design competitions, post-occupancy evaluations, or pilot projects focused on inclusive and climate-resilient public spaces.

CONCLUSION

The research presented a Mamdani-based fuzzy logic model to develop a systematic approach for assessing urban square design quality, combining spatial characteristics and perceptual elements. The quantification process utilized eight fundamental design attributes, including imageability, legibility, dominancy, enclosure meaning, time, diversity, and comfort, to model a measurable index that connects human perception with computational evaluation. The methodological reliability of the system resulted in an accuracy of ±1.5%, in line with the assessment of experts.

The model used fuzzy logic to represent intangible qualities that typically prove challenging to measure by traditional evaluation methods. The model incorporated two parameters that resist binary measurement through structured linguistic variables because they manifest culturally or symbolically and experientially. Such a system established a framework that detects concrete, measurable criteria and delicate perception points in evaluations. The implemented framework presents a structure representing complex urban areas while enabling design judgment to function inconsistently in adaptable ways.

The research results validated previous theoretical propositions that suggest that enclosure and comfort are the core elements for assessing urban space quality. The model highlights these factors as core priorities because Gehl (1987), Carmona (2021), and other theorists confirm that human-scale definitions and sensory openness lead to successful public spaces. The model received validation based on expert judgments because it generated outcomes that matched their assessments, thus demonstrating that fuzzy systems maintain both technical foundations and design interpretation quality.

The model provides relevant implications for practical use beyond its theoretical value. Staff from municipalities and educational institutions can use this model to gather evidence for funding public spaces and implement computational thinking into their urban design training programs. Due to its capability to define parameters and rules, the system can be adjusted to meet different cultural requirements or design purposes. The model demonstrates strong adaptability, making it a beneficial tool for academic uses and real-world design application requirements.

Future research on this framework can include expansion into areas such as integrating environmental data from GIS systems, improving membership functions by collecting user feedback, and extending model applications to parks, waterfronts, and linear corridors. The interpretable structure of this model enables its combination with agent-based simulations or neural networks, thereby enhancing its predictive strength and facilitating better decentralized decision-making.

The proposed fuzzy logic model serves academic research by advancing methodological discussions and operational practices through a solid theory-based public space quality evaluation system featuring

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scale and reliability. This method matches expert performance by eliminating dependence on expert participation, which positions it as an assessment tool and educational resource for building perception-aware, and more successful spaces.

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Resume

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Evaluating the Miyawaki Afforestation Technique in Urban Landscapes: Opportunities and Challenges

Osman Zeybek*

Abstract

Urban landscapes are increasingly dominated by impermeable surfaces, leading to significant ecological degradation, biodiversity loss, and urban heat island effects. The Miyawaki Afforestation Technique has gained attention as a potential solution for restoring urban green spaces by rapidly creating dense, biodiverse forests. This paper evaluates the potential and limitations of the Miyawaki method in the context of urban planning, with a focus on its ecological, social, and economic implications. While the method offers rapid forest establishment, increased biodiversity, and improved air quality, its applicability in varying climatic and urban conditions remains controversial. Issues such as land availability, maintenance intensity, and public perception of untamed green spaces present challenges for widespread adoption.

Additionally, the need for substantial soil preparation raises concerns regarding cost and feasibility in dense urban environments. This study critically examines these factors, proposing a balanced perspective on the Miyawaki method's role in contemporary urban design. The findings suggest that while the technique holds promise for enhancing urban sustainability, its integration into planning policies requires careful consideration of spatial, financial, and social dynamics.

Keywords: *Green spaces, Miyawaki method, Urban research, Urban ecology, SDG11.*

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INTRODUCTION

Urbanization has significantly altered natural ecosystems, resulting in the degradation of biodiversity, fragmentation of green spaces, and the intensification of urban heat islands. As cities expand, the balance between built environments and natural landscapes continues to shift toward impermeable surfaces, reducing the ecological functions of urban green spaces (Breuste et al., 2021). The pressing need for sustainable urban regeneration has led to exploring innovative afforestation techniques to mitigate environmental damage and enhance urban resilience (Schirone & Salis, 2011; Kohout & Kopp, 2020).

Urban green space must be increased in cities by extending current green space areas and creating new green spaces. This is important for two main reasons: increased health benefits for humans and the provision of ecosystem services for the city (Ramyar et al., 2020; Li et al., 2020; Tian et al., 2020). However, the provision of ecosystem services depends upon the scale of urban green space; large continuous green areas provide more ecosystem services as compared to small fragmented green spaces (Sen & Guchhait, 2021; Vega & Küffer, 2021; Puplampu & Boafo, 2021; Liu & Russo, 2021).

Many cities struggle to balance the rapid construction required for urbanization with the need to implement green spaces, which are crucial for environmental health and human well-being (Czaja et al., 2020; Churkina et al., 2020). Unlike rural areas, where natural landscapes and forests are abundant, urban areas are dominated by buildings and concrete. In these cities, green spaces are often limited and can only fulfill a fraction of the ecosystem functions that forests provide, such as air purification, carbon sequestration, and biodiversity support (Kais et al., 2021; O'Brien et al., 2022; Li & Hu, 2022). One of the methods that will expand the green areas squeezed in cities that have become concrete jungles and establish a balance between nature and the city is The Miyawaki method.

In alignment with Sustainable Development Goal 11 (SDG 11: Sustainable Cities and Communities), which emphasizes the need to make cities inclusive, safe, resilient, and sustainable, the Miyawaki Afforestation Technique has emerged as a promising method for rapidly increasing urban green cover. Developed by Japanese botanist Akira Miyawaki, this approach focuses on creating dense, multilayered forests composed of native plant species. These forests are designed to grow quickly, sequester carbon, improve air quality, and support biodiversity. The technique has gained attention worldwide, particularly for its ability to transform degraded urban spaces into thriving ecosystems. However, while its ecological benefits are well-documented, its broader application in diverse urban environments remains controversial.

This paper critically examines the potential and limitations of the Miyawaki technique within urban planning. While many studies highlight its rapid forest establishment and ecological advantages, its

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practical challenges—including climatic adaptability, soil preparation contradictions, land availability, public perception, and economic feasibility—require further analysis. This study evaluates the applicability of the Miyawaki method beyond its original tropical context. It discusses how it can be integrated into contemporary urban landscapes while addressing the objectives of SDG 11 by promoting greener and more sustainable urban environments.

This research aims to bridge the gap between theory and practice, assessing whether the method can be successfully adapted to varying urban contexts. To do so, the paper will explore empirical case studies, discuss financial and policy implications, and examine how public engagement can influence the acceptance of Miyawaki forests in urban settings. Ultimately, this study aims to provide urban planners, policymakers, and researchers with a comprehensive understanding of how the Miyawaki technique can contribute to urban sustainability while addressing the critical challenges associated with its implementation.

The main question of the research is whether the Miyawaki afforestation technique can be a solution in very dense urban areas where it is impossible to create any open and green areas. For this purpose, the importance and success of the application is emphasized and detailed through examples.

MATERIALS & METHODOLOGY

This study comprehensively reviews the Miyawaki afforestation technique, meticulously examining its theoretical foundations and practical applications. Through a synthesis of existing research and empirical field experiences, the study organizes information thematically to systematically analyze the method's principles, benefits, and strategies for implementation.

The materials utilized in this study were sourced from diverse resources. Academic publications, encompassing peer-reviewed articles, theses, and book chapters, provided essential theoretical insights and technical details. Additionally, conference proceedings and field reports documented practical applications and implementation outcomes, offering valuable case studies for analysis. To further enrich the research, application notes and online resources—such as manuals, blogs, and instructional videos—were scrutinized to capture real-world perspectives, community engagement initiatives, and project-based learning. These sources were accessed via academic databases (e.g., Web of Science, Scopus, Google Scholar) and official project websites, selected for their recency, reliability, and relevance to the study's objectives.

The review process was systematically conducted in three distinct stages. Initially, a literature search utilized relevant keywords, including the Miyawaki method, biodiversity restoration, urban afforestation, and community-based reforestation. The materials collected were

subsequently filtered based on their direct relevance to the Miyawaki technique, their coverage of implementation processes, and their scientific credibility.

The data was classified into thematic categories aligned with the study's objectives in the second stage. These categories included (1) the historical background and fundamental principles of the Miyawaki method, (2) its environmental benefits, encompassing biodiversity enhancement, carbon sequestration, and air quality improvement, (3) the implementation process, which details site selection, soil preparation, planting, and maintenance, and (4) the significance of community engagement in afforestation projects.

The final stage involved a thorough analysis and synthesis of the collected data. Theoretical insights were juxtaposed with practical applications, enabling the identification of successes and challenges encountered in real-world implementations. Field reports and application notes proved particularly beneficial in bridging the theoretical and practical domains, highlighting best practices, limitations, and future research directions.

This systematic methodology facilitated a multi-dimensional understanding of the Miyawaki technique while exposing critical gaps in the literature that warrant further scholarly investigation.

UNDERSTANDING THE MIYAWAKI TECHNIQUE

The Miyawaki technique is a widely recognized urban afforestation method developed and refined by Japanese botanist Dr. Akira Miyawaki (Miyawaki, 2004; Meguro et al., 2021). Unlike traditional reforestation methods, which typically use only two or three species, the Miyawaki method incorporates a diverse range of indigenous plants tailored to the specific location of the afforestation project (Lagariya & Kaneria, 2021; Sandeep et al., 2022). The goal is to create a self-sustaining, biodiversity-rich forest in a relatively short period, accelerating natural forest succession. The layered structure of a Miyawaki forest allows for horizontal and vertical coverage, making it highly efficient in urban greening efforts (Lewis, 2022).

A significant advantage of Miyawaki forests is their role in enhancing biodiversity, as they create a rich and stable ecosystem (Anand et al., 2023). Biodiversity refers to the variety of life in a given habitat, and increased plant diversity leads to greater animal diversity, providing food and shelter for various species (Lewis, 2022; Swapna, 2023). Traditional reforestation methods often rely on monoculture plantations, which are far less effective in fostering biodiversity and ecological resilience (Parikh & Nazrana, 2023; Daou et al., 2024).

Miyawaki and his team identified four guiding principles essential to the method (Miyawaki, 2004; Elliott et al., 2023):

- Using only indigenous species,
- Optimizing plant spatial composition,
- Planting multiple layers of vegetation, and

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- Ensuring high-density planting

These principles mimic natural forests, ensuring that a wide range of species, each suited to a different ecological niche, can thrive (Lewis, 2022; Anand et al., 2023). A key feature of Miyawaki forests is the development of a soil seed bank, allowing for long-term ecological stability and self-sustaining plant regeneration (Daou et al., 2024).

One notable feature of Miyawaki forests is their high tree density, with 30 to 40 species planted together in mixed layers, creating diverse habitats for insects, birds, and small mammals (Aarthi et al., 2021; Lewis, 2022). The competition for light among plants encourages rapid vertical growth, leading to a dense undergrowth of shrubs and herbaceous species that support a wide range of organisms (Mandowara, 2022). This structural complexity ensures genetic diversity within species populations, enhancing resilience to environmental changes, such as new diseases, pests, and climate fluctuations (Hara, 2023; Prasad, 2023; Khan et al., 2024).

Miyawaki (1990) emphasized that early forest establishment is knowledge-driven, requiring careful selection of native species, soil enrichment strategies, and pest control methods (Miyawaki et al., 1993; Maurya et al., 2021). The complex interconnections within a mature forest, however, develop over time and cannot be artificially designed by humans (Wang et al., 2023).

The impact of native plant biodiversity extends to insect and bird populations. Ewers and Didham (2006) found that a 2% increase in native plant species could lead to a 50% increase in insect populations, providing essential food sources for many bird species (Staab et al., 2020; Tallamy et al., 2021). Additionally, native plants result in deeper root systems and denser canopy formation, enhancing soil stability and ecosystem resilience (Raven & Wagner, 2021; Tallamy & Shriver, 2021). The layered vegetation structure of Miyawaki forests—including trees, shrubs, and herbs—is integral to its success, ensuring long-term ecological benefits and urban climate regulation (Postma et al., 2021; Ding et al., 2021; Nakhforoosh et al., 2021; Huber et al., 2021).

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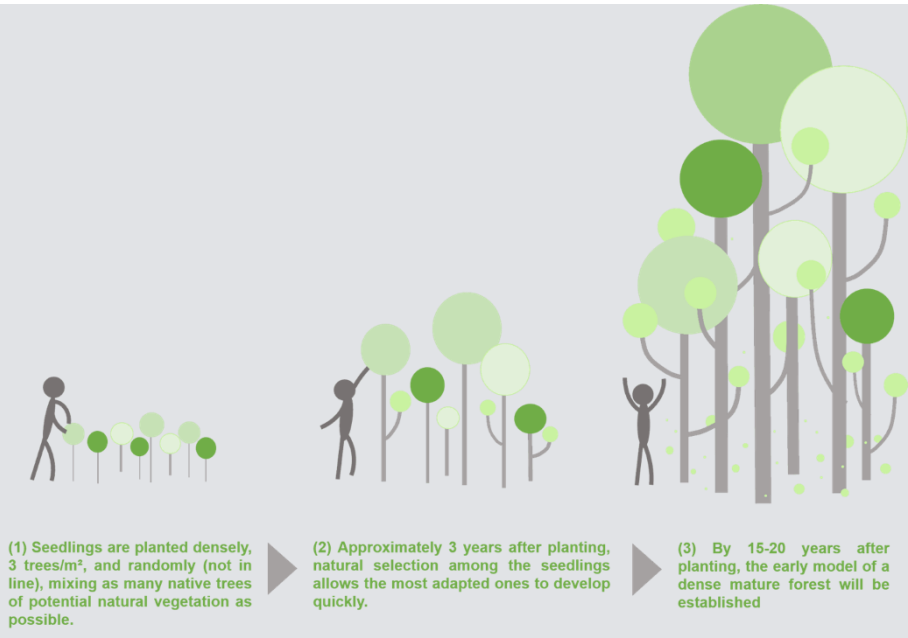

Figure 1. Phases of Miyawaki Forests (Anonymous, 2024).

Native plant species have adapted to their local climate, soil, and microorganisms over hundreds or even thousands of years, making them more resilient to environmental conditions and less susceptible to invasive species (Miyawaki, 1990; Anderson & Song, 2020; Hulme, 2020). The Miyawaki method prioritizes these native species, requiring that at least 50% of the plants used in a plot be indigenous to the region (Miyawaki, 2004; Kurian, 2020; Meguro et al., 2021). This distinguishes it from traditional afforestation techniques, which often incorporate non-native species that may not support local biodiversity as effectively (Lewis, 2022; Sandeep et al., 2022).

Historical research highlights the role of Miyawaki forests in post-war restoration efforts. In Fukutsu, Japan, intentional forest planting efforts aimed to counteract deforestation and resist urban expansion (Xiaoqin et al., 2021). Following World War II, large-scale residential development and road construction led to significant forest loss, with many sites not showing signs of afforestation until the 1950s (Zsolnai & Bajor, 2021). Studies indicate that 80% of Miyawaki forests recorded in the 1960s and 1970s were in early-stage growth. In contrast, by the 1990s and 2000s, these numbers declined to 20% for soil-based forests and 10% for field-based forests, reflecting the growing challenges of urbanization and changing land-use policies (Lewis, 2022; Fratini, 2023; Dhanorkar et al., 2023).

In high-density urban areas like London and New York, where green spaces are scarce, Miyawaki forests effectively restore lost ecosystems and create new green infrastructure (Agnihotri, 2022). However, given limited available land, alternative approaches such as green rooftops and urban micro-forests may be necessary (Meguro et al., 2021; Hanpattanakit et al., 2022). The reintroduction of dense vegetation in urban settings enhances biodiversity and improves human connections to nature, an aspect that has diminished with modern city living (Zsolnai

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& Bajor, 2021; Swapna, 2023). In a time when urbanization has led to ecological detachment, expanding Miyawaki forests can help mitigate environmental degradation and restore urban ecosystems (Lewis, 2022; Dhanorkar et al., 2023; Fratini, 2023).

ADVANTAGES OF THE MIYAWAKI TECHNIQUE

The Miyawaki forest technique offers numerous environmental and societal benefits, particularly in accelerating forest growth and enhancing ecological resilience. Known for its rapid forest development, this method requires irrigation only during the initial growth phase, after which the ecosystem becomes self-sustaining (Miyawaki, 1990; Miyawaki et al., 1993). During this stage, water regulation and protection from overgrazing are essential, and they can be managed through controlled grazing schedules after the initial irrigation process (Miyawaki, 2004).

A key advantage of Miyawaki forests is their role in soil and water quality improvement. Many planted species include medicinal plants, whose root systems facilitate groundwater infiltration and aid in pollutant breakdown through biological processes (Hanpattanakit et al., 2022). Additionally, these forests are highly effective in filtering environmental pollutants, significantly reducing urban temperatures and mitigating the urban heat island effect.

The dense forest canopy fosters rapid ecological succession, creating a resilient ecosystem that actively contributes to global warming mitigation. By sequestering significant amounts of carbon dioxide and filtering vehicular pollutants, Miyawaki forests play a crucial role in reducing greenhouse gas emissions and stabilizing urban microclimates, including lowering temperature and wind speed (Miyawaki, 2004; Hanpattanakit et al., 2022).

Rapid Growth and Development

The dense and layered structure of Miyawaki forests restricts light and space availability, preventing dominant species from outcompeting others and promoting more extraordinary biodiversity (Miyawaki, 2004; Meguro et al., 2021). This method leverages the concept of potential natural vegetation, recognizing that each region has an idealized plant community that would exist without human interference (Poddar, 2021). By identifying and planting species that naturally thrive in a given environment, Miyawaki forests are tailored to local ecosystems, ensuring their resilience and adaptability (Lewis, 2022).

This approach facilitates a process known as ecological facilitation, where pioneer species initiate environmental changes that pave the way for more complex genetic, taxonomic, and structural diversity to develop over time (Miyawaki, 2004). As the forest matures, this succession process leads to the establishment of a stable climax community—a highly diverse, self-sustaining ecosystem composed of mutually supporting species designed to maintain ecological balance (Meguro et al., 2021; Poddar, 2021; Lewis, 2022).

The international NGO Sugi Project creates small forests using the Miyawaki technique. They follow each of their projects from beginning to end, from soil analysis, local and endemic species survey, soil improvement, intensive planting, mulching, maintenance, and monitoring. Since its establishment in 2019, the NGO has created 232 forests in 52 cities, improved 140 school gardens, restored a total area of 203,108 square meters, and stated that a total of 428,508 plants were used in their projects, and 87.4% of these plants survived. It is possible to examine the data on the projects implemented by the NGO, which uses the Miyawaki technique itself, on their website (Sugi Project, 2024a). The project depicted in Figure 2 demonstrates the rapid growth implemented in the garden of ICHK Hong Lok Yuen Forest School in Hong Kong, which has an area of 100 square meters. 352 trees and shrubs were planted by students between 9 and 12. The project, which used 53 different local species, was established in August 2021. Some tree species, which were a few spans tall when planted, reached 5.2 meters in height in August 2023. Stating that there were problems at the beginning of the project due to the soil not being prepared well, the Sugi Project reported that 75% of the plants planted as of 2023 healthily continued their lives (Sugi Project, 2024b).

Figure 2. ICHKHong Lok Yuen Forest School implementation, example for rapid growth (Sugi Project, 2024b).

Enhancing Ait Quality and Reducing Pollution

The dense vegetation of Miyawaki forests serves as a natural barrier against air pollution, particularly in urban areas with high pollution levels. Research on urban green infrastructure indicates that the landscape configuration and quality of green spaces influence airflow, determining their effectiveness in mitigating pollution (Meguro et al., 2021; Zsolnai & Bajor, 2021). The high density and plant diversity in Miyawaki forests create a self-sustaining ecological system capable of generating localized airflow that reduces the transportation of airborne pollutants into populated areas. This function fosters microclimate formation and enhances biodiversity while protecting urban populations from harmful air contaminants (Poddar, 2021; Sandeep et al., 2022; Lewis, 2022).

Studies have demonstrated that Miyawaki forests significantly lower PM2.5 levels, reducing these harmful airborne particles by three times compared to general urban air quality and by 17 times compared to air quality around isolated trees (Aarthi et al., 2021; Lewis, 2022; Sandeep

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et al., 2022). The diverse plant species composition, including tall trees, shrubs, grasses, and flowers, fosters complex ecological interactions, enhancing the forest's ability to absorb and filter pollutants hazardous to human health and urban ecosystems.

Beyond air purification, the Miyawaki method excels in carbon sequestration, oxygen production, and soil pollutant removal, positioning it as an environmentally sustainable solution for urban greening. Unlike traditional afforestation methods, Miyawaki forests feature a high-density planting approach, incorporating a wider variety of species with distinct growth patterns and life cycles. This structural complexity enhances the long-term filtration of airborne toxins, including heavy metals and chemical pollutants, further improving urban environmental quality (Poddar, 2021; Zsolnai & Bajor, 2021; Lewis, 2022; Hanpattanakit et al., 2022).

Mitigating Urban Heat Island Effect

By mitigating the urban heat island (UHI) effect, the Miyawaki forest technique provides a valuable strategy for urban areas with elevated land surface temperatures, playing a key role in retrofitting and re-naturalization efforts aimed at developing sustainable and climate-resilient cities (Lewis, 2022; Sandeep et al., 2022). In contrast, conventionally landscaped urban areas, such as roads and artificial surfaces, typically rely on widely spaced, individual large trees, which remain exposed to direct solar radiation throughout the day. These trees lack dense vegetative support for transpiration, resulting in limited cooling capacity at night and ultimately exacerbating the UHI effect (Sharma et al., 2024).

The Miyawaki method employs systematic, high-density planting of native species to create a multi-layered and complex forest ecosystem in a short period (Poddar, 2021). During the day, dense canopy cover provides extensive shade, intercepting and absorbing solar radiation before it reaches urban surfaces, which reduces land heat absorption and lowers air temperatures through transpiration. This process significantly diminishes heat retention in built environments, making Miyawaki forests a key nature-based solution for urban climate adaptation and resilience (Lewis, 2022).

Another example is the Southbank Centre application from London. In the project, implemented with the motto "giving nature a chance to thrive within the brutalist architecture of London's Southbank Centre", 390 plants were planted in 120 square meters. The project's development in one year, where 12 different species were used, is given in Figure 3. In this urban landscape with no green space, measurements were also made on the urban heat island effect of the Miyawaki application. The measurements determined that a difference of 25.5°C was created with the application compared to the hottest surface of the space (Sugi Project, 2024c).

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Figure 3. Southbank Centre Miyawaki Forest from London (Sugi Project, 2024c).

Creating Habitats for Urban Fauna

The Miyawaki method has demonstrated seasonal benefits for urban fauna, supporting biodiversity restoration even in dense urban environments. In Hama-rikyu Garden, Tokyo, a butterfly species migrating from Honshu to Kyushu was observed in the forest just six months after initial planting, suggesting the technique's potential for establishing migratory pathways and reconnecting fragmented species populations (Poddar, 2021; Aarthi et al., 2021; Lewis, 2022; Sharma et al., 2024). This rapid ecological response highlights the method's effectiveness over conventional landscaping in promoting urban biodiversity.

A variety of animal species benefit from Miyawaki forests. For instance, Hibiya Park Forest in central Tokyo has recorded over 100 species of beetles and multiple spider species, likely due to the multi-layered vegetation that creates diverse micro-habitats and ecological niches (Zsolnai & Bajor, 2021; Aarthi et al., 2021). Additionally, Miyawaki forests provide ideal conditions for urban birds, as their closed canopy and dense undergrowth offer prime nesting sites and sufficient prey populations, supporting species such as sparrowhawks and kestrels. Amphibians, including frogs and newts, also thrive in the artificial wetlands integrated into Miyawaki forests, further expanding their ecological impact (Lewis, 2022; Sandeep et al., 2022).

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IMPLEMENTING THE MIYAWAKI TECHNIQUE

Before initiating planting, the Miyawaki team conducts a comprehensive site analysis, assessing factors such as land history, topography, soil conditions, hydrology, and nutrient flow to ensure suitability for afforestation (Schirone & Salis, 2011; Poddar, 2021). Public consultation is often included for restoration projects, while research sites may feature varied land histories to evaluate the technique's effectiveness compared to conventional reforestation (Zsolnai & Bajor, 2021). Once site selection and assessments are complete, initial preparation begins under the guidance of experts with extensive plant ecology experience (Sandeep et al., 2022). Unwanted vegetation is cleared to eliminate competition for nutrients, sunlight, and water, expediting ecosystem establishment (Lewis, 2022). The extent of clearing depends on land history; for example, at the Kelana Jaya project, significant removal of woody vegetation and invasive species was necessary to support native pioneer species (Ullah et al., 2023). After clearing, mounding creates undulating terrain, accelerating ecological succession (Sharma et al., 2024). Planting typically occurs post-monsoon when soil moisture supports growth, aiming for forest maturity within three years. Weeding and monitoring are conducted throughout this period to minimize competition from invasive species and ensure forest establishment (Schirone & Salis, 2011; Ullah et al., 2023).

Site Selection and Preparation

The lack of green space in many cities, driven by dense urban development, necessitates a critical reassessment of landscape planning and the integration of open spaces into green infrastructure wherever possible. While urban peripheries may offer more prominent areas for afforestation, securing sizable plots in city centers remains a challenge. However, Miyawaki's afforestation technique has demonstrated effectiveness even in compact areas as small as 100 square meters, significantly enhancing ecosystem services in constrained urban environments (Poddar, 2021). Given the limited afforestation options available in cities, optimizing every possible planting space is crucial.

Public participation was central to Miyawaki's approach, ensuring community engagement in every project. Initially, awareness campaigns and sapling planting events should involve the public to foster local ownership of the initiative. Site preparation begins with clearing existing vegetation and managing invasive species (Poddar, 2021). Underground utilities such as cables and pipelines must be assessed in the urban context before further interventions. Soil quality plays a critical role in afforestation success; therefore, comprehensive soil analysis should be conducted to ensure adequate nutrient levels. In cases where invasive herbaceous species are present, Miyawaki recommended herbicide application followed by a six-month observation period before further soil assessment (Lewis, 2022). The land should be leveled; if necessary, organic-rich soil should be

supplemented to optimize growth conditions. A thorough examination of the region's climatic conditions, soil pH, nutrient composition, and texture is essential, alongside in-depth research into endemic and native plant species to ensure long-term ecological stability (Zsolnai & Bajor, 2021; Sharma et al., 2024; Panchabhai, 2024).

Bruns et al. (2019) highlight that the soil is the foundation upon which a tiny forest is established. During soil preparation, a loose and airy structure is created to a depth of one meter, incorporating sufficient organic material to facilitate the development of a dense fungal network within a year. The prepared soil consists of a subsoil layer, a mixed layer enriched with humus, a humus layer, and a top layer of litter cover. Humus, formed through the partial decomposition of plant and animal matter, provides essential nutrients for the growth of trees (Figure 4). They also advise how to heal soil structures depending on their types, such as sand, clay, or peat, as shown in Table 1.

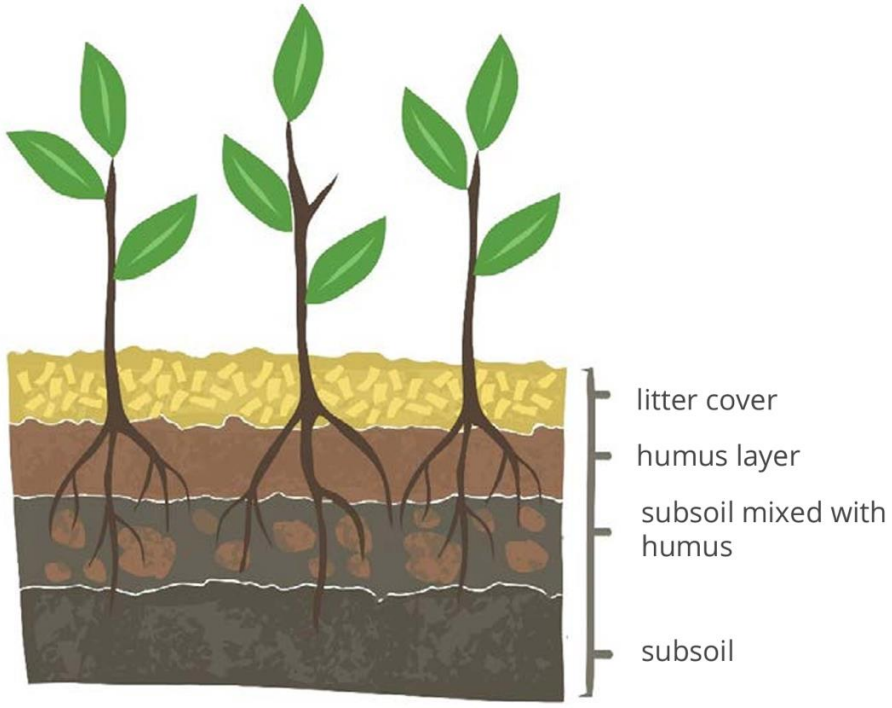

Figure 4. Tiny forest soil structure (Bruns et al. 2019).

Table 1. Choosing soil supplements to heal the structure (Bruns et al. 2019).

Soil Type	Which supplement should be added?	Supplement function	How much?
Sand	Ripe compost from organic waste or peat	Ensures that the soil can hold more water and makes the soil more nutrient-rich.	5 – 10 kg/m²
	Add dried manure from goats, horses, or cattle.	Nutrients for young saplings.	5 – 10 kg/m²
Clay	Straw cut into small pieces.	Straw helps loosen clay soils, which makes it easier for trees to take root.	5 – 10 kg/m²
	Ripe compost from organic waste.	Nutrients for young saplings.	5 kg/m²
Peat	Straw cut into small pieces.	Straw helps loosen peat soils, which makes it easier for trees to take root.	5 kg/m²

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Once the necessary soil supplements have been selected and procured, soil preparation at the planting site can commence. This process typically involves using heavy machinery, including excavators, dump trucks, and graders. Ottburg et al. (2018) cataloged the phases of soil preparation for a tiny forest facilitated in Zaanstad, Netherlands, within their case study application notes (Figure 5).

Figure 5. Preparing the soil for planting and maintenance process (Ottoburg et al. 2018; Bruns et al. 2019).

Ottburg et al. (2018) explain the seven steps in their case. In the first phase, soil supplements are delivered to the planting location. In the second phase, the length and width of the Tiny Forest down to 1 meter deep were excavated, and the excavated dirt was placed next to the trench. Half of the dirt was poured back into the trench in the third phase. Half of the soil supplements were poured into the trench in the fourth phase and spread evenly over the planting surface. In the fifth phase, the soil supplements were mixed through the dirt using the excavator. In the sixth phase, the rest of the excavated dirt was poured back into the trench and mixed in the other half of the soil supplements. Lastly, the soil was ready for planting.

Planting and Maintenance Process

While soil preparation is about to be completed, research on the supply of plants can be started. Miyawaki gave importance to the youngness of the plants when choosing them. He did not prefer saplings with thick and tall trunks (Aarthi et al., 2021; Poddar, 2021; Meguro et al., 2021). After planting pits are opened in the field, primary or

secondary school students generally plant the saplings together (Figure 6). Because children's weight is less than that of adults, it prevents the root area from being seriously crushed. At this stage, the sociological aspect of the project also comes to the fore. While ground cover, herbaceous, and shrub species are preferred on the edges of the land, tree species that will grow in height are planted towards the center. A dense planting of up to three plants per square meter is preferred. When the soil is optimal regarding plant nutrients and water retention capacity, plants begin to proliferate by competing to receive more sunlight (Daou et al., 2024). Communities around the world have widely embraced the innovative Miyawaki method. It has been proven effective in restoring and conserving degraded areas. Using the latest ecological and biodiversity census done on the Miyawaki forest in Sumatra, the increased progression in species recolonization from the initial to the final stage of the forest has been successfully documented. Such evidence caters to the continuous eligibility for such projects for carbon offset funding (Zsolnai & Bajor, 2021; Lewis, 2022; Mandowara, 2022; Sandeep et al., 2022; Sharma et al., 2024).

Figure 6. Planting phase with children (UNESCO, 2024; Morino Project, 2024).

Community Engagement and Involvement

As a flourishing forest will need to be enjoyed by all for generations to come, community engagement is a crucial part of any Miyawaki forest project. Of course, by regenerating native forests, the environment and wildlife will benefit. However, the human community must agree that a forest is desirable in the chosen area, and a sense of local ownership and stewardship needs to be generated. Also finally, the education and

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personal development created by the involvement of all community sections in this kind of project is incalculable. While the inclusion of children in sapling planting activities is especially important as it provides better results for the root health of plants, it also increases children's awareness of issues such as environmental problems, biodiversity, and urban ecosystem at an early age (Zsolnai & Bajor, 2021; Xiaoqin et al., 2021; Mandowara, 2022; Charkow, 2022).

Monitoring and Evaluation

Monitoring and evaluation are essential components of the Miyawaki method, ensuring the long-term success of afforestation projects. Miyawaki emphasized these processes as a response to the ineffective 'gardenification' of large conservation areas, advocating for a scientifically driven approach to urban forestry (Kurian, 2020; Zsolnai & Bajor, 2021).

Before planting, the site undergoes detailed mapping and soil fertility assessments, including nitrogen, phosphate, and soil moisture tests, to determine optimal conditions for tree growth (Xiaoqin et al., 2021). Unlike landscapes dominated by grasses and wildflowers in early ecological succession, shrubs dominate in mid-succession, forming the foundation for forest development. In tropical mixed forests, full maturity typically takes 30 to 50 years. However, a reasonable ten-year goal is to reach an open canopy stage, fostering biodiversity accumulation and increasing the presence of plant and animal species (Lewis, 2022).

The Miyawaki afforestation process is highly site-specific, accounting for land size, location, and natural resources. Public participation is integral, with communities selecting tree species best suited to local soil conditions and project objectives. Tree shelters and canes are used, particularly in the early months, to protect young saplings and prevent damage from wildlife. Unlike traditional planting methods, where one person digs and plants each tree, the Miyawaki technique promotes collective participation in afforestation efforts (Kurian, 2020; Zsolnai & Bajor, 2021; Xiaoqin et al., 2021; Lewis, 2022).

CHALLENGES AND LIMITATIONS

While the Miyawaki Afforestation Technique has demonstrated significant ecological benefits, its broader application faces several challenges that must be carefully considered. These challenges include climatic adaptability, soil preparation contradictions, land availability, public perception, and economic feasibility.

Climate Adaptability

The Miyawaki method, conceptualized by Akira Miyawaki, represents a reforestation technique focusing on the rapid establishment of native forests within constrained areas. Despite its growing acclaim for promoting ecological diversity, several critiques underscore its limitations and potential pitfalls. A notable concern regarding the Miyawaki method is its effectiveness across varying ecological contexts.

Schiavone et al. contend that, although the method is grounded in self-organized criticality and cooperation theories, its application within Mediterranean forest restoration initiatives has not consistently demonstrated favorable outcomes. They postulate that the biocoenotic relationships promoted by the Miyawaki method may not invariably culminate in a dynamic equilibrium, a critical component for sustainable forest ecosystems (Schiavone et al., 2010). This raises the possibility that the method lacks universal applicability and could engender ecological imbalances in particular environments.

Furthermore, the method's dependence on elevated planting densities may foster interspecies competition, inhibiting growth, and diminishing biodiversity. Nayak and Solanki assert that while the method aspires to restore natural vegetation, introducing a multitude of species nearby can inflict stress on individual plants, thereby impeding their maturation and the establishment of a balanced ecosystem (Nayak & Solanki, 2022). This perspective suggests that the Miyawaki method may unintentionally disrupt the natural processes it aims to enhance.

Additionally, the methodology's necessity for intensive initial care and maintenance prompts inquiries regarding its practicality and sustainability. The substantial initial investment in labor and resources may prove unfeasible for specific communities or regions, particularly those grappling with economic constraints. The imperative for continued management to secure the survival of planted species could further detract from the method's appeal as a swift solution for reforestation. However, it is important to note that specific references to substantiate this claim were not found in the provided literature, leaving this point largely unverified.

Moreover, the Miyawaki method has faced criticism for potentially disregarding local ecological knowledge's significance. In certain instances, the method's standardized approach may inadequately account for the idiosyncrasies of local ecosystems, resulting in the introduction of non-native species or neglecting crucial ecological interactions. Such oversights can undermine the long-term viability of reforestation endeavors, as the method may fail to adequately address the unique requirements of the local environment (Kiboi et al., 2014).

In summary, while the Miyawaki method offers a novel approach to reforestation, it is imperative to evaluate its applicability and efficacy across diverse ecological contexts critically. The aforementioned concerns regarding ecological sustainability, practicality, and the necessity for localized knowledge underscore the importance of fostering a more nuanced understanding of reforestation strategies that can effectively navigate the complexities inherent in various environments.

Soil Preparation and Contradictions

The soil preparation phase is the technique's most critical and expensive phase. Unfortunately, soils in urban areas are often problematic. According to the analysis results of soil samples taken from

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the field, deficient and excess plant nutrients and chemical or biological pollution elements in the soil are determined. If there is a level of pollution that cannot be cleaned, it may be necessary to dig up and dispose of the soil in the field to a large extent and replace it with a healthy soil layer, which is a very laborious and long phase. The main goal in soil preparation is to have dense organic matter on the upper part of the soil, to be deep and fluffy, and to be processed, just like in a forest, quickly.

The soil in the area to be applied is excavated about one meter. An excavator is required for this phase. According to the analysis and structure result, the excavated soil is mixed with different preparations and filled back into the excavated area. This stage is critical for improvement if there is a problem in the soil structure (such as dense clay layers or hard, impermeable zones). The new mixture filled into the planting area is not compacted. Leveling work is done with rakes, and the seedling planting stage has started. The soil is compacted due to the use of heavy vehicles during the excavation stage. However, the point is that these vehicles do not go above the ground where the soil is processed. It is important that the soil is not compacted and does not harm the young roots of the newly developing plants. This is why Miyawaki generally preferred to have children plant the young saplings.

However, the impact of afforestation on soil health has been a contentious topic. Studies by Kong et al. and Qi et al. reveal that afforestation can decrease microbial diversity and functionality in soil, which is essential for maintaining healthy ecosystems (Kong et al., 2022; Qi et al., 2022). This reduction in soil health can undermine the ecological benefits afforestation techniques like Miyawaki aims to provide, further complicating public perception of their efficacy. Additionally, Guo's research indicates that different afforestation methods, including Miyawaki, can adversely affect understory vegetation and soil quality. This suggests that the outcomes may vary significantly based on local conditions and implementation practices (Guo, 2018).

Land Availability and Urban Constraints

One of the primary advantages of the Miyawaki method is its ability to create forests in small, degraded urban spaces. However, its effectiveness is often maximized in larger, contiguous areas where species interactions can thrive. In densely populated cities with scarce and expensive land, allocating sufficient space for Miyawaki forests may not always be feasible. Additionally, there is a paradox in the literature. While some sources promote Miyawaki as suitable for small urban spaces, others suggest that significant land areas are necessary for a self-sustaining forest. Policymakers and urban planners must assess whether the method can be integrated into fragmented green networks or is more suitable for peri-urban and suburban areas.

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Public Perception and Social Functionality

Public acceptance of the Miyawaki method poses another challenge. Conventional urban parks are designed for recreation and accessibility, providing open spaces for walking, exercise, and social gatherings. In contrast, Miyawaki forests prioritize dense vegetation and ecological restoration, often limiting direct human interaction. The aesthetic of a densely packed urban forest may be perceived as unstructured or unkempt, which could lead to resistance from communities accustomed to manicured green spaces. To increase public acceptance, hybrid models that combine Miyawaki forests with recreational green spaces could be explored, ensuring both ecological and social benefits.

Economic Feasibility

Implementing the Miyawaki method often involves significant initial expenses due to intensive ground preparation, dense planting, and the need for ongoing maintenance in the early stages. These requirements can make the method financially demanding, particularly when applied over extensive areas. Dr. Derrick Lai, an associate professor at the Chinese University of Hong Kong, notes that while the method promotes rapid tree growth and high survival rates, it necessitates substantial investments, which may not be practical for large-scale afforestation in developing countries (Lee, 2023).

The method's resource demand—including labor, materials, and energy—can pose logistical and financial challenges. The necessity for soil rejuvenation, dense sapling planting, mulching, and subsequent watering and weeding contributes to the overall costs, potentially limiting its applicability in regions with constrained budgets (Rewilding Academy, 2024).

Urban planners, policymakers, and researchers can develop strategies to optimize the Miyawaki method for diverse urban contexts by addressing these challenges. While the technique holds promise for ecological restoration, its long-term success depends on careful integration with existing urban planning frameworks and continued empirical assessment.

CONCLUSION

The Miyawaki Afforestation Technique constitutes a noteworthy strategy for enhancing urban green infrastructure, characterized by its capacity to facilitate rapid forest development, bolster biodiversity, and mitigate environmental stressors. However, the technique's effectiveness is contingent upon several determinants, including land availability, maintenance requirements, and climate compatibility. While empirical evidence showcases its ecological successes across numerous urban initiatives, the scalability and adaptability of the Miyawaki method necessitate further exploration.

Ecological Benefits

From an ecological perspective, Miyawaki forests are pivotal in bolstering urban resilience. Their functions include carbon

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sequestration, pollutant filtration, and the provision of essential habitats for many species. Furthermore, these forests contribute to soil health enhancement and the urban heat island effect mitigation, positioning them as valuable instruments for climate adaptation. Nevertheless, uncertainties regarding their long-term ecological efficacy in non-tropical climates remain, underscoring the need for additional empirical research.

Social and Economic Considerations

Socially, Miyawaki forests have the potential to cultivate community engagement, promote environmental education, and foster local stewardship, thereby instilling a heightened sense of ecological responsibility among urban residents. Conversely, these forests' dense and self-sustaining characteristics might conflict with public expectations regarding accessible and recreational green spaces. A hybrid approach that merges Miyawaki forests with thoughtfully designed recreational areas may provide a viable solution for balancing ecological integrity and public usability.

Economically, while Miyawaki forests promise long-term cost reductions through diminished maintenance demands and enhanced ecosystem services, the associated initial investment and soil preparation expenses present significant challenges. Innovative financial models, including public-private partnerships and municipal funding incentives, merit further investigation to facilitate broader adoption of this technique.

Addressing Challenges and Future Directions

A fundamental challenge is ensuring that Miyawaki forests are appropriately integrated within urban planning frameworks and land-use policies. Planners must evaluate the compatibility of these forests with existing urban networks and determine whether they should be prioritized in specific locations, such as underutilized or degraded sites. Policymakers should also contemplate the establishment of standardized methodologies to enhance the replication and scalability of the Miyawaki technique across diverse contexts.

Final Thoughts

To comprehensively assess the Miyawaki Afforestation Technique, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis provides a structured evaluation of its potential and limitations.

- Strengths: Rapid growth, high biodiversity, minimal long-term maintenance, carbon sequestration, and climate resilience make it a valuable afforestation tool.
- Weaknesses: High initial investment, intensive soil preparation, suitability concerns in non-tropical climates, and limited public accessibility challenge its implementation in urban settings.
- Opportunities: Growing global emphasis on sustainability, climate adaptation policies, urban reforestation initiatives, and increasing environmental awareness create a favorable environment for the method’s expansion.

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- Threats: Urban land scarcity, public resistance to unmanaged green spaces, financial constraints, and the need for long-term monitoring may hinder widespread adoption.

By addressing these strengths and mitigating the weaknesses while capitalizing on emerging opportunities, urban planners and policymakers can integrate the Miyawaki method effectively into sustainable city strategies.

In conclusion, the Miyawaki technique represents a transformative methodology for urban greening, aligning with Sustainable Development Goal 11 (SDG 11) by striving to render cities more sustainable, resilient, and livable. However, the successful implementation of this technique necessitates a comprehensive understanding of the spatial, financial, and societal constraints involved. Future research should prioritize optimizing its application across varied climatic conditions, evaluating its socio-economic impacts, and integrating its principles more seamlessly into urban planning agendas.

Thus, while the Miyawaki technique holds substantial promise, its contribution to urban sustainability must be contextualized within a broader framework considering ecological functionality, public accessibility, and economic viability. By addressing these critical dimensions, urban centers can unlock the full potential of the Miyawaki method as an instrument for sustainable urban regeneration.

Ultimately, the Miyawaki technique offers a promising solution for urban afforestation, but its success depends on its adaptation to local conditions and integration into urban policy frameworks.

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Resume

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Analysing the Transformation of Space Design through Globalization and Its Effects on the User: A Case Study of 'Yer Ev' in Aydın

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Abstract

With globalization, the speed at which people can access information has increased, the boundaries in the world have blurred, and societies, cultures, and economies have moved away from each other to the extent that they have come closer. Changes in social communication styles have, on the one hand, made it possible for a locality in any part of the world to become visible, and on the other hand, made it necessary to filter the information obtained against an identity problem that may arise. Within the scope of the study, the inevitable effects of globalization have been analyzed in the general concept of design and specifically in interior design. In this context, the research aims to examine the changing built environment with the effects of globalization and to emphasize the transformations that occur in the cultural and social lives of individuals. In line with this purpose, "Yer Ev" and newly built apartments located in the Incirliova district of Aydın Province were examined within the scope of the research. The study was carried out by selecting the phenomenology design from qualitative research methods. Images were collected through on-site observations in the region, and the collected images were presented by categorizing them in terms of spatial evaluations. Semi-structured interviews conducted with eight participants were analyzed and tabulated using the Nvivo program. Within the scope of the research, it was observed that design data specific to the culture of the geography in which the interior design is lived was not included as a value and that standardizations were brought to the design action, which should be shaped by user-specific data by nature, and that uniformity was experienced. The importance of presenting studies based on research that are far from generalizations in determining the needs and demands of individuals' lives was emphasized.

Keywords:
Interior design, Globalization, Yer Ev.

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INTRODUCTION

Design, an umbrella concept, has been influenced by many factors throughout the historical process. Developments in the field of technology and changes in communication tools have transformed the way information is processed, adding new perspectives to the conceptual interpretations of design. The relationship between technology and design is significant in understanding the relationship between technology and society. The power of technology has seduced individuals; its products and processes have influenced the ways in which individuals think and behave, even affecting their quality of life (Botha, 2003). Technological developments in the globalizing world have become so complex that they eliminate the basis for predictions, making it impossible to know the outcomes of human behavior (Furedi, 2001). Technology has fallen short of helping individuals make sense of their everyday experiences, making being in daily life uncertain (Sharr, 2013).

Changes in the speed of information transfer due to technology have allowed information produced in one part of the world to be accessed from another part within seconds. The speed of information dissemination has replaced specialized solutions to problems with general solutions based on adaptation, blurring physical and cultural boundaries. Cultural transformations have altered the accepted behaviors and actions within societies. In this context, Castells (2008) examines social action through the changing patterns of relationships between nature and culture and categorizes the transformation experienced in the process into three models: The first relationship model is defined by the dominance of nature over culture for thousands of years, the second relationship model established at the beginning of the modern era sees culture dominating nature, and the third model, a new stage where nature is resurrected as an artificial cultural form and culture refers to itself, reconstructs nature as an ideal cultural form. Thus, information constitutes the key component of social organization; the flow of messages and images between networks forms the fundamental characteristic of social structure. Historically, functions and processes are increasingly organized around networks, forming the new social morphology of societies. With the new technological paradigm, events and situations occurring in different times and places can spread throughout the entire social structure (Castells, 2008).

Technological developments have enabled collaboration among designers working anywhere in the world, and designers, influenced by regional, national, and international factors, have operated in local physical contexts (Lees-Maffei and Fallan, 2016). Consequently, new technologies have fundamentally changed the world, forcing new ideas and practices in design to confront new conditions (Heskett, 2017). The technological revolution has reshaped the foundation of society at an accelerating pace, making societies globally interdependent. These

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developments have caused changes not only in the process of creating designs but also in the speed of their dissemination.

In the relationship between technology and design, as Heidegger states, the increasing influence of technology has weakened the possibilities of making designs that evoke meanings (Sharr, 2013). Heidegger, stating that a design situates human existence, explains this through building design as follows:

A building is constructed according to the characteristics of the land and its occupants, and it is shaped by the physical and human topography it inhabits. Furthermore, it is made from the fruits of the earth: stone, wood, and metals. A building is more concerned with the people who inhabit it rather than abstract objects. Indeed, the form of a building reflects the values and belief systems of those people (Sharr, 2013).

In this context, the design of spaces oriented towards the regions where societies live and the cultures they belong to becomes crucial. Because each region and each culture Ioffers different spatial possibilities to designers. When this aspect is ignored for any reason, it can lead to undesirable consequences such as the misuse of spaces beyond their functions, alteration of spaces, or even their non-utilization. However, economic and cultural conditions may compel users to utilize these spaces. In such cases, users may strive to incorporate features of their own cultures and regions into the spaces, making them suitable for their values. Bauman (2010) emphasizes that individuals' lifestyles are shaped by the physical and cultural characteristics of the place they live in, examining the relationship between technological developments and daily life through the issues of locality and spatial identity. According to Bauman, in an artificially created environment, individuals face an almost insoluble identity problem, deprived of the opportunity to negotiate meaning and thus acquire the knowledge necessary to understand and solve that problem in the featureless monotony and sterile hospital-like environment of the space. Bauman describes the relationship between technology and changing spatial culture as follows:

Women gathered at natural meeting places such as the fountain, the wellhead, or the riverbank... They would fetch water, wash laundry, and exchange information and ideas. The fountain is no longer there. Until recently, in modernized countries, there were small shops with coin-operated washing machines where brief conversations took place while washing clothes. These machines are also gone... Today, large shopping malls could provide people with opportunities to meet; but they are too big to run into familiar faces and too busy and crowded to sustain the conversations needed to establish behavior standards...

The concept of the ‘yer ev', which is the subject of the study, is a regional term used for houses with gardens, generally single-story, in the Aydın region. The term "yer ev" is used by the local population to refer to a specific type of building, typically a single-story detached house. These houses have certain distinctive features influenced by the climate and cultural characteristics of the region. Generally, the houses

have two entrances. One of these serves as the main entrance, while the other is used to access the rear courtyard without entering the house itself. The rear courtyard typically includes a central garden area, a toilet, a wood storage area, and, depending on the needs, small livestock housing facilities such as a barn. However, it is observed that with the changes occurring, the local people are gradually abandoning the 'yer ev' and transitioning to apartment living. As a result of the conducted research, the aim of the study is to examine the changes in the cultural and social lives of indoor users in the context of users and spaces, with the transformation of the built environment's locality concept due to the effects of globalization. In this regard, the sub-goals of the study are provided below:

1. What are the cultural changes experienced by users as they move from regional discourse "yer ev" to new settlements?
2. What are the social changes experienced by users as they move from regional discourse "yer ev" to new settlements?
3. What are the parameters in the relationship between users' experienced cultural and social changes and space design?

In this context, in order to make accurate assessments regarding the meaning of design, it has become necessary to consider the processes referenced by the network society, globalization, and glocalization concepts, which are shaped by technological developments, as values and to reveal the relationships between these concepts. In this context, the first part of the study examines the concepts of network society, globalization, and glocalization, and the relationships between the concepts are elucidated. The second part of the study provides information about the design of the research and the analysis methods. In the third part of the study, the data obtained from the participant-led semi-structured interviews and spatial evaluations are analyzed. In the final section of the study, the findings obtained in line with the aim of the study are evaluated together, providing information to designers and planners about the extent to which spatial changes at the urban scale affect the lives and cultures of users. It is aimed that these findings contribute to subsequent studies and design processes.

THE CONCEPTS OF NETWORK SOCIETY AND GLOBALIZATION

New forms of communication emerging from technological advancements are taking shape through networks, with individuals' relationships with these networks defining the social structure. Consequently, the impact of networks on individuals' life experiences is debated, and various readings are made through the network-based social structure.

In its broadest definition, the network society refers to a society whose social structure (the organizational arrangements of people in their relationships of production, consumption, reproduction, and experience, expressed through a communication system coded by culture) consists of networks supported by information and

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communication technologies (Castells, 2004). Van Dijk (2006) states that networks lead to a comprehensive restructuring of society, supporting globalization and socialization on the one hand, and localization and individualization on the other. Castells (2008) describes networks as highly suitable tools for a social organization that aims to displace space and nullify time, instantly embedding new values into the public mood for policy. Castells (2005) asserts that the network society carries a global character and cannot operate solely or primarily within a national context. Therefore, globalization, although less analytical and more descriptive than the concept of network society, is another way of referring to the network society.

The definitions highlight a direct relationship between the concepts of the network society and globalization, necessitating the elaboration of globalization. According to Popkewitz and Rizvi (2009), globalization is a term for considering the effects, consequences, and causes of changes occurring today. It is described as an event that, as the ontological condition of the present, makes visible the rules and standards of thought, hope, and action (Popkewitz, 2009). Therefore, as a term related to the present, globalization is a concept that highlights the practices of simultaneous construction for thinking about what is happening in the world (Popkewitz, 2009). In other words, globalization involves the networking of connections between different social contexts or regions across the globe. Thus, globalization can be defined as the intensification of worldwide social relations that link distant localities, where local occurrences are shaped by events occurring miles away and vice versa (Giddens, 1994). The defining technologies of globalization (computerization, digitization, the internet, etc.) help establish its defining perspective, with the concept's defining perspective being integration and its symbol being a global communication network that unites everyone (Friedman, 2002).

Held and McGrew (2003) note that the concept of globalization is defined in various ways by different people: remote action (local actions having significant consequences for others far away); time-space compression (instant electronic communication eroding distance and time constraints on social organization and interaction); accelerated interdependence (events in one country directly affecting others and intensifying interconnections between societies); a shrinking world (eroding boundaries and geographic barriers to socio-economic activities), etc.

Globalization is often viewed in various ways, but one common understanding is that it is an irreversible process that impacts everyone equally and in the same manner, representing an inescapable fate for the world. Öncü and Weyland (2010) argue that a common theme emphasized by various authors addressing global dynamics is the increasing speed, volume, and diversity of the flow and circulation of capital, trade, population, consumer goods, and cultural products across the globe, and that the main advantage of globalization narratives is that

they force simultaneous thinking, emphasizing fluidity and circulation over space. One of the disadvantages of globalization is that the growth it triggers results in urbanization, gradually eroding traditional rural societies and values. Therefore, one of the negative aspects of globalization is the threat it poses to cultural identity and values (Stiglitz, 2002). In the age of globalization, the challenge for countries and individuals is to strike a healthy balance between preserving a sense of identity, homeland, and community and doing what is necessary to survive in the globalization system (Friedman, 2002).

Berner (2010) emphasizes that globalization does not lead to worldwide homogenization; instead, it creates a world that is more diverse, heterogeneous, and complex than ever. Berner states that a fundamental misunderstanding often influences the globalization debate: the assumption that the global society, economy, and culture are becoming increasingly 'placeless' and present everywhere or at least beginning to manifest themselves. With the effects of globalization, it can be said that social values and spatial qualities specific to geography are becoming similar, but they are homogenizing by moving away from their own values. For example, cities are becoming increasingly globalized, affecting all areas of life. People everywhere are being exposed to new ideas and cultural practices that were once considered strange, the concept of globalization supports the amalgamation of products for different countries without considering cultural differences among users (Momade, 2022). One of the problems caused by globalization is cultural degradation (Öztürk and Öncüer Çivici, 2018). From this perspective, the issues related to this homogenization and cultural degradation contribute to the emergence of the concept of glocalization.

Glocalization

It can be observed in the definitions made that there is a tendency towards standardization and homogenization on Earth with globalization. However, the uncertain nature of globalization deepens interpretations of the meanings the concept implies. In this regard, Bauman (2010) expresses the dichotomous structure of the concept as follows: The more globalization unifies, the more it divides; it unites while it divides; the reasons for encouraging the uniformity of the globe are identical to the reasons for division. In addition to the fact that the flow of knowledge in every field reaches global dimensions, there is also a process of "localization" and fixing of space; therefore, what is perceived as globalization for some means localization for others (Bauman, 2010). Similarly, Friedman (2002) states that everything coexists with its opposite in globalization. According to Friedman (2002), while globalization homogenizes cultures on one hand, it also enables individuals to share their unique individualities with an increasing portion of the world. This situation contributes to the recognition of cultural values and spatial qualities in the world, as well

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as to the inclusion of individual uniqueness. In this case, the concept of "glocalization" emphasizes both the localization of the global and the globalization of the local. The ongoing interaction between the global and the local makes differentiation and homogenization possible (Robertson, 1995). In other words, the emergence of the concept of glocalization acknowledges that globalization may conflict with local interests and needs, hence the need for local compromises. The interaction between global and local creates a third space to compensate for the weaknesses of these two concepts (Francois, 2015). According to Friedman, healthy glocalization is the ability of a culture to assimilate effects that can naturally adapt to it when confronted with other powerful cultures, resist things that are truly foreign, and distinguish things that may be different from it. The sole purpose of glocalization is to assimilate various aspects of globalization in a way that contributes to geography, culture, progress, and diversity (Friedman, 2000).

In summary, glocalization draws attention to the preservation of values belonging to geography and society, as well as to the relationship between the global and the local concepts. Although this relationship is subject to various studies at the cultural level, it is also an important parameter for designers. When the national literature data is examined, in a study conducted at the product scale, it was found that user groups who did not experience the effects of globalization preferred traditional elements such as divans, floor tables, and floor cushions in their furniture choices, while user groups influenced by globalization tended to prefer furniture that appealed to a modern lifestyle, differing from local traditions (Aras and Özdemir, 2018). In another study, Aras and his colleagues evaluated the socio-cultural changes through the spatial design of traditional Urfa Houses, revealing that there was a lack of compatibility between these traditional spatial configurations and the changing conditions of contemporary life (Aras et al., 2003). Ertürk and Gökdemir (2017), in their study at the urban scale, examined the effects of socio-cultural differences on the spaces in two adjacent neighborhoods, identifying significant changes in the types, numbers, and usage patterns of the spaces between the neighborhoods. It is seen that the concept of globalization and its effects have been examined in many studies examining the life practices of individuals.

For design disciplines focused on humans, it is important to preserve local values while being aware of the effects of globalization. Because this affects the design process of spaces where cultures are formed and sustained. Recognizing that the effects of globalization will continue, it necessitates the analysis of spaces and environments. This reveals the relationship between glocalization and design. Global and local are so intertwined that perhaps the best word to describe the world designed by designers today is glocalization (Ching et al., 2017). In this context, globalization cannot be avoided; however, local values should not be allowed to disappear.

Despite its advantages, globalization affects the localities of nations; this can be observed in internal changes occurring in the use of unique spaces, their distinctive features, certain cultures, ways of life, ways of thinking, and even in the perception of "new and modern" solely for the sake of appearance. Societies cannot escape globalization but can face it by preserving their localities in every way. The main responsible parties for this issue are authorities and architects (Fellahi, 2021).

While globalization and glocalization are influenced by many factors, they also influence these factors, making the concepts multi-dimensional. In readings regarding the layered structure of concepts, the spatial scale emerges as one of the areas where this interaction is most intense, thus increasing the importance of determining changing indoor usage habits.

METHODOLOGY

This study employs a qualitative research methodology to investigate the transformations in the cultural and social lives of interior space users, focusing on the user-space relationship within the context of the changing notion of locality in the built environment under the influence of globalization. Qualitative research is characterized by its exploratory and interpretive nature, aiming to comprehend a problem within its natural context (Klenke, 2016). By utilizing qualitative data collection methods such as observation, interviews, and document analysis, this approach seeks to uncover both previously identified and latent issues. It emphasizes a realistic examination of natural phenomena associated with the problem, framed within a subjective and interpretive paradigm (Seale, 1999). The study is structured using the phenomenological design, a subset of qualitative research methodologies. "Phenomenological research design focuses on phenomena that we are aware of but do not have an in-depth and detailed understanding of" (Yıldırım & Şimşek, 2016). It is stated that these phenomena encompass perceptions, experiences, concepts, and situations. The purpose of phenomenology is to understand human experience (van Manen, 2007). Phenomenology is a qualitative research method used to allow individuals to express their understanding, emotions, perspectives, and perceptions regarding a specific phenomenon or concept and to describe how they experience that phenomenon (Rose, Beeby & Parker, 1995).

Study Group

"In phenomenological research, individuals or groups who can experience the phenomenon under focus and can express or reflect on this phenomenon are the data sources" (Yıldırım & Şimşek, 2016). Similar to other qualitative research methods, phenomenological research focuses on the depth and details of knowledge to comprehensively express the phenomenon being studied, rather than aiming for generalizability or universality (Baltacı, 2019). In the

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research conducted within the phenomenological design, the study group consists of users selected through purposive sampling method, aiming to identify the cultural, social, and spatial experiences of individuals who have moved from "local homes" to apartment units. The study group was selected through criterion sampling, one of the purposive sampling methods. The criterion for the study was individuals who have experienced cultural and social changes due to leaving their homes with local characteristics for various reasons and undergoing a different spatial arrangement for at least five years. Accordingly, individuals who had moved from “yer ev” to apartment dwellings within the past five years and voluntarily agreed to participate in the study formed the study group. Ethical approval for the study was obtained from the Social Sciences Ethics Committee of Eskişehir Technical University (Approval Date: April 24, 2023; Protocol Number: 35/16).

In qualitative research approaches, different opinions are presented by researchers regarding the determination of the sample size. However, qualitative research prioritizes achieving a saturation level over focusing on the size of the study group. Conceptually, saturation is reached when further data collection does not yield deeper understanding or additional insights into the phenomenon being studied, allowing for the data collection process to be concluded (Akçay & Koca, 2024). In this study, conducted with eight participants from the İncirliova district who had moved from ground-level houses to apartment dwellings, data saturation was achieved, and the analysis phase was initiated.

Data collection tools and analysis

Since interviews are commonly used as data collection tools in phenomenological studies (Yıldırım & Şimşek, 2008), the interview technique was used as the data collection tool since the research was conducted based on the phenomenology design. The interview technique provides researchers with interaction, flexibility, and the opportunity to examine through probes while revealing experiences and meanings related to phenomena (Yıldırım & Şimşek, 2008). While creating the semi-structured interview form, relevant literature was extensively reviewed, and various items were determined to identify users' attitudes, experiences, and perceptions regarding spatial designs related to their changing and evolving lifestyles. These questions were organized after pilot applications and semi-structured interviews were conducted with participants. The process of establishing the research framework is presented in Table 1.

Table 1. Establishment of the Research Framework

On-site observations were made in new and old settlements to analyze the changes in the region.	As part of the research, observations were conducted starting from the streets of the 'yer ev' where the local population previously resided to the streets surrounding the apartments they recently moved to, aiming to understand differences in usage patterns. In this context, the functions and usage practices of streets in both residential areas were observed.
Facade and interior space analyses of "yer ev" in the İncirliova district of Aydın province were conducted during the fieldwork.	The facades and interior space usage areas of the 'ground-level houses' were analyzed and evaluated in conjunction with the new living spaces in the apartments. This evaluation was conducted to analyze the extent to which the spatial needs of the users in the 'yer ev' align with apartment living.
Analyses of semi-structured interviews with users were conducted using the Nvivo software.	The interviews conducted with the users were analyzed through descriptive analysis, and themes were developed. These themes highlighted the key concepts that emerged during the process of change.

The data obtained from interviews with 8 participants were analyzed using the descriptive analysis method. In descriptive analysis, "the obtained data are first described systematically and explicitly. Then, these descriptions are explained and interpreted, cause-and-effect relationships are examined, and conclusions are reached" (Yıldırım & Şimşek, 2016).

Table 2. Analysis Process of Research Data

In the scope of the research, various data collection processes were conducted including on-site observations, comparative analyses of spaces, and semi-structured interviews with users. This approach is considered crucial for ensuring the validity and reliability of the collected data. Providing detailed and objective descriptions of the study processes, ensuring their applicability and repeatability, and employing data triangulation are among the most recommended measures (Marshall & Rossman, 2006). Triangulation, which involves gathering data from multiple sources or methods to corroborate findings, is widely used and significantly influences the quality of studies (Fraenkel, Wallen & Hyun, 2011).

FINDINGS

The findings obtained from the research are structured consistently with the interviews and space evaluations, and they are composed of headings identified through analysis.

Spatial Evaluations

The Incirliova district of Aydın province is geographically divided into two by the line formed by the highway and the railway. This

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separation has significantly affected the district's construction pattern and development style. The structures in the blue area in Figure 1 consist of traditional structures called ‘yer ev’. The dark blue area within the blue area indicates where ‘yer ev’ are densely located, which is the focus of the study. However, the area marked in orange on the other side of the highway and railway indicates an area where apartment-type construction has become widespread, moving away from traditional settlements. The distinct sub-region in the orange region indicates the area included in the scope of the study and where apartment buildings are the densest. This region is a residential area where urban transformation has rapidly increased in recent years. In this area, where traditional ‘yer ev’ have almost completely disappeared, the density of multi-story apartment buildings is striking.

Figure 1. Incirliova District Map 'Yer Ev’ and Apartment Buildings Settlement Relationship

As part of the study, photographs were obtained from within the interior spaces to the extent permitted by the participants. Streets with ‘yer ev’ are important public spaces where the physical structures of homes and the social areas they provide encourage interaction among users. In residential areas with typically single or two-story houses, the direct connection between homes and the street, as well as semi-private areas like courtyards, fosters the strengthening of social bonds. In such neighborhood structures, the street serves not only as a pathway but also as a shared living space where individuals engage in daily activities and socialize. The connection between the street and the home extends beyond physical boundaries, offering a social platform that enables users to come together.

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Figure 2. Streets with 'Yer Ev' (Personal archive)

The process of urbanization has brought significant changes to both the physical and social functions of streets. The social interaction environment observed in traditional neighborhood streets weakens in areas with high apartment density. The absence of private gardens or parking spaces in apartment complexes leads to a shift in the function of streets, transforming them into areas plagued by parking and traffic problems, rather than spaces for socialization. This situation limits the streets' role as public meeting and interaction spaces, weakening users' social connections. Furthermore, these streets, which are not designed to meet the needs of users, fail to support the spatial infrastructure necessary for socialization.

Figure 3. Streets with Apartment Buildings

The narrow street structures and the positioning of apartment buildings relative to each other negatively affect not only social interactions but also environmental and climatic factors. In the summer months, the interruption of cooling breezes diminishes the quality of life for apartment residents and also obstructs the natural ventilation function of the streets. These physical arrangements reduce the street-

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user relationship to merely a transit or passage area, eliminating the prioritization of social interaction. As a result, in streets with high apartment density, users lose both the environmental comfort expected from the physical space and the public spaces that could foster the development of social ties.

Figure 4. Facade of 'Yer Ev'

The houses built in line with the needs of the local community generally have two entrance doors. This is because they serve both to carry firewood or coal, used for heating in winter, to the areas at the rear of the houses, and as an entrance for livestock for those engaged in animal husbandry. Even today, the front doors are still actively used when needed.

Figure 5. Courtyard Area and Garden Entrance

Access to the courtyard is provided without entering the house through the secondary entrance. The courtyard area shapes the rear facade of the house. In the rear facade, there is a secondary toilet and handwashing area associated with the interior spaces. A portion of the courtyard is designated as a woodshed/coal storage area for storing items to be burned in the winter. Fruit trees and various plants are placed in the courtyard.

According to spatial examinations, 'yer ev' have been shaped in line with the geographical, social, and cultural needs of the local users. This contributes to the harmonious coexistence of the local community with the environment. Various solutions have been found for heating and cooling the houses according to the environment and climate. It has been observed that the use of stoves for heating is common. Since stoves are usually located in one room, residents use this room during the winter months. However, due to the intense heat in the summer, the local community has developed different cooling options. These include using air conditioning, taking advantage of the openings in houses with different facades, and sitting in garden areas.

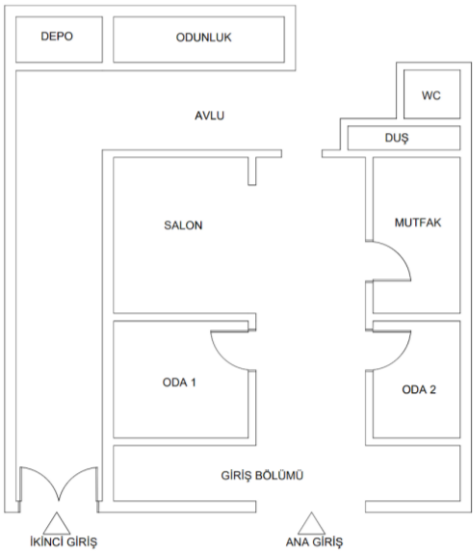

Figure 6. 'Yer Ev' plan

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As seen in the plan, the houses allow for transition between the street entrance and the courtyard. While the courtyard area is used for cooling off in the summer, it serves as a storage space for firewood and coal in the winter. Access is provided from the kitchen area to the toilet and bathroom, while access to the secondary toilet area located outdoors is provided from the courtyard area. There are two separate rooms inside the house. While one room contains a stove for heating purposes, the other rooms are not heated during the winter months.

Figure 7. Interior of the 'Yer Ev'

When entering the house from the street, a visual connection can be established with the courtyard area located at the back. The circulation space inside the house is also provided along this transition axis. The living area is in relationship with both the courtyard and the kitchen section, serving as a space for seating. This settlement layout not only ensures an airflow suitable for the region's climate but also strengthens internal and external relationships, thereby reinforcing the connection with the street.

Figure 8. Kitchen Section

The window in the kitchen opens to the courtyard area. This window is used both for ventilating the kitchen and as a service window. Transition from the kitchen to the toilet and shower area is possible.

Like in the kitchen area, only general lighting is used in other areas of the house as well.

Following spatial examinations, the data obtained from semi-structured interviews with participants were analyzed.

Findings from semi-structured interviews

Based on the findings obtained from semi-structured interviews with 8 participants who transitioned from 'yer ev' to apartments, it was found that the participants lived in 'yer ev' for more than 15 years, but later moved to apartment buildings in other developing areas of the region for various reasons. When looking at the reasons for transitioning from 'yer ev' to apartment buildings, it was observed that both young and elderly individuals had different motivations and faced different challenges. Direct quotations from participants regarding the cultural changes they experienced after moving from 'yer ev' to new residential units are provided below:

"The main reason for moving to this house is the change in the sociocultural structure of the neighborhood where our 'yer ev' *is located. We started to have difficulties because the neighborhood received too many immigrants. Because cultural differences are more easily noticed in small places. During this process, fights and problems increased. We wanted to move away" (P3).*

"We moved because our neighborhood received a lot of immigration. Because the familiar environment changed, new customs came. I couldn't stand it, so I moved" (P1).

"In our neighborhood, it became dangerous to walk on the streets at night. We were worried about the safety of our children, so I wanted to move. My daughter came of marriageable age. I didn't want her to marry someone from that neighborhood. We received too much immigration, we don't know the people who come. So, we moved" (P4).

"I wanted to live among more educated and cultured people. Everyone in my workplace lived in an apartment. I also wanted to live in an apartment. So, we moved" (P5).

"No one knew who anyone was anymore. I didn't feel safe. Because very different people came" (P2).

"I got divorced from my husband. I live alone with my daughter. That's why I wanted to move to a neighborhood where I would feel safer. At least we are safer in the apartment" (P7).

It is observed that one of the most important reasons for the local people's transition to new residential units was the disruption of the sociocultural structure of the neighborhood where 'yer ev' were located. Due to the migrations in the region, the neighborhood began to differentiate culturally, causing residents to worry about their safety. This situation resulted in people leaving their homes where they had lived for many years and moving to an apartment in a new neighborhood. Another influential reason is the interest of the

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participants in apartment living. The fact that living in an apartment is seen as more prestigious in terms of culture has led the participants to leave their 'yer ev'. In this context, with globalization and population growth, people are moving away from their cultural realities by striving for communal living, apartment living, and luxury consumption. Direct quotes from the participants' views on the changes in the social context they experienced as they moved from their 'yer ev' to their new settlements are presented below:

"I still go to my old neighborhood to socialize." (P3)

"We sit on the street here. You can't sit here, of course, cars pass by. So, sometimes I get bored sitting at home, and I still go to my old neighborhood. I haven't met anyone here anyway." (P8)

"I didn't like the apartment I moved to at first. I was both climbing stairs and didn't know any of the neighbors. My old neighbors were going to sell the 'yer ev'*. So, we moved to the same apartment with my old neighbors. Now I'm very happy" (P1)*

"I go to my old neighborhood during the holidays. Other than that, I don't see anyone from there. I've built a new life for myself. I feel more comfortable here because people are more educated." (P5)

"I go to my old neighborhood to socialize. I know there are places I know here, but I still miss my neighbors" (P6)

It was observed that participants meet their socialization needs by going to their old neighborhoods after moving from 'yer ev'. In fact, there are individuals who choose to move as a group to a new place. However, one participant stated that she went to her old neighborhood out of necessity and wanted to be in her new environment otherwise. This situation is important in terms of the relationship people establish with the environment socially. Because the relationship 'yer ev' has with the street and the environment is quite strong. On the other hand, the physical structure of the apartment does not allow for such socialization. The direct quotations below provide insights into the cultural and social changes experienced by participants after moving from 'yer ev' to new residential units:

"I still dream of going back to the old house. We need to live with the earth, not among these concrete buildings. However, it was good to get new furniture for the new house, the old ones were very worn out." (P2)

"If we hadn't sold our old house, I would have gone back there. Because I don't have a place here to dry tarhana (a traditional Turkish soup mix) and make tomato paste. I have to go to the 'ground floor' houses of my neighbors in my old neighborhood to do it." (P6)

"I live on the lowest floor of the apartment I moved into. My balcony is also spacious. So I can still go out to the garden whenever I want, and I make my tarhana, pasta, and tomato paste on my balcony." (P1)

"We moved into an apartment, but we couldn't leave our animals behind. We have 17 cats, a budgerigar, and a rabbit. Just as animals belong to the

earth, so do humans. We are trying to fit in here, but I miss our old house. I want to go out to my garden." (P4)
"The biggest advantage of our new house is that we don't have to deal with a stove to heat it. Heating was a huge problem. It made the house dirty, and we all had to sit in the same place." (P3)
"In our new house, everyone has their own room. I can have my privacy. That's why living here is better. And we don't have to struggle to keep warm. Having central heating is a huge advantage." (P8)
"We didn't sell our old house. My parents are making our winter preparations there. For me, being in the new house and not having the house get dirty from wood and coal for heating is very important. I don't know if it's because of the materials of our old house, but it used to be cooler. But now I can cool down by turning on the air conditioner." (P5)
"I don't have a place to make winter preparations anymore, but that's okay, I buy ready-made ones. As long as my child and I are safe, I don't need anything else." (P7)

According to the participants, there are spatial differences between 'yer ev' and apartment buildings. Among the disadvantages of apartment living are the lack of space for preparing winter meals and the restriction of the relationship with the environment such as garden/street. It was observed that the absence of areas in the roofs and gardens of 'yer ev' for drying tarhana, making paste, drying vegetables, and fruits is a problem for most participants. However, two participants stated that this situation was not a problem for them. The weakness of the relationship with the environment in the apartment was also seen as a disadvantage by the participants. However, it was observed that the biggest advantage of living in an apartment is heating and being able to establish privacy. It was stated that heating with a stove dirties the houses and reduces the private areas due to the heating of only one room. This situation has made it difficult to create private areas within the house. However, it was observed that participants need private areas within the house. In this context, themes were determined based on the descriptive analysis results of semi-structured interviews. The identified themes are presented in Figure 9.

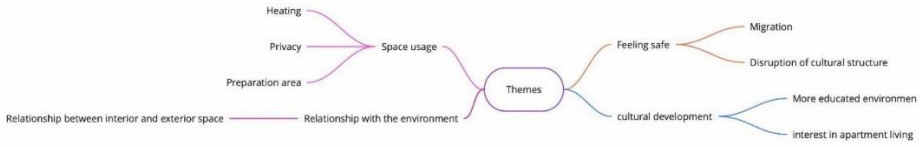

Figure 9. Resulting Themes

The study examined the experiences of individuals who moved from 'yer ev' to apartment flats. The majority of participants stated that they moved due to changes in the socio-cultural structure of their neighborhoods and increasing security concerns. The arrival of migrants from outside the region, with their different cultural habits, led to incompatibilities and conflicts with the existing residents, prompting them to relocate. Additionally, the perception of apartment living as a

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more prestigious and modern lifestyle emerged as another significant factor supporting participants' transition to apartment flats.

After the move, it was found that participants made efforts to maintain social relations with their former neighborhoods. However, due to the physical and social limitations inherent in apartment structures, this need could not be fully met. While the strong social and cultural connections established through spaces such as gardens and streets in traditional houses were lost, the advantages of apartment flats, such as heating convenience and individual privacy, became more prominent. However, one of the spatial reasons for the transition from 'yer ev' to apartment living—heating—could be addressed without disrupting the region's cultural, social, and spatial structure. This could also contribute to the sustainability of regional values. These findings clearly highlight the impact of globalization and modernization processes on individuals' spatial preferences and social life.

CONCLUSIONS

The effects of globalization have transformed individuals' lifestyles, and these transformations have become the subject of numerous international and national studies, ranging from the scale of products to the scale of spaces and cities. In this study, which was handled with this awareness, the relationship between the social, cultural, and economic effects of globalization and the new design perception that emerged in the houses where individuals live was emphasized. In the socio-cultural context, globalization has brought geographical boundaries closer, increased interactions among people, and led to the coexistence of individuals from different cultures. This has reshaped social structures and norms. In the examined example of the district where 'yer ev' are located, it is observed that the migrations from outside have created a multicultural social fabric in the region. However, the mismatch of values in daily life routines within the community due to incoming migrations and unmet life expectations, has resulted in social stratifications and disconnections, prompting the local population to seek new living spaces. The transition of individuals from their familiar physical environments to apartment buildings has significantly changed their life experiences.

When we look at the social and cultural changes experienced by the participants who moved from their 'yer ev' to new settlement areas, it is seen that their efforts to preserve their daily lives and traditions have turned into a struggle in places unsuitable for geography and culture. This situation results in the local people changing their eating culture, animal husbandry processes, their ties with nature and their social environment. In this context, it reveals the necessity of designing the new living spaces offered to the local people in line with the regional culture. New apartment buildings do not provide designated spaces for individuals' daily activities. Suitable conditions for pet keeping are not available, and each apartment does not have its own outdoor space.

While individuals' daily activities remain the same, the way they carry them out has been redefined. In the design of apartment buildings, specific design elements unique to the culture of the region have not been considered. This situation leads to both cultural and spatial challenges for the users of these spaces. Because existing cultural values and environmental harmony have been disregarded in the construction of new settlements. In this regard, failing to respond to the lifestyles, cultures, and spatial needs of the local population will lead to various deteriorations over time.

Design decisions such as space configuration and spatial scale have been made without taking into account the constraints or opportunities brought by the geography. The uniqueness of spaces shaped by unique user data has been eliminated with the introduction of standardizations. Individuals have become part of a structure that maintains similar lifestyles within the same behavioral patterns. They have adapted their living spaces to their own usage through the solutions they have developed.

The study has shown that participants experience problems in their socio-cultural and spatial usage processes due to standardized lifestyles and spatial features resulting from globalization. In this regard, the importance of designing new housing for local communities in accordance with the geography, socio-cultural structure of the local population, and spatial needs have been emphasized. Within this framework, there is a need for comprehensive studies to prevent the loss of cultural and spatial values.

Within the scope of the article, the importance of presenting studies based on research that is free from assumptions and preconceptions in determining the needs and demands of societies living in different geographies by adopting different cultural values, especially in the Incirliova Region, is emphasized. Academic studies conducted in this field will serve as a valuable resource for design practitioners.

In summary, Horkheimer and Adorno (1995), emphasize that experiences related to the world have shaped human life, and the changing qualities of objects have altered their functions. Differentiations in the spatial design of dwellings have defined the boundaries of human-environment interaction. Finally, in the globalized world, reconsidering the questions raised by Adorno (2000) about the home and the individual, who he describes as an entity constantly exposed to the influence of the surrounding world of objects, is necessary:

What does it mean for the subject to have sliding windows that can only be pushed right and left instead of inward-opening windows? How has the presence of rotating door handles instead of soft door knobs, the disappearance of courtyards, the removal of a few steps in front of the street door, and the garden walls affected them (Adorno, 2000)?

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Resume

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Design Principles for a Special Education Center for Children on Autism Spectrum Disorder

Merve Kavaz *

Abstract

Autism Spectrum Disorder (ASD) expresses different usage of communication, application of language and stereotypic behavior. ASD continues lifelong. Therefore, good design quality and special education is essential for individuals who are diagnosed with ASD. The suitable design of special education center for ASD will help children on the spectrum to learn and gain communication skills in comfortable environments. However, design for autism is an overlooked topic by design researchers, interior architects. This research aims to fill the gap in the literature of design for ASD. The qualitative research is applied in the research to comprehend design problems and solve it by new understanding of design. In this study, 6 autism experts' idea were taken in the meetings to design better autism centers for individuals on the spectrum. Participants of the study shared their observation of autism centers and approach for better autism centers. Depending on the repetitive view of problems and solutions, some research codes were achieved to have common sense of autism design. Moreover, special education center in the USA was visited to analyze more deeply. Main problem of special education design is crowded classrooms which doesn't help students to self-regulate. Also being unaware of ASD and its relation to the design creates ignorance to design for ASD. Depending on the interviews and observation of autism center, solution for design problems are displayed. By this way, design set-up can be made to create autism friendly centers.

Keywords: *Autism spectrum disorder (ASD), Design for autism, Special education center design.*

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INTRODUCTION

The place has an indirect way of communicating with people. People have this communication through the senses. As a result of the communication, place experience occurs. Place experience is gained through sensation, perception, and cognition. When the sensual ability is different, the experience of place can be distinct. Yi Tuan (1977) mentioned that blind people develop an acute sensitivity to sounds, they can use them and their reverberations to evaluate an environment's spatial character. Individuals' place experience depends not only on their physical abilities but also their mental or developmental orders. For instance, individuals who are diagnosed with Autism Spectrum Disorder (ASD) experience environments and places quite differently. Every person on the spectrum is not the same. Some can bear hyposensitive features of ASD, and some can bear hypersensitive features of ASD. Loud noises, bright lights, strong smells, and crowded spaces can trigger individuals who have hypersensitive ASD features. On the other hand, hyposensitive individuals can have inactive behaviors as a result of their experience of place. They may need rocking back and forth in a chair, spinning, and deep pressure to fulfill their sensory needs (Moller, 2024).

Autism Spectrum Disorder (ASD) was founded thanks to various scientific research in 1967 by Neil O'Connor and Beate Hermelin. According to scientific research, it was found that ASD sources from neurology (Rowland, 2020). Children on the spectrum don't orient to visual and auditory skills as much as their sense of touch. To understand ASD broadly, it expresses impaired social behaviors, differences in communication and application of language, and obsessive behaviors up to the individual's interest. ASD has typical symptoms that are related to social communication, restricted or repetitive behaviors, or interest (CDC, 2024):

Social communication:

- Avoids or does not keep eye contact.
- Does not show facial expressions when happy, sad, and angry.
- Does not share an interest with others by 15 months of age.
- Does not point to show you something interesting by 18 months of age.
- Does not notice when others are hurt or upset by 24 months (2 years) of age.
- Does not notice other children and join them in play by 36 months (3 years) of age.
- Does not pretend to be something else, like a teacher or superhero, during play by 48 months (4 years) of age.
- Does not sing, dance, or act for you by 60 months (5 years) of age.

Restricted or repetitive behaviors or interests:

- Lines up toys or other objects and gets upset when the order is changed.
- Repeats words or phrases over and over (called echolalia).

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- Plays with toys the same way every time.
- Is focused on parts of objects (for example, wheels).
- Gets upset by minor changes.
- Has obsessive interests.
- Must follow certain routines.
- Flaps hands, rocks body, or spins self in circles.
- Has unusual reactions to the way things sound, smell, taste, look, or feel.

Other Characteristics:

- Delayed language skills.
- Delayed movement skills.
- Delayed cognitive or learning skills.
- Hyperactive, impulsive, and/or inattentive behavior.
- Epilepsy or seizure disorder.
- Unusual eating and sleeping habits.
- Gastrointestinal issues (for example, constipation).
- Unusual mood or emotional reactions.
- Anxiety, stress, or excessive worry.
- Lack of fear or more fear than expected.

The number of ASD is increasing day by day. It is stated that 1 in every 36 children is diagnosed with ASD (CDC, 2023). According to the Autism Turkey Platform's data in the previous years, there are 550,000 children with ASD, and around 150,000 children with ASD in the 0-14 age group. Considering the parents and close relatives of individuals on the spectrum, there are approximately 2 million people affected by ASD spread across all provinces in Turkey (ODFED, 2024). The growing number of people on the spectrum is a big threat. In comparison to statistics in 2000, now the number of individuals on the spectrum is % 241 higher than the baseline (Loftus, 2024). Moreover, boys are four times more likely to be diagnosed than girls. % 36.5 of ASD caregivers use Applied Behavior Analysis (ABA) (Loftus, 2024).

ASD continues lifelong. Therefore, society need to be adapted to ASD. This adaptation can be done through social consciousness regarding ASD. Therefore, each discipline should take this global issue as a research problem in the scope of their discipline and try to put forward solutions. In this way, ASD will be on the agenda to create a livable and better world. It is beyond any doubt that people on the spectrum and their families make huge efforts to cope with the effects of ASD. The big role in coping with the effects of ASD is education. That is why, the learning environments of individuals with ASD are significant for their self-development.

Educational places, that are part of daily life where individuals on the spectrum spend their most of time, are crucial for the educational development of these individuals. The schools that are not designed for students with ASD and their education may cause discontinuous education. Hence, educational rights that is individuals' basic needs can

be affected negatively. The greatest support to be given to an individual with ASD is education. In the Autism Spectrum Disorder Handbook written by Tohum Autism Foundation, it is stated that uninterrupted, intensive, and one-to-one education in the early childhood period (before the age of 3, at most before the age of 5) is of great importance for the development of the individual (2019). While a special curriculum is applied in education, training is given with content that increases individuals' social interaction skills and attention.

The education of individuals with ASD becomes more open to development as they acquire certain skills. The education in early childhood which is also primary education is designed to improve communication, daily life skills, and motor skills (MEB Özel Eğitim ve Rehberlik Hizmetleri Genel Müdürlüğü, 2020). Education is a lifelong learning process that is realized in collaboration with families and teachers. Therefore, the review and experience of experts on the ASD have utmost importance when designing places for individuals on the spectrum. This study aims to understand the current design problems in autism centers and recommend new design principles for autism centers. Thus, it is expected to detect design problems and necessities in autism centers and recommend design solutions accordingly.

LITERATURE

Architecture has a multidisciplinary structure that includes various disciplines such as sociology, archeology, humanities, and art. Therefore, architecture has multiple ways of seeing and thinking. ASD and architecture seem like they are not related at first glance. Maybe, that is why, it is an overlooked topic by many architects, designers, and researchers. As it mentioned previously, educational environments are significant for individuals' self-development. Therefore, educational places should be designed to support learning of all individuals. However, educational places for students with ASD, who are among special individuals, can only be designed by understanding the features of ASD and the lives of those individuals. Design means observing the life routine of individuals, recognizing their routine, and preparing the ground for the realization of the expected life. In this sense, when designing for people with special needs such as ASD, it should be essential to design with empathy.

Empathetic design provides equitable design solutions for its users. It is needed especially for people with special needs. "By assuming that the life experience of disabled people is unfamiliar to designers, such guides suggest that empathy-building offers a way for designers to step into the user's shoes." (Bennet and Rosner, 2019).

The pioneer design criteria for autism design were found by Dr. Magda Mostafa. Mostafa's ASD Design criteria were called ASPECTSS. ASPECTSS stands for Acoustics, Spatial Sequencing, Escape Space, Compartmentalization (Partitioning), Transition Space, Sensory Zoning, and Safety. These criteria are designated to apply to individuals with ASD.

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ASPECTSS, the world's first experimental design method formula for ASD. This research; which is for children with special needs, was awarded with UNESCO/ Emir of Kuwait award. In the article titled Architecture for Autism: Built Environment Performance In accordance to the ASPECTSS Design Index, ASPECTSS features are explained as stated (2015):

• Acoustics: Acoustics criteria is one of the set of criteria that affects individuals on the spectrum the most. Acoustic comfort is provided by cavity walls, sound-insulated materials, and systems that minimize the echo. All the applications are for decreasing exterior and interior places-based noise.

• Spatial Sequencing: The organization of places is designed depending on the daily activities of the place user. This criterion is based on the sensory smoothness of the place transition. Therefore, there is a rational idea when connecting places. For instance, high-stimulus areas such as music rooms, and dance halls can be grouped, and focus-needed places such as study rooms, and classrooms can be grouped.

• Escape Space: This criterion is related to defining small descriptive areas that neutralize individuals on a spectrum in the environment. Escape space can be a playing area or even a swing in a classroom where focus is needed. Escape space aims to soothe anxiety and emotional hardship or help when individuals have disruptive sensory-based challenges. Disruptive sensory-based challenges can be disturbed by bright lights, some color, and noise. Escape spaces are places that individuals can use as a sensory shelter when in need. Moreover, they can be designed to recalibrate senses by using calming elements. For instance, the element of nature in an escape space.

• Compartmentalization: Compartmentalization aims to create a singular function in a section. In these sections few people and single activities took place. This criteria is against to universal open plan principle. Compartmentalization is related to setting a boundary through furniture, divider, or separator. Also, compartmentalization can be made through the application of different colors or materials on the floor. By this way, the sensory and social load of individuals on the spectrum aims to be decreased.

• Transitions: The design of transitions function in cooperation with the criteria of sensory zoning and spatial sequencing. Through transitions, the sensory level is arranged when passing from a high stimulus area to a low stimulus area. In other words, transitional spaces are preparatory areas for passing from one function to another.

• Sensory Zoning: Sensory zoning is provided to group similar sensory places together. This can be applied to defining sensory features of functions. After that, placing low stimulus places closer provides transitions to high or middle stimulus places.

• Safety: Individuals on the spectrum have some altered perception of the spatial organization and depth. In addition to the altered perception, they may need safety sensors or stimulators especially if they are hypo-sensitive. These stimulators may remove hazardous factors to prevent

individuals from any accidents. In this way, when they display stereotypic behaviors such as spinning they will be under protection. Safety precautions can be provided by building systems, material selections, safety barriers, and usage of correct furniture and fittings. By taking safety precautions, accessible and safe places can be created for all types of different abilities, disabilities, and age groups.

ASPECTSS covers various perspectives of autism design. Each criterion is highly significant in developing a sustainable living environment for individuals on the spectrum. There are some studies in the world which are related to different aspects of design such as acoustics, color, and material (Kanakri, S., 2017; Grandgeorge, M., Masataka, N., 2016). On the other hand in Turkey, there is only one PhD thesis (Designing the interior of educational environments to provide physical and psychological comfort for children with autism who are between the age of 5-11) in the Interior Architecture and Environmental Design discipline[1] (Kavaz, 2022). It demonstrates a gap in the Interior Architecture and Environmental Design literature. Some studies are gathered under aspects of design such as color, and acoustic as explained below.

[1] Yök Tez Merkezi, 2024.

Acoustic: The reaction to sound depends on the hypersensitivity and hyposensitivity features of ASD. Hyposensitive and hypersensitive ASD people perceive sound as follows (Crampton, 2018):

Individuals with ASD with Hyposensitive Features:

- They can hear noises by one ear, another ear may partially hear or not.
- They can't define some sounds
- They like to slam doors, bang objects together, or use high tones of voice so they can feel it.

Individuals with ASD who have hypersensitivity characteristics:

- They can hear distant conversations.
- They have difficulty isolating background sounds and as a result, they may not be able to focus.
- Sounds are perceived as louder than they are.
- Sounds are perceived as in altered form.

There is another research related to acoustic and autism studied by Dr. Shireen Kanakri (2017). She observed the repetitive behavior of children on the spectrum under the acoustical design of classrooms. Depending on the research above the 70 dB sound level there were repetitive behaviors triggered such as repetitive movement and speech, closing ears, hitting, blinking eyes, making loud noises, and complaining. This research shows the relationship between environmental stimulators such as loud noises affect attention and behavior. Also, loud places trigger repetitive behavior (Kanakri, 2017). Acoustic insulation is essential when designing for autism. Therefore, sound-absorbing materials such as acoustic foams, fabric, and fiberglass can be applied. Acoustic panels are effective for sound insulation as well. Acoustic panels can be in any form and material which is suitable for ceilings and walls.

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Color: Individuals on the spectrum perceive colors differently because of their altered vision. There are some chemical imbalances and neurological disorders in the retinas of individuals with ASD (Autism Key, 2011). According to color studies, % 85 of individuals on the spectrum perceive color as more intense and bright than typically developed individuals. % 10 of individuals on the spectrum perceive color as typically developed individuals. % 5 of individuals on the spectrum perceive color as more blurry (Autism Key,2011). Color preference and its perception is an ongoing research topic. Kingston University has a research project about the perception of children on the spectrum in cooperation with GA Architects. Depending on the study, 20 different colors were found suitable for individuals on the spectrum who are between 15 to 19 years old. In general, blue and green tones of colors are preferable amongst the age group (GA Architects, n.d). In addition to the recommended colors; single colors, low stimulus colors, and less toxic colors should be selected.

Another research is on the light color's effect on 13 children on the spectrum. 6 different colors (yellow, white, red, blue, green, pink) of light effect are observed on 6 different typical behaviors (playfulness, eye contact, repetitive body movement, repetitive speech, aggression, refusal of task) of children on the spectrum (Kavaz, 2022). Depending on the observation, playfulness was most in the color of light such as yellow. Eye contact was observed mostly on yellow and green light. Moreover, refusal of tasks and aggressive behavior were mostly observed under the white light. Repetitive speech was observed mostly under the red and blue light. Repetitive body movement seems most under yellow and red light (Kavaz, 2022).

Material: Due to the stereotypical behavior of individuals on the spectrum, they are prone to accidents more than typically developed individuals. For that reason, correct materials in interiors must be selected. Low slip surfaces and waterproof flooring materials will allow users to move safely. Moreover, plain surfaces will be better not to cause any confusion for individuals with ASD. Material selection should be based on tactility, with neutral textural qualities (Almaz and Mohamed, 2023). Maintenance is another factor of materials when considering sustainability. That is why easy maintenance needs to be considered. For instance, instead of using wall-to-wall carpet, carpet tiles will be maintained more easily. Natural materials which don't include any VOC are autism-friendly. Natural materials can be wood, stone, or fabric-based materials. Seating and furniture are significant, especially in educational environments. Therefore, table edges needed to be beveled to not harm any individual on the spectrum. Also variety of seating in consideration of the sensory needs of students needed to be taught. A selection of bouncy, rocking, hammock, cushioned, balance, and spinning chairs will meet their variety of needs (Almaz and Mohamed, 2023).

Lighting: Lighting has a big role in the discipline of architecture. It also serves people of all ages and features. ASD is a group with different

sensory needs that must be considered when designing light. Individuals on the spectrum may not have only sensory sensitivities, they may have sensitivities on vision as well. It also depends on the hyposensitivity and hypersensitivity features of ASD. For instance, hypersensitive ASD individuals realize each detail in their surroundings, while hyposensitive individuals exclude details about their surroundings. Bourne and Kleibrink (2016) describe the visual perception of hyposensitive and hypersensitive individuals on the spectrum as follows

Hypersensitive Individuals' Visual Perception:

- They avoid bright light.
- They avoid sunlight
- They follow each movement in the room by their eyes.

Hypersensitive Individuals' Visual Perception:

- They can't easily differentiate between background and object.
- They can lose vision when objects or people move.
- They can't easily place objects.

To reduce light sensitivity, indirect natural incandescent lighting should replace fluorescent lighting (Bullock, 2018). Due to fluorescent lighting's flickering nature, it can be perceived as an environmental stressor for individuals on the spectrum. Places need to be maintained with dim lights. Also, indirect lighting reduces flickering, intensity, and brightness, helping ASD individuals cope with their light sensitivity (Gaines KS et al., 2014).

DESIGN OF SPECIAL EDUCATION CENTERS

The design of the special education centers should fulfill the needs of children. There are some regulations for designing special education centers in different countries. According to regulations of the US General Services Administration:

Entry and Circulation: The entry includes the transition space, vestibule, and reception area where parents, teachers, children, and visitors enter the facility. The main circulation provides pathways between discreet functional spaces.

Staff Area: Staff areas include the director's office, assistant or secretary workspace, staff lounge and work area, staff toilet, parent/teacher conference area, and central resource storage

Classrooms: Architecturally defined spaces within classrooms include the entrance, cubby storage, classroom and teacher storage, diapering station and storage, toileting and hand washing, sleeping, nursing, and food preparation. The classroom should have an art sink, raised areas, and loft areas (though these level changes need not be built in), and must have open, architecturally unrestricted areas.

Common Areas: The center may also include a multiple-purpose space. The multiple purpose space may be used as a meeting or gathering area and as an activity area. If adequate outdoor play yard space is not available, or if the climate in which the center is located is not conducive to outdoor play during significant portions of the year, an indoor large-

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motor activity area must be provided. If lofts are to be located in this room, applicable protective surfacing must be provided for the highest unprotected deck of the loft or climber, whether portable or permanent.

Main Circulation: There are two types of circulation paths in a center: the main circulation connecting the various classrooms and major spaces of the center, and the internal circulation patterns within those spaces. The main circulation serves as a community space as well as a pathway. Especially in child care centers, the circulation space should never be simply utilitarian. Instead, it should be conceived as a street or a gallery with stopping and cueing areas along the way.

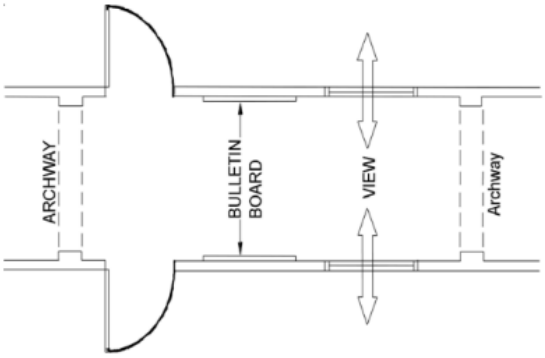

Figure 1. Corridor

According to Ministry of Education (MEB) Kindergarten for 8 children Special Education Requirement Program determines the spatial needs as in below:

Table 1. . Ministry of Education (MEB) Kindergarten for 8 Children Special Education Requirement Program

Room Type	Features	Room Number	Student Number	M²	Total M²
Waiting Room	It is designed for parents of students to wait and meet their needs. It should include seating units, TV, Wi-Fi, and kitchenette. It must be located on the ground floor	1	-	24	24

Infirmary	It should be located on the ground floor and have 2 rooms connected. In one room examination, injection, and medical dressing can be done. In another room, two patients can stay. Also, it should include separated male and female WC.	1	2	16	16
Activity Room	It is suitable for 37 to 66-month-old kids, and children can sit around an oval table. Floor and wall materials should be soft. TV, Wi-Fi, and toys should be provided in the room.	8	8	24	192
Sleeping Room	It should be connected to activity room. Therefore, children can rest on beds.	4		24	96
Playing Room	Floor and wall materials must be suitable for playing. Ball pit, and trampoline can take place in the playing room.	1	8	48	48
Individual Education Room	It can be designed in connection to the activity room.	4	1	12	48
Language and Speaking Therapy Room	Preferably it should be located on the first floor.	1	3	16	16

RESEARCH METHOD

In this research qualitative research method was applied. Qualitative research helps to create a solution for a problem through observation, interview, and document analysis. In this way, known or unnoticed problems can be perceived (Seale, 1999). After the data collection process, an analysis of the data is done. There are some qualitative analysis methods such as descriptive, rhetorical, and content analysis. In

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this research content analysis is applied. The content analysis reviews data in detail and explains notions, themes, and categories. Content analysis focuses on the data. Repetitive and emphasized notions are detected from the data set and codes are identified. Through codes, categories, and themes are specified. Shortly, the detected similar and related data (codes) are interpreted and brought together within the framework of certain concepts (categories) and themes (Baltacı, 2019).

It is possible to classify data as primary and secondary. If data is collected for the first time, it can be called primary data. If data previously collected for another purpose will be used, such data is called secondary data. Quantitative research is related to numeric data such as kg, height, and measurement (Açık Ders, 2024). Qualitative research is related to abstract notions such as attitudes, behaviors, and ideas. In this research idea of experts who focus on ASD in their discipline was the target group to collect primary data. The consent form and purpose of the research were shared with experts.

There are 6 experts in ASD joined to the meeting. All experts are specialized in the topic of ASD and observed children between the ages of 3 to 18. One of the experts is a psychologist in an Autism Center in Turkey. One of the experts is a licensed counselor and play therapist in the USA, and actively works with children on the spectrum. Another expert and participant is a special education teacher of autistic individuals in the USA. 2 experts are academicians in Turkey who specialize in education for ASD. 6th expert is an architect who has various experiences in autism design. Experts' names and work names are not shared due to confidential concerns. The experts were found through the review of related departments in universities and autism centers. Participants are reached through email and visit to autism center. 4 meetings were in person. 2 meetings were online. The meeting took approximately 30 minutes. Another part of the research is the visit to the Behavior Associates Autism Center in Muncie, Indiana, USA. The consent form and purpose of the research were shared with the head of the center. After validation of the research visit was realized.

INTERVIEW FINDING

There are specific questions asked to the participants of the meeting. However, in some meetings, more information was taken from the different experiences of the participants.

The main questions asked of each interviewee are as in following lines:

First Question: What are the main problems you observed in the learning environments?, Second Question: Is there any design element that affects individuals on the spectrum the most?, Third Question: How can the design of learning environments be developed?, Fourth Question: Is there any suggestion for interior architects?

6 participants' answer was given in Tables 2 to 7. 1st interviewee is a Licensed Professional Clinical Counselor and Play Therapist in Chicago.

She expressed that ASD is a mysterious field before. However, now it is embraced more. She said "ASD is a neurological diversity, it is not an illness. Therefore there is not a cure for it. Our responsibility is to help children navigate their world. Navigation starts with the language that we speak. As a society, we should embrace autistic individuals' identity firstly by the language that we use for them. As I said, ASD is not an illness. So, autism is not an accessory that we call a 'person with autism'. When we call like that, we indirectly convey that one group is superior to another. Now, language has changed a lot. We should use neuro-diverse language. It is a good idea to ask autistic individuals what they want to be called".

Table 2. First Participant's Answer

Participants	**1.**Design Problems	**2.** Prominent Design Element	**3.**How to develop Learning environments?	**4.** Expectations from designers?
1st Participant	Crowded classrooms. (Participant declared that there are 30-40 kids in each classroom) Places are not designed for their sensory needs (self-regulation tools such as rocking chairs and blankets can help to self-regulate). A sensory path is needed in transitional spaces.	Lighting, noise, and odor overlook the sensory sensitivity. For instance, the wrong selection of lighting triggers headaches.	Playful environments are needed. Playing provides self-regulation and connection. U shape or circular seating system creates more connection. Relaxation areas are needed. The application of warm and neutral colors is preferable	The learning needs of autistic students are essential. Avoiding too bright light and noise is beneficial for them. Sensory rooms and relaxation places are essential. Autism is not an illness. It is neurodiversity. So, forcing people to do what they want is not okay. We need to accept autistic people as they are.

Table 3. Second Participant's Answer

Participants	**1.** Design Problems	**2.** Prominent Design Element	**3.** How to develop Learning environments	**4.** Expectations from designers?
2nd Participant	Noise problem. Design should include all types of autism since it is a spectrum disorder. Visual overload so visual should be less in school environments. Classrooms are so crowded.	Design for sensory sensitivity. Sudden noises such as bell sounds to announce break time disturb kids.	Sensory rooms and some of the features or tools of sensory rooms can be copied in playing areas. The design language needs to be simple and plain.	Pursuing sensory needs for the creation of places to support senses, special education, playing, and sports.

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2nd interviewee is a psychologist in Ankara who worked in inclusive and special education schools. His answers are analyzed in Table 3. 3rd interviewee is based in the USA, in the field of special education for students on the spectrum. In the Table 4, 3rd interviewee's answers can be observed.

Table 4. Third Participant's Answer

Participants	**1.** Design Problems	**2.** Prominent Design Element	**3.** How to develop Learning environments	**4.** Expectations from designers?
3rd Participant	Safety is the principal. property disruption may occur when there are not any appropriate materials used for autistic kids. Due to the disruption of property, wall floor materials can be soft.	There are design-based safety issues. For instance, designers can prefer designing room positions to not directly towards to exit and block the exit if it is possible.	The environment should be free from stimuli to prevent distractions, especially in learning environments.	Adaptable places for each type of user are needed. Attaining access to all types of spectrum is crucial in the design. For instance, if a student has disruption or anger problems, so there shouldn't be a bunch of furniture.

4th participant is an architect based in Turkey and has various experiences with ASD and design. Analysis details can be seen from Table 5.

Table 5. Fourth Participant's Answer

Participants	**1.** Design Problems	**2.** Prominent Design Element	**3.** How to develop Learning environments	**4.** Expectations from designers?
4th Participant	There are no or very limited relaxation areas. They need classrooms with a certain number of students and personal places.	Limited studies regarding autism design. No consideration of environmental factors. Very limited or not have personal/relaxation spaces.	Variety in size while designing classrooms. For instance, small spaces for relaxation and big spaces for movement. Flexibility in design is a necessity.	Designers need to extinguish uncertainty in the design. Uncertainty cause anxiety and aggression for students on the spectrum.

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5th participant works as an academician in the field of special education in Turkey. He has expertise in ASD. Table 6 displays analysis of the 5th participant.

Table 6. Fifth Participant's Answer

Participants	**1.** Design Problems	**2.** Prominent Design Element	**3.** How to develop Learning environments	**4.** Expectations from designers?
5th Participant	Places need to be designed for socialization. Seating design and public places can be designed for the social atmosphere.	Lighting and safety.	Autism centers or educational places need to be multifunctional. Arts and sports places must be added. One-way circulation must be designed.	Designers should avoid applying complex textures and colors. Having enough natural light is essential in learning environments. Safety precautions must be taken. For instance, fixed furniture and apparatus to not open windows can be added.

6th participant is an academician in the field of special education in Turkey. She has various educational experiences with children on the spectrum. Analysis of 6th participant's answer is given in the Table 7.

Table 7. Sixth Participant's Answer

Participants	**1.** Design Problems	**2.** Prominent Design Element	**3.** How to develop Learning environments	**4.** Expectations from designers?
6th Participant	Color in the interior is not suitable for children on the spectrum. Bright colors shouldn't be used in places.	The most prominent feature of the autism design is the sociability of functions. Therefore the set of individual and common areas is significant in autism centers.	Materials and textures need to be researched more. For instance, hard textures are not very good with students on the spectrum. If there will be a renovation in design students need to be informed. Since they like certainty and familiarity.	Creating a playful environment for students is expected from a designer. Playing is a way of learning and connecting with others.

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OBSERVATION FINDING

To support research and observe design for ASD, Behavior Associates in Muncie, Indiana, USA visited and photographs in the center were taken. Behavior Associated founded in 2013 has 3 centers in Indiana, USA. In Behavior Associates ABA (Applied Behavior Analysis) is applied. ABA focuses on improving behaviors, social skills, academics, reading, and communication. ABA Therapy breaks down complex behavior into smaller tasks and rewards individuals when they complete tasks (Behavior Associates, 2024). In addition to ABA therapy, speech therapy, and mock classroom accommodate the needs of students from elementary to high school.

Figure 2. Façade View of Behavior Associate

Figure 3. Garden & Playground

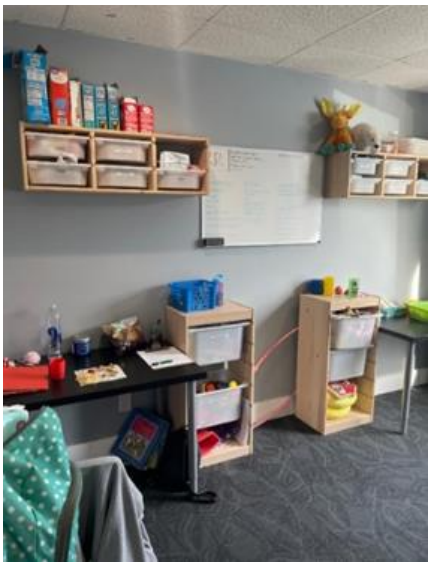

Figure 4. Special Education for Individuals

Figure 5. Special Education for Individuals

Figure 6. Communal Education Room

Figure 7. Transitional Place

Figure 8. Daily Life Teaching Place

Figure 9. Daily Life Teaching Place

Figure 10. Individual Area

Figure 11. Communal Education Room

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Behavior Associates Muncie is located in an area where there is a connection to nature and children on the spectrum can spend time in nature and play games (Figure 2 and 3). It has various sizes and functions of place in the center. Individual and common classrooms offer personal and communal education. In Figure 4, it seems that the design language of the room is plain. The floor has carpet covering which is safe for students on the spectrum. Individual rooms are spacious and it takes only 2 students for the education (Figure 5). The wall color is also very light blue which doesn't disturb children. Figure 6 is photographed to display communal education areas. As it can seem, tables have a beveled corner that protects students from any accident. Also, no furniture or design distracts students' attention. Fixed furniture is preferred which is a safe way of mobile design for children on the spectrum (Figure 6).

In the transitional place perception of contrast is made by the dark color of the flooring and walls. In this way, it directs students to the other functions. Another positive approach is to create places to adapt students to housework. In Figures 8 and 9 kitchen is designed to teach students how to prepare food and clean it. On the dishwasher dirty label is placed to notify kids (Figure 9). Also in the cupboards, all items' names are written. There is an also individual area for children in high school (Figure 10). Wood and carpet are applied to design a home-like environment. The break area and study area are designed together. The teaching area is separated by a partition wall (Figure 11).

DISCUSSION

Depending on interviews with 6 experts who are from different backgrounds and have experiences in ASD shared their ideas regarding to main design problems and various ways of suggestion to design for autism. When answers to 1st question (What are the main problems that you observed in the learning environments?) are analyzed, it is noticed that the main problem in the learning environment is having crowded classrooms. Therefore, the size of classrooms can be proportioned for effective learning. Moreover, another problem is that learning places don't help individuals on ASD to self-regulate. It can be provided by the existence of relaxation areas, soothing colors, and design language.

2nd question (Is there any design element that affects individuals on the spectrum the most?) is related to the most effective elements of design.

There are some common answers are highlighted depending on the interviews. For instance, the safety of places and the approach of sensory design are the most effective design elements for ASD.

3rd question's answer includes various strategies to develop the design of educational environments for individuals on the spectrum. Firstly, children on the spectrum can be sensitive to environmental stimuli such as noise, bright light, or color. Therefore, design should address this sensitivity. On the other hand, some groups of children can be hyposensitive. Therefore, for them, places could stimulus. For instance,

rocking chairs and sensory paths (Figure 12) can be applied in the educational environment for children on the spectrum.

Figure 12. Sensory Path

Places should create various options for all types of spectrum. In general, design language could be plain. However, for stimulation, some individual rooms or seating could be designed for those in need. Another idea is creating a playful environment that helps children to socially engage and communicate. Also, the seating design should be arranged to increase communication. One expert suggested U-shaped seating.

According to the 4th question (Is there any suggestion for interior architects?) analysis, it is expected to create flexible places that include all types of spectrum. To include, a set of sensory features which is self-soothing, and stimulating design elements should be applied. Extreme environmental stimuli such as noise, bright light, and colors are avoided. The design of the educational place should encourage children to move and communicate. Place variation should be provided for students to be alone in relaxation or individual rooms/areas also communal areas should take place in the educational environments. Lastly, each case and person is unique. Therefore, asking what user prefers in the place should be the main concern for interior architects. In Figure 13, design problem and design solution analysis depending on interview can be seen. By this way, necessities of centers and their problems can clearly be perceived. Appropriate design solutions can easily be provided to the children on the spectrum.

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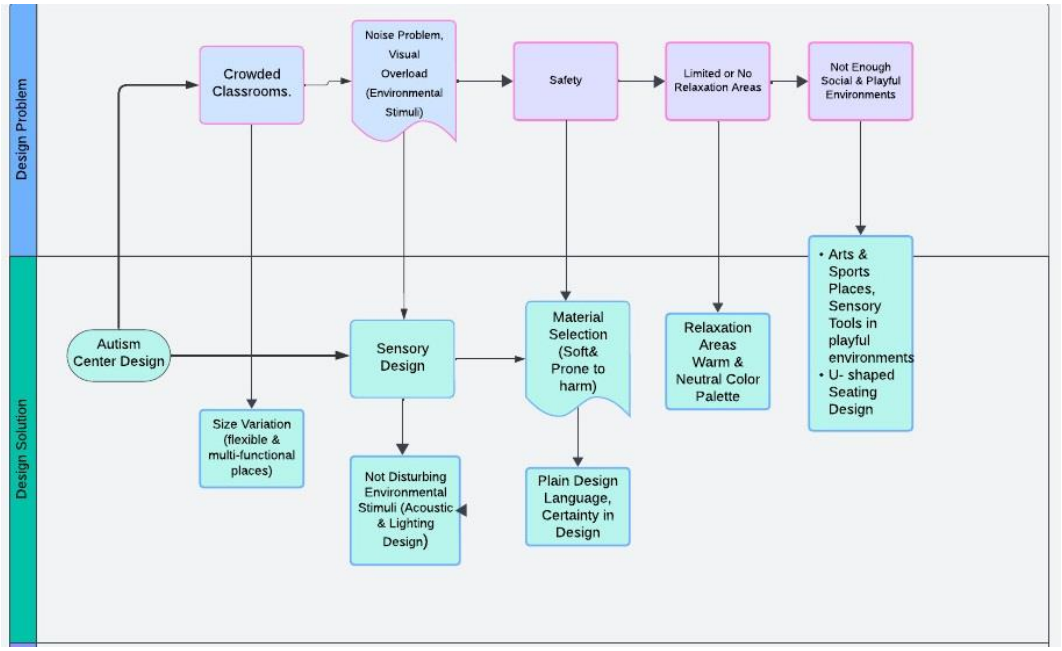

Figure 13. Analysis of Interview

CONCLUSION

This research aims to find design principles for autism centers for a more comfortable and healthy environment. During the research, several design problems were identified and demonstrated solutions by enquiring particular questions to the participants who are experts on ASD. Depending on the surveys there are several design problems such as having crowded classrooms, overlooking sensory needs in design, noise problems, safety issues, visual overload, and not enough relaxation and social places. Also not including all types of autism is another design problem for the user.

In light of the research following design solutions can be recommended:

- The number of students needs to be arranged according to the physical capacity of the places in the centers.
- Safety in the design must be provided when designing places for ASD. For instance, due to aggression of children on spectrum property disruption may occur. Therefore, hard materials on surfaces or sharp edges of furniture can harm children on spectrum and also the designed environment. That is why, the material choice should be made accordingly.
- There is not only one type of ASD. Some people are hypersensitive and hyposensitive. Environmental stimuli such as bright light and sudden noises can mostly affect hypersensitive individuals (Gaines, K. et.al., 2016). Therefore, complex design language and too intense stimulation should be avoided in these places.
- Certainty and familiarity are seeked by children on the spectrum. So, if there is a design change in the place students on the spectrum are needed to be informed before.

- Size variation in places should be provided. For instance, big size of places encourages movement and small sized places enable students to relax.
- Self-regulation is essential for students on the spectrum. Therefore, relaxation areas needed to be provided.
- Social and playful environments are significant in the self-development of children on the spectrum. Sensory tools can be added to these playful environments. Moreover, functions for art and sports could take place in autism centers.

Future research into sensory design elements for ASD will give a more detailed approach to ASD design. Therefore, educational places that have a big role in children's self-development will be appropriate for their needs.

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Resume

Merve KAVAZ is an interior architect, researcher, and university lecturer. In 2014, she received her bachelor's degree from Bilkent University, Ankara Turkey. In 2015 she graduated from Coventry University, United Kingdom. She is one of two Turkish recipient who received Commonwealth Scholarship in 2015. In 2022 she received her PhD from Hacettepe University. During her PhD education she researched in Health and Environment Lab at Ball State University for 6 months. Research is supported by TÜBİTAK scholarship which is for PhD dissertation. She has various articles related to inclusive design. She is still working on the topics of design for all. Also teaching in design studios and carrying out elective courses.

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An Iconic Representation of Modern Architecture from Construction to Destruction: Tercuman Newspaper Building

Zeynep Yanılmaz *

Abstract

The study focuses on the Tercüman Newspaper Building, which has recently drawn attention following its demolition. The Tercüman Newspaper Building was built in 1974 based on a project selected through a competition organized by Kemal Ilıcak. The architects of the building, Günay Çilingiroğlu and Muhlis Tunca, were influential figures in shaping the modern architectural practices of the period. In addition to the architects' design approach and education, Kemal Ilıcak's vision played a key role in shaping the building's architecture. The Tercüman Newspaper Building, one of the first examples of New Brutalism in Türkiye in the 1970s, stood out as a modern heritage structure that gained attention for its innovative structural analysis. Over its 49-year existence, the building was widely discussed both for its architectural design and its symbolic value. This study aims to examine the building's functional transformations from its construction to its demolition and contribute to its role in social memory. The first stage of the study, structured in four phases, establishes the theoretical framework and discusses demolition and conservation actions in the context of modern architecture. The second stage provides details on the plan, structure, and façade characteristics of the building, along with an analysis of its symbolic value. The third stage examines the functional changes the newspaper building underwent after changing ownership and the process leading to its demolition, also exploring the public reactions to the demolition. The fourth and final stage emphasizes that modern heritage buildings, which reflect the architectural practices and socio-cultural life of a period and should be preserved for future generations through a robust conservation mindset.

Keywords: *Collective memory, Destruction, Modern architectural heritage, Tercüman Newspaper Building.*

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INTRODUCTION

The rapid urbanization in parallel with the growth of industry and trade since the early years of the Republic had a significant impact on the architectural approach of the period. In addition, one of the most important factors shaping the architectural production of the period was political and economic change. Between 1960 and 1980, Türkiye entered a period of radical economic, political, and social change (Zürcher, 2008). A key event that laid the foundation for this transformation was the military coup of May 27, 1960. This military intervention ushered in a new era for Türkiye in almost every respect. In the 1961 constitution, the concept of the 'welfare state' became more prominent, autonomy was granted to universities and the press, and the influence of labor unions and professional organizations increased. Social and political issues began to be discussed with a more liberal approach, and the media's ability to highlight societal demands grew (Tekeli, 2007; Yücel, 2007).

The 1961 Constitution introduced several innovations in the structure of state institutions, bringing socialist thought to the forefront. Founded based on this idea, the State Planning Organization (DPT) was one of the most important mechanisms guiding architectural production in the country. The first Five-Year Development Plan (1963-1967), prepared in 1962 by the DPT, was based on the idea that scientific development and planning could be achieved in a non-political field. This plan aimed to define urbanization, industrialization, and development policies. The first plan was followed by the second (1968-1972), third (1973-1977), and fourth Five-Year Development Plans (1979-1983). These development plans facilitated planned urban growth in Türkiye and highlighted the hierarchical mechanisms shaping architectural design in society (Tekeli, 2007).

With these innovations in state policies and advancements in industry, the number of architecture schools began increasing, and private architecture schools were founded. Following the Academy of Fine Arts and Istanbul Technical University, which produced the first generation of architects in the country, architecture departments were established at Middle East Technical University (1956), Erzurum Atatürk University (1957), Dokuz Eylül University (1963), Karadeniz Technical University (1963), Konya Selçuk University (1970), and Trakya University (1977) (Erkol, 2016). During this period, as the number of architecture schools increased, architectural publications also proliferated. In the 1950s, the availability of domestic and foreign sources for Turkish architects to follow international architectural trends was highly restricted (Tuluk, 2009). By the 1960s, the growth of architectural education and production in Türkiye led to a rise in academic publications in the field. These publications enabled architects aware of global developments in architectural production to begin incorporating innovative strategies into construction and design activities in Türkiye. During this period, Türkiye experienced a growing shift toward designing and building with new construction technologies (Akcan, 2010).

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In line with these developments, the process of urban change, which began in the early years of the Republic, has continued rapidly to the present day, with cities transforming significantly under the impact of industrialization and globalization. During this process of urban development, some buildings have lost their functionality over time, have become inadequate to meet demands, or have been demolished for political, economic, and other reasons. At this point, the act of demolition, which has been regarded as a means of urban modernization, especially in the last half-century, must be examined.

Paul de Man, who argued that modernization is possible through destruction, supports this idea with the words, “The whole power of the design of modernity lies in its desire to sweep away everything that came before.” In alignment with this perspective, Nietzsche states that the modern world should erase the past, asserting, “One must voluntarily forget the past in order to achieve something today” (Berman, 1999). Berman (1999), who stated that the act of destruction in modernism had taken precedence over all other actions, reveals its destructive character with the words, “Take your axes and hammers... and demolish, tear down venerable cities without mercy.” However, he also criticizes the destruction of lives and the loss of a sense of belonging that people once experienced in the demolished buildings.

The use of demolition as a means of modernization in cities can be observed in the urban development of many cities, such as Paris, St. Petersburg, and New York. Cities that undergo demolition with the idea of 'making room for the new' reshape the present by erasing the past (Berman, 1999; Çetken, 2011). Tanyeli (1998), who evaluated the impact of demolition on urban change through historical demolitions in Istanbul, defines its use as an urban planning tool under the concept of “making by demolishing. He characterizes the reshaping of cities by demolishing the old and constructing the new as a deliberate assertion of power. The transformative power of demolition is a means of asserting dominance over the city. Demolition is not only a tool of modernization but also an act that symbolizes who holds authority over the city. Cities are reshaped to serve the interests of those who control demolition (Tanyeli, 1998).

Conversely, some argue that demolition is often not the right decision for urban identity. Buildings originally constructed for specific functions, even after losing their original purpose, remain significant due to their forms and strong connection to their surroundings. They continue to embody the values that help shape the city's identity (Ganiç, 2016). Artun (2011) characterizes the demolition of certain urban buildings as symbolic defeats. In particular, the destruction of architectural works rooted in specific ideologies or movements is seen as the defeat of the cultures they symbolize. These demolitions result not only in the physical loss of buildings but also in the erasure of their societal impact and the cultural symbols of that period (Yanılmaz & Yalçınkaya, 2022). Buildings serve as integral parts of social life, carrying meanings beyond their

physical structures. Therefore, every demolition results in the loss of the memories, meanings, and experiences tied to the building.

At the same time, buildings, which are also a reminder, undertake an important mission in terms of social memory (Bekar at al, 2024). Memory, which enables us to connect with the past, has a collective quality beyond personal experiences in terms of its connections with time, space, society, culture and politics (Russell, 2006). According to the French sociologist Maurice Halbwachs (2016), who first mentioned this social nature of memory, people remember their past experiences only by referring to the memories of others and through some landmarks. These landmarks are often just a place (Vurucular Kesimci & Ciravoğlu, 2024). Therefore, the preservation of some spaces that play a key role in shaping social memory is extremely important both to ensure the continuity of memory and to carry urban continuity and cultural images to future generations. As mentioned above, the act of demolition results not only in the destruction of these spaces but also in the loss of social memory.

Modernization efforts through demolition have not only targeted historical buildings but have also included 20th-century modern buildings, which have been demolished for various reasons. In particular, the demolition of the first block of the thirty-three block Pruitt-Igoe housing complex in St. Louis, Missouri, in 1972 sparked a debate about whether modern architecture should be considered cultural heritage. Nevertheless, conservation theorists have struggled to recognize modern architecture as cultural heritage and deem it worthy of protection (Omay Polat, 2008). In fact, since modern buildings are not widely recognized by society, their evaluation as cultural heritage has led to hesitations. However, Mörsch, who views conservation in a broad context, emphasized that cultural heritage worthy of preservation exists in all periods, stating, 'There is no period in history whose architectural remains do not convey meaning' (as cited in Omay Polat, 2008).

DOCOMOMO (Documentation and Conservation of Buildings, Sites, and Neighborhoods of the Modern Movement), founded in 1990 to protect modern heritage, defined elements of modern heritage as 'products that lack historical references and incorporate modern design principles based on function, technology, or spatial conditions rather than ornament and decoration' (Sharp, 2000). Thus, with the support of non-governmental organizations, international efforts have been initiated to ensure that modern architectural structures meeting this definition can be preserved for future generations. The act of demolition, which threatens cultural heritage, has become a subject of debate for both historical and modern buildings, and strategies have been developed to preserve them.

As mentioned above, demolition and conservation actions in architecture and urban planning processes are approached from different perspectives. Striking a balance between demolition and conservation is crucial for the sustainability of cities. Demolition and

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conservation involve a complex decision-making process in which each building should be evaluated based on its unique context. In this process, multiple factors -social, environmental, and economic, among others- should be taken into consideration. This study highlights the need to ensure the continuity of cultural heritage and urban memory, considering the social and cultural losses caused by each act of demolition.

In recent years, there are many buildings in Türkiye that have come to the agenda with their demolition and the decision to demolish them has been met with public outcry. One of these buildings is the Tercüman Newspaper Building, which sets an example for the innovative architectural practices of the Republican period with its brutalist mass form and contemporary and bold static analysis. The building, which survived for 49 years from 1974 until 2023, has been the subject of much debate over its formal, functional and symbolic value until its demolition, and has caused a great resonance with its demolition.

The Tercüman Newspaper Building, which undertakes an important mission with its architectural features, ideological and symbolic value, has not been sufficiently covered in the architectural literature despite being a prominent building among its contemporaries. The first article written about the building is Atilla Yücel's article titled "Tercüman Newspaper Building: On Form, Symbol and Function in Architecture" published in Mimarlık magazine in 1985. The newspaper building is also mentioned in Şevki Vanlı's article "A Few Aspects of Turkish Architecture in the Last 30 Years that I Consider Important" published in Yapı magazine in 2002. Vanlı (2006), in his book " Speaking of Architecture: The 20th Century Turkish Architecture that Doesn't Want to Be Known, A Critical Overview ", in the chapter titled "Günay Çilingiroğlu's Search" interpreted the building as an individual design attempt. In Murat Gül's book "Architecture and the Turkish City: Istanbul's Urban History since the Ottomans" published in 2017, Tercüman Newspaper Building is described as one of the groundbreaking projects of the period. In addition to these studies, in Kaymak's (2019) master's thesis titled "Tercüman Newspaper Building as an Example of Avant-Garde Modernism in Türkiye", the architectural features of the newspaper building were revealed and the ideological values that were effective in determining the design approaches were questioned.

As seen in the literature review, the Tercüman Newspaper Building is discussed in this study in order to leave a permanent trace in the social memory and scientific literature in recent times when scientific publications on the building are limited and it has come to the agenda with its demolition. The aim of the study is to present an in-depth analysis of the functional transformations of the building from its construction to its demolition. Thus, it is aimed to reveal the social, cultural, economic, etc. contributions of a physically destroyed modern heritage value to the city and its inhabitants during its existence. At the same time, it was pointed out that other buildings, which are likely to be demolished in the

coming years, should also be protected with these considerations in mind.

RESEARCH METHOD

This study, which makes an architectural reading of the Tercüman Newspaper Building, one of the iconic representations of modern architecture, through its physical and symbolic value, is designed with a descriptive design. The study generally consists of four phases (Figure 1).

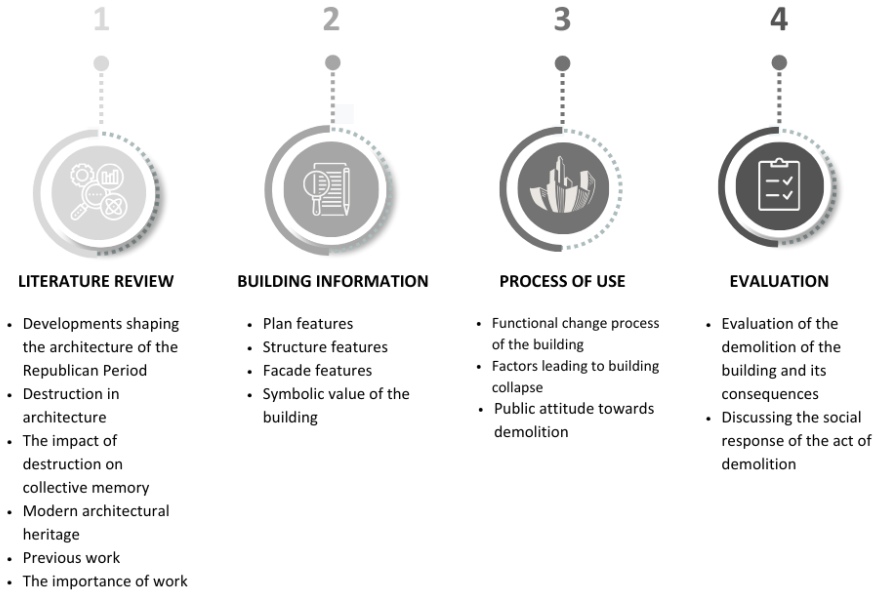

Figure 1. Stages of the Study

The first stage covers the theoretical framework. This section examines the developments that shaped the architecture of the Republican Period, the perception of demolition as a tool for modernization, different approaches to this issue, and the impact of demolition tendencies on social memory. Additionally, previous studies on the Tercüman Newspaper Building are reviewed. The second stage provides information about the building. This section presents its architectural features, including its plan, structural design, and façade characteristics. Next, the building's symbolic value is examined, focusing on its attributed meaning and how ideological goals manifest in physical space. The third phase of the study discusses the building's functional changes over time, the developments that led to its demolition, and public reactions to its destruction. The fourth and final part conducts a comprehensive evaluation of the building's architectural and symbolic value, the importance of preserving buildings that represent a period or movement, the social impact of demolition, and the place of the Tercüman Newspaper Building in collective memory. This study gathers information from past academic research, electronic and print publications, and websites.

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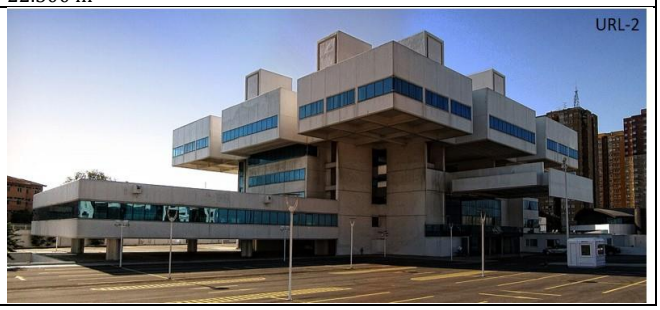
BUILDING FEATURES

Tercüman Newspaper started its publishing life on May 26, 1955 in Istanbul's Babıali district, which can be considered the center of press and publishing activities. The newspaper, whose circulation did not reach the expected level from its foundation until 1961, underwent a significant transition after this year. Businessman and journalist Kemal Ilıcak joined Tercüman's management team in 1962 and eventually became the sole owner of the newspaper (Nuhoğlu, 2021).

By the 1970s, the newspaper's sales had increased considerably and it was no longer able to fit even in the few buildings it had occupied on the Babıali slope. The newspaper's ever-increasing circulation and Ilıcak's vision and goals for the future necessitated the design of a new facility that would reflect the publication's corporate identity (Nuhoğlu, 2021). As a result, the newspaper sought a new headquarters in order to increase the number of pages, expand its staff and build the largest and most modern press building. The process of designing the new building started by requesting preliminary studies from different architects within a certain program (Kaymak, 2019).

In 1972, as a result of a competition organized by Kemal Ilıcak, the project for the new building of the newspaper was awarded to Günay Çilingiroğlu and Muhlis Tunca, two representatives of modern architecture of the period. The architectural education and design approach of these architects played an important role in the development of modern architectural style in Türkiye. Çilingiroğlu realized original architectural projects by combining the principles of functionality, durability, and beauty with a pure and simple design approach. Together with Tunca, who adopted a similar design approach, Çilingiroğlu participated in architectural project competitions and developed a modernist architectural language with innovative and bold structural experiments (İSMD, n.d.). Aligned with this approach, the Istanbul Advertisement Site and the Tercüman Newspaper Building exemplify brutalist architecture, where raw materials are exposed, and functionality shapes the building volume. These are among the most important modern architectural works of Çilingiroğlu and Tunca. Among these works, the architectural details of the Tercüman Newspaper Building (Yücel, 1985) are presented in Table 1.

Table 1. Project information

Project Tag	
Employer	Tercüman Gazete ve Matbaacılık (Kemal Ilıcak)
Architectural Project	Günay Çilingiroğlu – Muhlis Tunca
Static Project	Rasin Etiman
Heating, Air Conditioning and Plumbing Project	Fikret Taşangil – Engin Kember
Electrical Installation Project	Bülent Cedetaş
Production Company	Çavuşoğlu – Kozanoğlu Construction
Construction Date	1972- 1974
Building Area	22.500 m^2
Building Image	

Architectural Features

The newspaper building was constructed in Zeytinburnu district on the D100 (E-5) highway, then called "London Asphalt ", in order to facilitate easy transportation and distribution to and from Yeşilköy (Atatürk) Airport (Figure 2). Zeytinburnu District is separated from the historical peninsula by the city walls, bordering the E-5 highway and 15-20 minutes from Atatürk Airport. For this reason, it is characterized as an important window of Istanbul opening to the outside. Therefore, the choice of this location for the construction of the newspaper building was a very conscious choice.

Figure 2. Location of the Tercüman Newspaper Building

The building is located in Merkezefendi Neighborhood, block 2969 and parcel 41. On a total plot of 80,000 m^2, in addition to the newspaper building, a tower block housing a business center and hotel complex was also built. However, in the following years, due to economic reasons, the entire 56,000 m^2 program could not be realized and only the newspaper building was built (Yücel, 1985).

The functional program of the building was grouped into three main groups and the shaping of the building was directed accordingly. Accordingly, the newspaper building consists of the printing house, editorial offices and administrative/social units belonging to the

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newspaper, and sections belonging to upper management and companies (Yücel, 1985) (Figure 3).

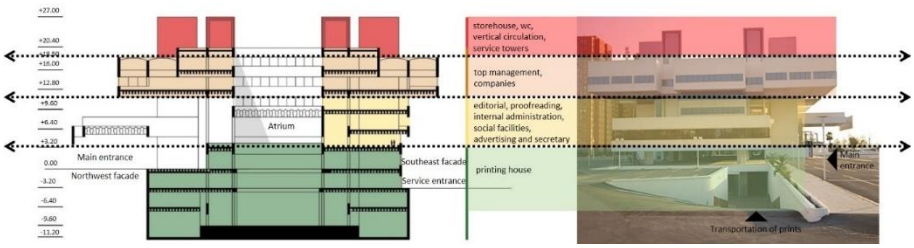

Figure 3. Section diagram [Accessed from section (Kaymak, 2019)]

Plan Features

The bottom three floors consist of the shelter, switchboard, basement, printing house and entrance areas (Figure 4). The action areas related to the printing house are located in a 23.65 x 99.85 meter mass below the entrance level. At the lowest level (-9.60 and -8.40) there is a power plant and a shelter. The transportation of the prints to the outside is realized by means of ramps at this level. The basement floor at -6.40 consists only of a horizontal circulation line connecting to the elevators and stairs. The offset printing machines on the printing press floor (-3.20) are placed along a long line parallel to the form of the space. The 0.00 level, where the main entrance is located, is positioned at the center of the mass, and the gallery spaces symmetrically opened on both sides of the entrance provide a visual relationship with the printing floor.

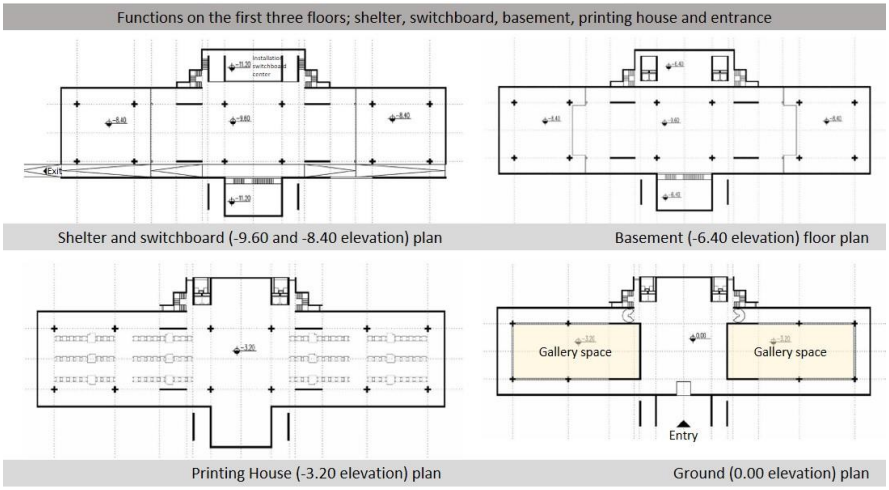

Figure 4. First 3 floor plans [Accessed from plans (Kaymak, 2019)]

The second group of functions of the building, including the editorial and administrative/social units of the newspaper, consists of three different mezzanine floors (Figure 5). On these floors are the editorial offices, redaction, internal administration, social facilities and secretariat. These floors were retracted from the building boundary where the printing press and upper management units were located. Thus, the mass of the printing press and the mass of the top management were completely separated from each other (Yücel, 1985). There is no functional space on the northwest façade of the building. The only mass

element on this façade is the entrance eaves suspended from the load-bearing curtains. Spaces were placed on the southeast facade where the service entrance is located and on the side facades. In these facades, the upper and lower masses are tried to be separated from each other with fullness-void effects, retractions and transparent glass surfaces.

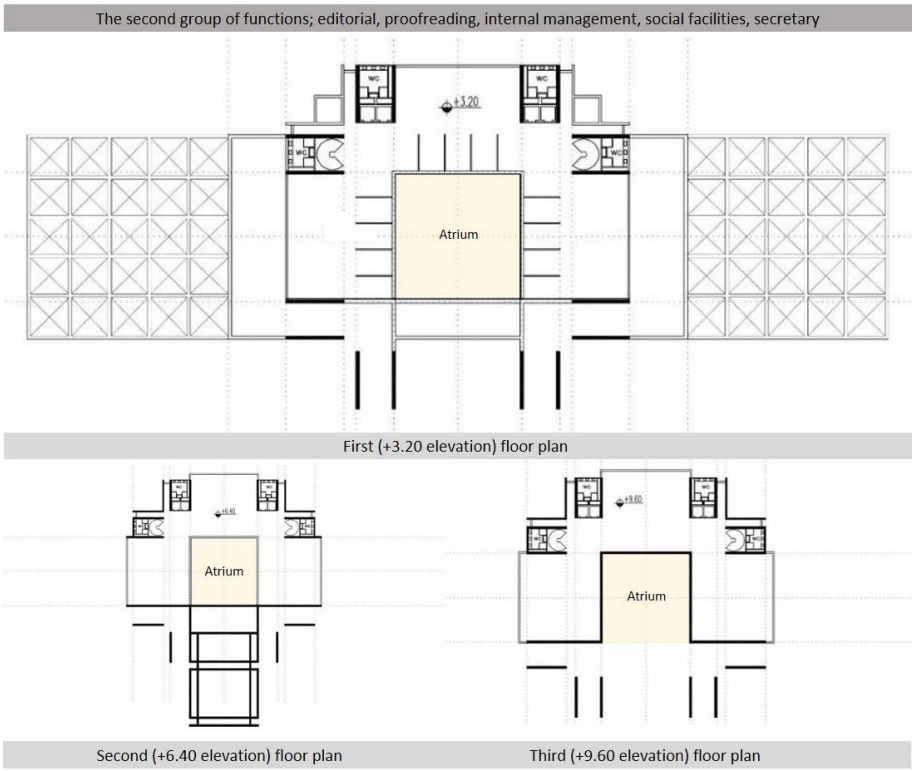

Figure 5. First, second and third floor plans [Accessed from plans (Kaymak, 2019)]

The upper management and corporate mass is the mass at the top of the building consisting of two floors, which can also be called the cantilever floor (Figure 6). Over 15 meters long and carried by cantilevers about 13 meters above the ground, this mass creates a "hovering effect" and gives the building a monumental appearance (Yücel, 1985). The total area of the administrative mass is 2500 m^2. On the fourth floor, which consists of eight rectangular modules of 15x15 meters, the courtyard is like a part of these modules due to its similar dimensions. These modules offer ample space for developing flexible solutions for different working arrangements. Just above the fourth floor is the fifth floor, which was created by drawing inwards. This floor is designed as a cafeteria and covers the circulation area and some of the modules. It has no openings on the facade and receives daylight only from the courtyard.

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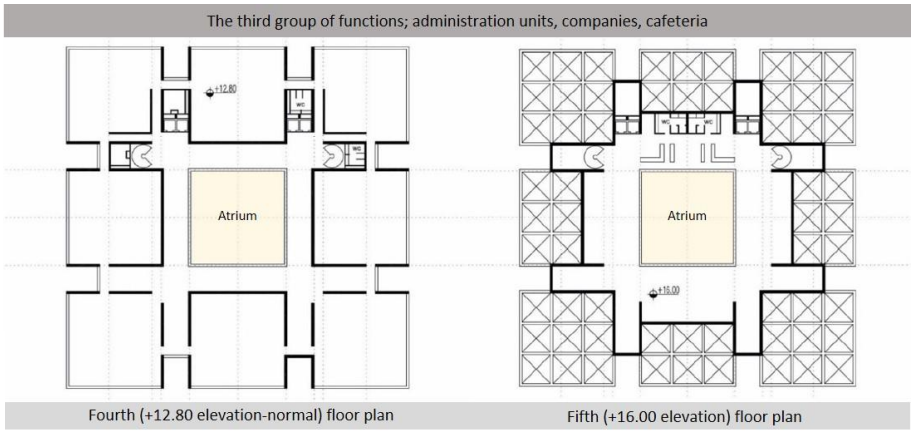

Figure 6. Fourth and fifth floor plans [Accessed from plans (Kaymak, 2019)]

Eight service towers of 3.8 x 7 meters, balancing and connecting the layered vertical structure of the building horizontally, constitute the most striking structural elements of the building (Yücel, 1985) (Figure 7). Each service tower consists of a space between two parallel curtain carriers. The four towers on the southeast facade contain volumes such as elevator, staircase, wc, storage, shaft (Kaymak, 2019). The four towers on the northwest façade, which is the entrance façade of the building, start to rise after the printing house mass and stab into the administrative mass at the top. The fact that these service volumes are massively separated from the building and have a prominent place in the façade characteristic emphasizes Louis Kahn's approach of "service spaces" and "served spaces".

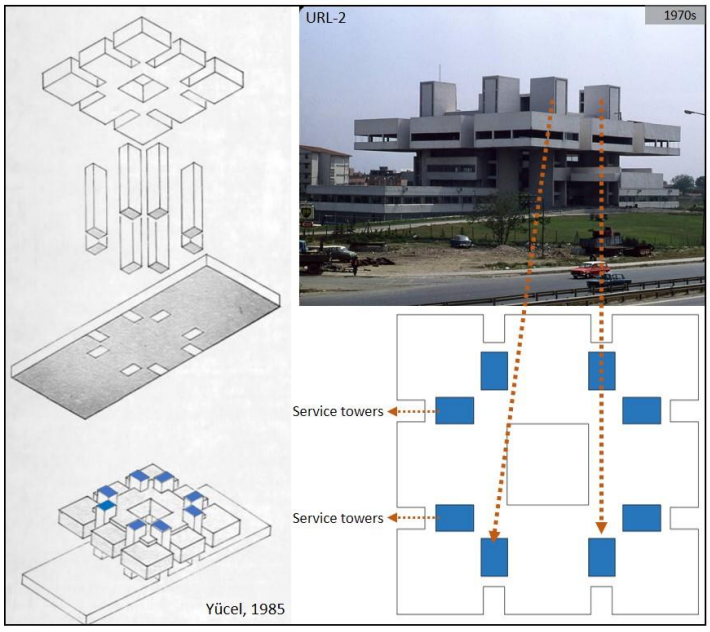

Figure 7. Orthographic representation of service towers

Structural System

Tercüman Newspaper Building is a bold example of its period not only with its architectural form but also with its structural system features. In the building, 16 tower curtains of 6.70 X 0.4 meters surrounding the service towers constitute the basic vertical structure of the building

(Figure 8). These tower bulkheads were cast in situ, and the courtyard space facilitated sliding formwork and crane operations (Yücel, 1985).

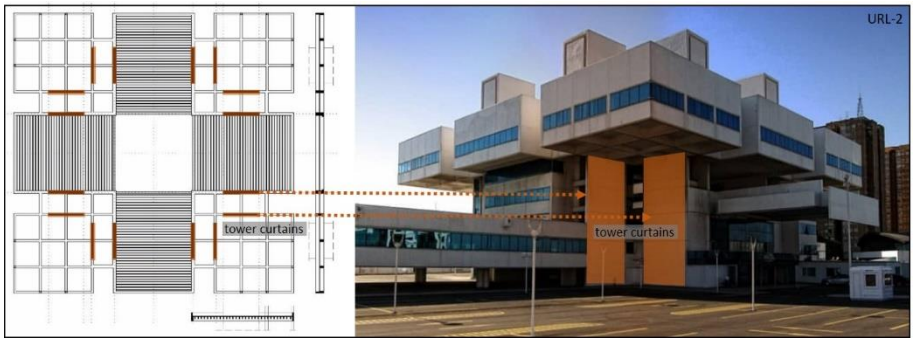

Figure 8. Tower curtains in the structure

The most striking aspect of the building's structure is the T-beams that carry the administration floor modules at +12.80 level with 15-meter cantilevers (Figure 9). Beams other than corner brackets are pre-stressed. Prestressed structural members are used as flexural members to cross large spans. By using these elements, it is possible to cross large spans with smaller cross-sections than normal reinforced concrete beams (Kaymak, 2019). A partial prefabricated system was used in the building with prestressed elements constructed after the static calculations of Rasin Etiman. The choice of prestressed prefabricated elements provided advantages such as fast production, durability and the construction of cantilevers that reinforce the "hovering" effect of the structure. On the other hand, it also brought along some of the problems mentioned by Yücel (1985) during the construction phase; “While a gross concrete structure was initially considered, the resulting surface corrugations were decided to be covered with plaster as a precast system, which would be safer, was deemed too heavy. The plasters that did not hold on the high-dosage concrete were poured; all surfaces were re-machined and plastered again.”

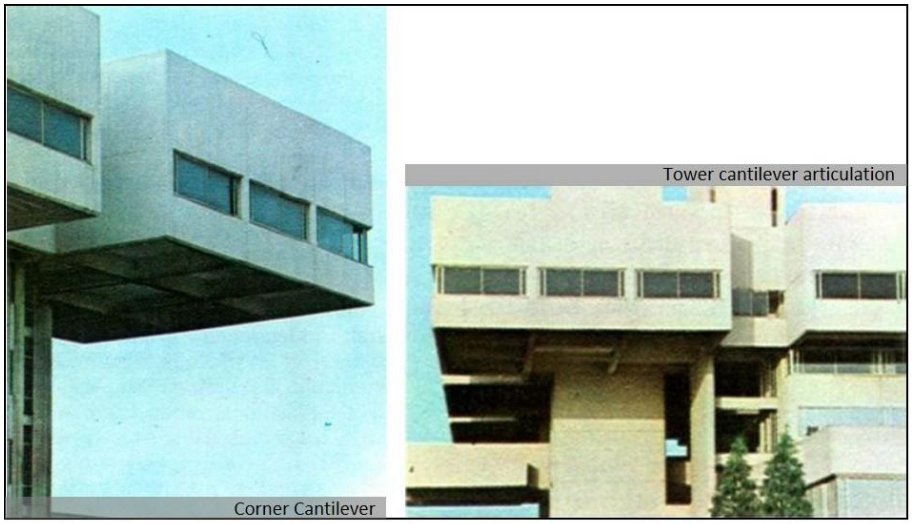

Figure 9. T beams carrying the cantilevers (Yücel, 1985)

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Façade Features

The fragmented mass form of the newspaper building and its modular structure that rises by articulating with the structure are the most important elements that reveal its façade character. The horizontal and vertical mass mobility is partially balanced by the use of strip windows on the façade. While the strip windows increase the horizontal effect, they also create a space effect between the masses thanks to their transparent structure. In particular, the effect of separating the floors from each other is very powerful (Figure 10). On the vertical, narrow and vertical windows passing through the corners of the tower curtains reveal the boundaries of the service towers.

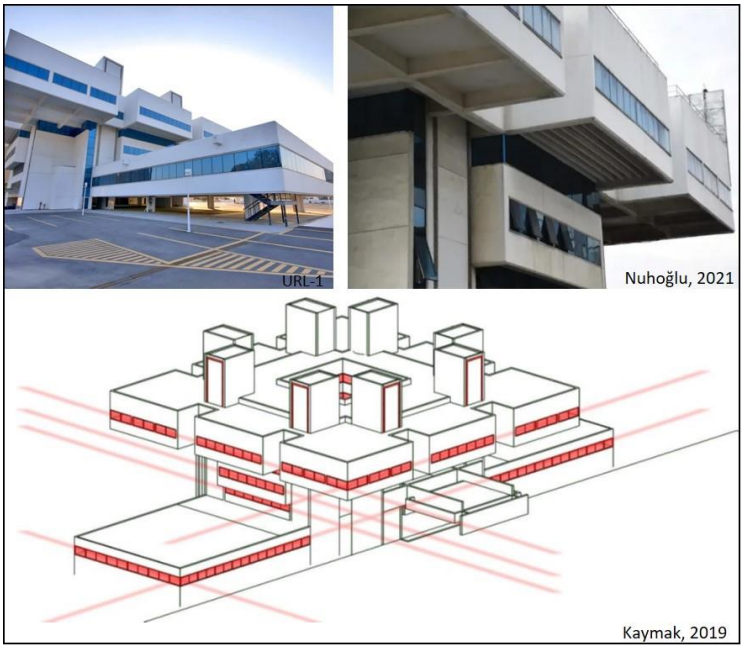

Figure 10. The effect of facade openings on mass

Symbolic Value of the Building

Since its establishment, Tercüman Newspaper has been on a rapid rise, especially with Kemal Ilıcak's entry into the administration and his ideological expectations. With the desire to be the best newspaper in the world, it aims to have the most modern and largest facilities to serve this purpose and to lead the press world. The strong and original form and monumental quality of the newspaper building constructed for this purpose is an expression of the goals and vision Kemal Ilıcak envisioned for Tercüman Newspaper (Nuhoğlu, 2021). Some of the features of the building were personally requested by Kemal Ilıcak during the design phase. Accordingly, he wanted the building to be designed to meet the needs of the newspaper for at least 50 years and, if necessary, to allow for horizontal and vertical growth even after 50 years (Yücel, 1985).

While other leading newspapers in Türkiye underwent a comprehensive restructuring process in the 1990s and 2000s, the fact that Tercüman took such a step in the 1970s has been interpreted as an important and courageous move in the history of the Turkish press and

media. The location of the new facility, disconnected from the urban context, allowed the building to be perceived as a whole from a distance in the nearby unbuilt environment and to reflect the institutional identity of the publication on the building (Nuhoğlu, 2021). Thus, the symbolic value of the building can be read dominantly through its plastic effect and monumentality. The building's strong form and impressive monumentality have made it an important reference point in the city. The monumental and symbolic value of the building was frequently emphasized by the newspaper:

"Two hundred and twenty-five square meters of concrete blocks at the four upper corners of our building, standing in a void without any support from below, may scare you. The fact that the eight large workplaces stand in space like wings is a novelty not only in Türkiye but in Europe as a whole. The ability to stop huge concrete blocks, each with spans of up to twenty-three meters, in a vacuum was made possible by an agreement with the world-famous Freyssinet Prestressing Company, and the fine calculations made by Rasin Etiman, the company's representative in Türkiye, in electronic brains for days, presented the miracles of the construction monument on the London Asphalt to our architecture. The hollow concrete blocks were suspended from the top by high-strength rebar, which was also specially manufactured in Germany and tensioned with special blocks. This system was also applied in the construction of the ring road crossings, and the concrete roads with wings on both sides became a miniature of the blocks of the Tercüman building. Our building was raised on sixteen load-bearing curtains rising from the main foundations laid twenty meters below the ground, and these curtains formed towers with separate functions on top of the building. Our building is waiting on the edge of the London Asphalt with its four winged spaces, towers, Tercüman's letter "T" jokes visible from all sides, the latest system printing-typesetting, color machines and cameras for the employees of a newspaper that has no other thought but to work for Türkiye, for the Turkish nation (Tercüman Gazetesi, 1975)."

With its ideological line, growth targets and visionary structure, Tercüman Newspaper creates a corporate image. This image has become concrete with the new facility building. Turning the symbolic value of the building into a functional element, the newspaper used the building as a background for all kinds of events such as sweepstakes, promotions, etc. (Nuhoğlu, 2021). During these events, famous names from the art and sports community of the period were hosted in the building and photographed from the interior, while the newspaper building formed a symbolic background for the events organized.

With its form and bold static analysis, the building parallels the architectural developments in the world in the same period. Architects Günay Çilingiroğlu and Muhlis Tunca, who closely follow the architectural approaches in the world, confirm this parallelism with their design approach in the newspaper building. With its monumental scale that can be perceived from distant points and its form that differs from its context,

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the building not only gathers together the functional volumes of the newspaper, but also functions as a modern sculpture that reflects the representations of the newspaper (Kaymak, 2019).

FUNCTIONAL CHANGE PROCESS AND DEMOLITION OF THE BUILDING

This part of the study consists of two parts. In the first part, the functional changes that the building underwent from the day it was built until its demolition are mentioned. In the second part, the demolition process and the public's views on how the demolition was received are presented.

Functional Change Process

The Tercüman Newspaper Building, which attracted attention in terms of both its architectural and symbolic value at the time of its construction, could not serve the newspaper for 50 years as planned, and its function was changed many times by different institutions and organizations. Although mostly used as offices, it has also undergone some structural changes for functions such as education and trade. The process of change and development of the newspaper building from the day it was built to the day it was demolished is shown in Figure 11.

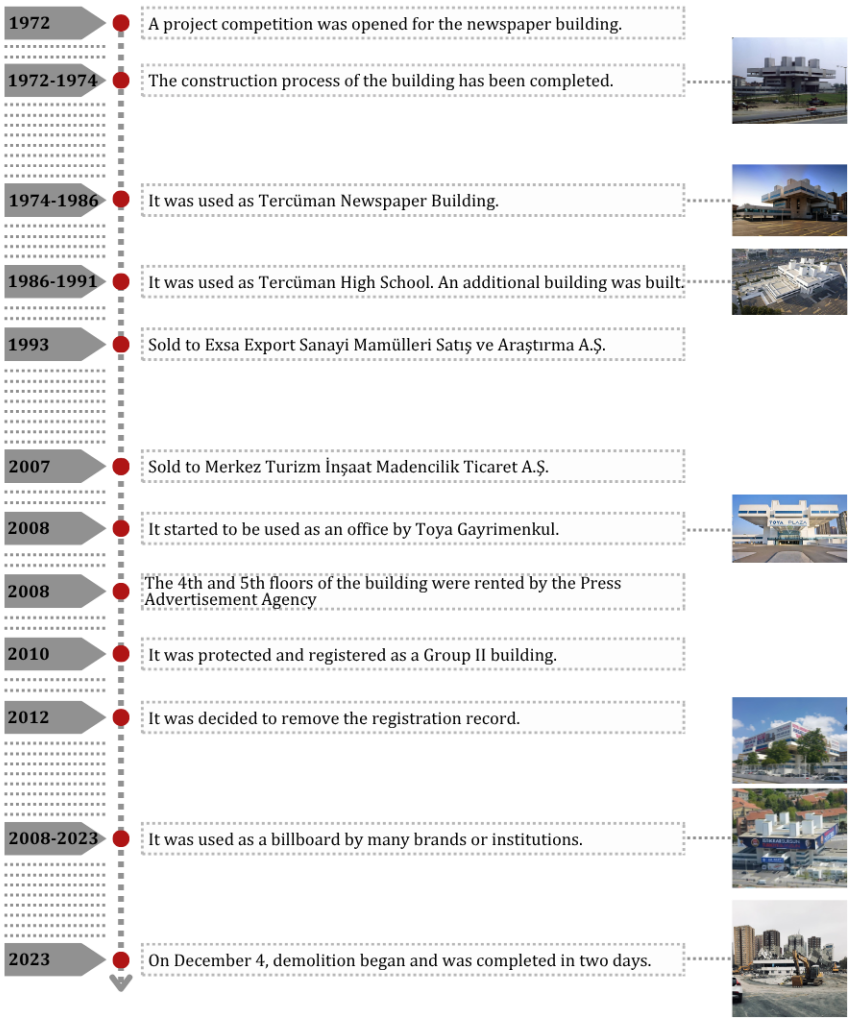

Figure 11. Time-dependent change process of the building

In 1972, the construction of the project, which was accepted as a result of the competition opened in 1972, was completed within two years. Since 1974, the building, which served the needs of Tercüman Newspaper and provided a background for its ideological goals, served the newspaper for 12 years until 1986. In the face of the economic difficulties Tercüman Newspaper faced, Kemal Ilıcak, the owner of the newspaper, turned to the education sector as a new means of investment. Accordingly, Tercüman High School was established in 1986 with a similar ideological approach to the newspaper and started to serve in the same building. Kemal Ilıcak's vision for the newspaper and his efforts to ensure that everything had to be in the "largest" and "most modern" buildings continued in the high school.

New space requirements arose during the transformation of the newspaper building into an educational building. A three-story horizontal mass has been added to the E5 highway façade of the building, especially to meet the increasing need for classrooms (Figure 12). In this mass, there are action areas such as dining hall, classrooms, wc, administrative units.

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Figure 12. The addition to the building for the high school [Accessed from plan (Kaymak, 2019)]

The project of the additional building belongs to Günay Çilingiroğlu, one of the architects of the existing building. The linear addition to the ground floor was originally envisioned to be on all four facades of the building, but due to economic reasons, it could only be built on one facade. Despite its static strength, no classrooms were placed on the corner consoles, and these floors were reserved for less dense spaces (Kaymak, 2019).

The lowest floor of the annex building, at elevation -11.20, is planned entirely as a cafeteria. This floor has no access to the existing building and is designed as a completely open space without dividing walls. There are classrooms at -7.46 level. The relationship of the annex building with the existing building is provided by the stair hall added from the outside at the level of -3.20, which was the printing house floor in its previous function. In the annex building on this floor there are classrooms, principal, assistant principal rooms and toilets. The part that was used as a service entrance when it was a newspaper building started to function as the main entrance (Figure 13).

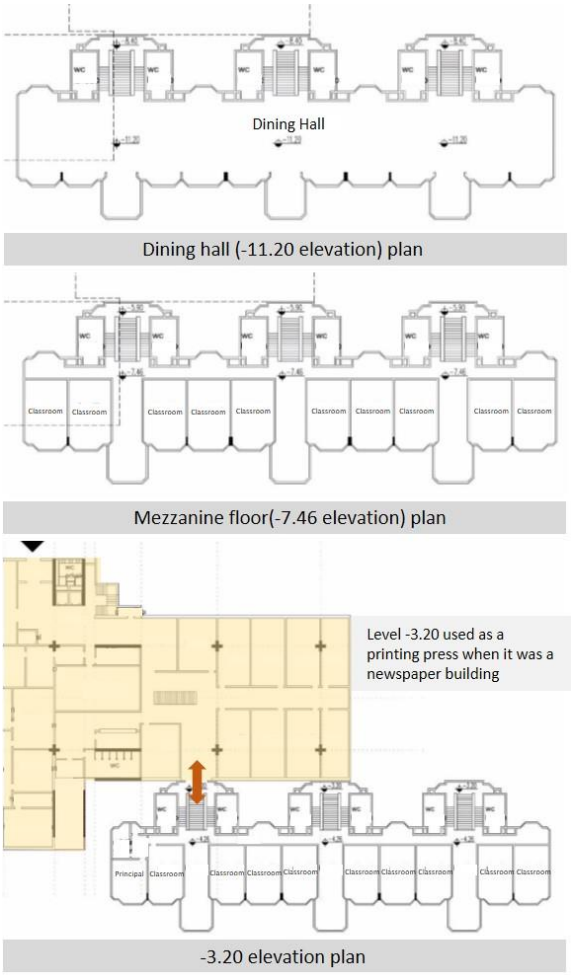

Figure 13. Annex building floor plans [Accessed from plans (Kaymak, 2019)]

On the façade where the annex building was built, the two curtain carrier walls on the -3.20 level were closed and started to be used for functions such as wc and storage. In addition, the number of stairs in the building has been increased for vertical circulation to meet the increasing circulation in the school building. In the existing building, a single-arm staircase was added to the central axis to provide circulation between the first three floors, the former function of which was the printing house mass. Similarly, another staircase was needed on the ground floor, rising from the center of the courtyard. The main entrance of the building is also preserved for the school. One of the gallery spaces on the ground floor of the newspaper building, which provides a visual connection with the printing house floor, has been reduced in size to create more space for classrooms and administrative units (Figure 14).

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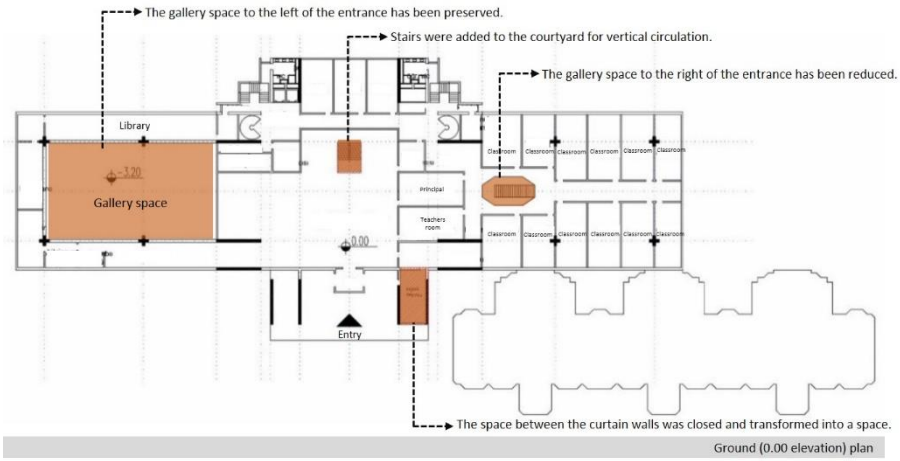

Figure 14. Spatial changes on the ground floor [Accessed from plan (Kaymak, 2019)]

The façade boundary of the first floor (+3.20 elevation), which was retracted compared to the upper floors, was completed forward at the level of the upper floor and joined to the existing space. These areas started to be used as classrooms. On the floor, whose former function was the upper management and corporate mass, 15x15 meter modules were divided to create offices with different functions. The modules in the corners function as units that bring together different areas of action: the school founder's section, the teacher's lounge, the els and the administrative section. Classrooms are located in the central modules and areas around the courtyard (Figure 15). Although the static strength of the building is quite good, the classrooms, which are high-density spaces, are not placed on corner consoles for safety reasons.

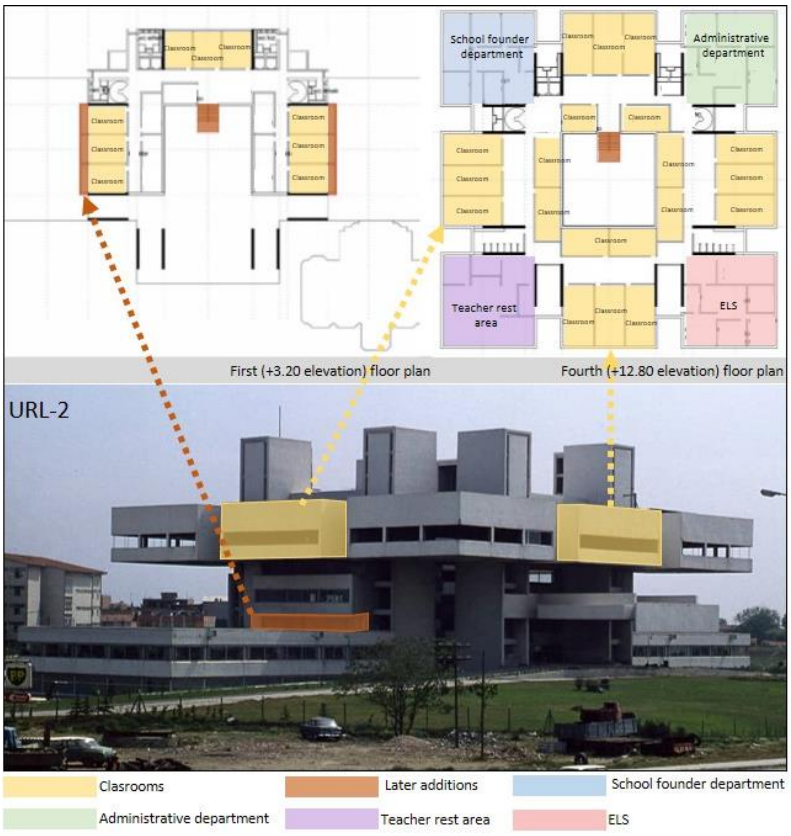

Figure 15. Layout of the upper floors

It is seen that the Tercüman Newspaper Building underwent a very comprehensive spatial transformation process while being transformed into an educational building. The linear addition to the building on the E5 highway facade was designed by Günay Çilingiroğlu, one of the architects of the building, in harmony with the building without disturbing the characteristic of the existing building. While the printing house and office floors in the newspaper building were transformed into spaces to serve the school function, they underwent a number of changes both with additions to the facade and revisions in the interior. The building, which served as Tercüman High School from 1986 to 1991, was vacated after it was sold.

The building, which was registered to Tercüman Gazetecilik ve Matbaacılık A.Ş., was first sold to Sasa Suni Sentetik Elyaf Sanayi A.Ş. on August 5, 1988. Subsequently, on June 4, 1993, while it was registered in the name of Hacı Ömer Sabancı A.Ş., it was sold to Exsa Export Sanayi Mamülleri Satış ve Araştırma A.Ş. The parcel where the building is located was sold to Merkez Turizm İnşaat Madencilik Ticaret A.Ş. on April 10, 2007. In 2008, it was revised by Toya Group under the name of branded office project and started to serve under the name Toya Plaza (Kaymak, 2019). Since these years, different floors and sections of the building have been used for multiple brands, institutions and organizations. During the same period, the Press Advertisement Agency fully leased the fourth and fifth floors of the building to use as its central management office.

The building, which has been described as a unique example of the new brutalism in modern architecture in our country since its construction, was requested to be protected as a "Cultural Asset" in an application made by the Istanbul Metropolitan Municipality Directorate of Conservation Implementation and Inspection on 26.03.2008. Two years later, with the decision dated 29.01.2010 and numbered 3562 of the Istanbul Regional Board for the Protection of Cultural and Natural Assets No. IV, it was decided to determine the protection group as II, to register it and to put it under protection (TMMOB MO İstanbul, 2023).

Over time, the facade of the building has been covered with billboards and its originality has been damaged (Figure 16). In addition to the application made by the Press Advertisement Agency on 25.08.2011, the Istanbul Association of Free Architects made an application on 11.11.2011.; it has been requested to take necessary actions to restore the building to its original appearance by removing the additions and unqualified additions that disrupt the aesthetic quality of the cultural property with iron construction and wooden panels on the building. In the face of the aforementioned letters and requests, on 25.03.2011, the relevant person requested the removal of the registration record of the building, the issue was evaluated with this application and it was decided to remove the registration record of the building with the decision dated 23.05.2012 and numbered 661 of the Istanbul Regional Board for the Protection of Cultural and Natural Assets No. IV (TMMOB MO İstanbul,2023). The justification for this decision was that "the reinforced

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concrete building is not significant in terms of its historical, archaeological, environmental and other significance and characteristics".

Figure 16. Use of the building as a billboard (URL-2, URL-3)

Before its demolition, in its final use, the building's elevation difference on the southeast and northwest façades was equalized at the level of -3.20. The former main entrance at the 0.00 level was elevated, enclosed with glass between the carriers, and surrounded by a balcony. The building was used by multiple companies and institutions simultaneously for years (Figure 17). The institutions renting the building have organized the entrances from different points. Accordingly, the new main entrance on the southeast façade led to the Anadolu Agency on the second, third and fourth floors and the Press Advertisement Agency on the fifth and sixth floors. The sixth floor, originally a cafeteria, was repurposed by the Press Advertisement Agency for social functions such as a cafeteria and a gymnasium. The fifth floor serves offices, administration and meeting rooms. Part of the ground floor and the first floor was occupied by the Türkiye Youth Foundation. The left side of the new ground floor at the -3.20 level was used as Toya Real Estate's warehouse, and the right side as Vatan Computer's warehouse. The annex building built for Tercüman High School was used as a sales store by Vatan Computer. Prior to 2008, a four-story addition was constructed between the curtain wall of the newspaper building and the high school annex. This section was independent from the other buildings and was once used by the Honorary Consulate of South Sudan but had remained vacant in recent years. The floors of the newspaper building below the -3.20 level had not been used in recent years and had been left idle.

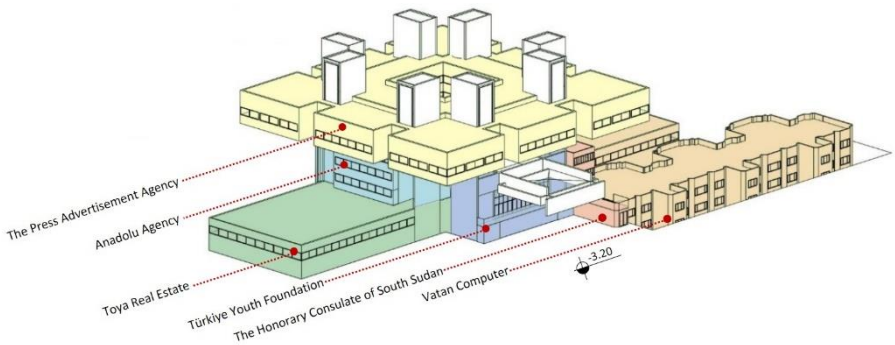

Figure 17. Use of the building after 2008 (Kaymak, 2019)

Criticism on the Demolition of the Building

Tercüman Newspaper Building could not preserve its structural integrity with the interventions made especially after 2008, and each institution made separate revisions to both the façade and the interior, which damaged the original quality of the building. In 2012, after the removal of the registration record, the building entered a process of de-identification with the billboards hung on its facade. Sensitive to this situation, the Istanbul Metropolitan Municipality Department of Cultural Assets Directorate of Cultural Heritage Protection submitted a petition on 10.03.2020. Accordingly, it requested "re-evaluation of the registration status of Tercüman Newspaper Building, as it is one of the outstanding examples of Brutalist architecture in our country and has revealed different architectural approaches and practices in the period it was built" (TMMOB MO İstanbul,2023). In response to this request, a detailed report on the technical and aesthetic qualities of the building in question was prepared on 29.11.2021 upon the request of the Istanbul Regional Board for the Protection of Cultural Assets No. II. Despite all these efforts, the fact that the building was not re-registered and left idle in recent years has dragged the building towards demolition. In fact, while the process of re-registration of the building was ongoing, the first steps were taken for the demolition of the building on December 4, 2023 on the grounds of earthquake risk, and the building was completely demolished on December 5, 2023 (Figure 18).

Figure 18. Demolition of Tercüman Newspaper Building (URL-4)

The demolition of the building faced criticism from both the architectural community and people who had seen or used it. The DOCOMOMO Türkiye National Working Group, which conducts research on protecting modern heritage buildings, highlighted errors in the building's registration and de-registration process and expressed concerns about its demolition;

"…An analysis of the Conservation Regional Board's decisions reveals that the 2010 registration decision does not acknowledge the building's modern architectural heritage values. The 2012 de-registration decision's reference to Law No. 2863 highlights the inadequacy of current conservation legislation in preserving 20th-century modern architecture in Türkiye as cultural heritage. Resolving these contradictory legal processes and preventing the loss of modern architectural heritage will

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only be possible by establishing a legal framework for the protection of 20th-century modern architectural heritage." (on December 6, 2023).

After the demolition, TMMOB Chamber of Architects Istanbul Branch issued a condemnation letter with the following words;

"…The sudden demolition of the (former) Tercüman Newspaper Building, an "iconic" building engraved in the social memory as an "iconic" building, located outside the Istanbul Karasurlar, in Zeytinburnu District, Merkezefendi Neighborhood, block 2969, parcel 41, without any information shared with the public, is a great loss and this attitude is unacceptable..." (on December 17, 2023).

In addition to professional organizations, the public also expressed many opinions and criticisms about the demolition of the building. It is seen that these criticisms are shaped on basic issues such as the role of the building in the history of modern architecture, its impact on social memory and cultural identity, the possibilities of functional change and the lack of conservation awareness.

The Role of the Building in the History of Modern Architecture

The stylistic and structural features of the newspaper building, which is one of the important representatives of the brutalist architectural movement that has become widespread throughout the world since the 1950s, have been mentioned in some opinions expressed on social media;

"Interpreter Building is also being demolished. It was one of the most qualified brutalist buildings in the country, we all had an image of it in our minds. For years the facade was covered with advertising tarpaulins, now they are demolishing it. Let's see how far we go backwards" (H. K.).

"It was one of the most iconic examples of brutalist architecture in our country with its gigantic consoles, we all had its image in our minds. Every building can be retrofitted, but not every building can be demolished" (C. A.).

Social Memory and its Impact on Cultural Identity

In addition to its contributions to the history of modern architecture, the newspaper building also has an important place in the urban and social memory of Istanbul;

"…It was so iconic that its building, which changed hands many times even before Tercüman Newspaper existed, was always referred to as Tercüman Building. But this building no longer exists. The building that I admired even as a child, the building that gave me the feeling of "This building is special" at that age is no more" (N. Ö.).

"Some buildings, whether beautiful or ugly, are the memory of the city. The Interpreter building is like this" (M. M.).

Beyond its physical presence, the building has left deep traces in the social memory of many people through personal memories and experiences;

"…And finally, our memories... In other words, the main mechanism that makes a city, built environment 'ours', transforms and gives meaning

to it; our experiences. For me, Tercüman Building was a place where journeys, courage, artistry and borders made sense; and for millions of people like me, who had a relationship with this building, it was a place that they added to their lives with an infinite variety of feelings. It was a loyal part of our city, which we sometimes passed by with glimpses in our struggle for life, sometimes admiring its facades, waiting in front of it, spending time in it; always waiting for us in the same place. While we were still naively criticizing the advertising facades that occupied the building; suddenly one night, we witnessed the entire building being razed to the ground without question" (D. K.).

"The former Tercüman Newspaper Building, now TOYA Plaza, in Cevizlibağ, which I used as a workplace for years, is being demolished. I am saddened" (M. K.).

"It has a special place in my heart. Since my grandmother lived in Sefaköy, we used to take the 522 in front of Tercüman Building to come home from Ümraniye to her or back from her, especially when there was no metrobus. Then the metrobus came to Istanbul, it became my car... Every time I pass by there, I take a special look" (B. Ç.).

In the years when Tercüman Newspaper was published, it was also emphasized that the building was an important source of employment for the people of the region;

"…Known for the Tercüman newspaper, the building is iconic, one of the most recognizable buildings in Istanbul. It has made a great contribution to the neighborhood in terms of employment. Many of our citizens, especially women, retired from this building…" (C. Ç.).

Opportunities for Functional Change and Lack of Conservation Awareness

Public criticism has suggested that instead of demolishing the building, it should be re-functionalized with alternative uses;

"It's a shame. It's like a lost opportunity, it could have been turned into anything, especially a modern museum. If the architects are still alive, I feel sorry for them" (C. S. A.).

The unconscious approach and deficiencies in the conservation of modern architectural heritage in Türkiye are criticized;

"Tercüman Building was registered by the Conservation Board for its architectural value. Then the facade was covered with advertisements. No advertisements etc. can be placed on registered buildings. Istanbul Association of Freelance Architects reflected the situation to the Conservation Board. Board revokes the registration decision for some reason. Now they have demolished the building. It's a pity" (D. H.).

"For a long time invisible with ugly advertising signs, now completely destroyed" (B. A.).

The demolition of the building was widely covered in newspapers and news websites (Figure 19).

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Figure 19. News about the demolition of the building

EVALUATION and CONCLUSION

The Tercüman Newspaper Building was constructed in the 1970s with an innovative architectural style that was unfamiliar in Türkiye at the time. This pioneering approach earned it a unique place in architectural literature. The building is a tangible reflection of the design philosophy and educational background of its architects, Günay Çilingiroğlu and Muhlis Tunca. In addition to the architects, the goals and strategies of the newspaper's owner, Kemal Ilıcak, were instrumental in shaping the building, particularly in relation to the newspaper industry. The Tercüman Newspaper Building can be characterized as an ideological statement, reflecting its progressive, modern, and visionary ideology.

The building has highly distinctive architectural elements that set it apart from its contemporaries. These elements include the functional separation in space organization, the division of service areas from the main mass, the integration of circulation and service cores into the massing, and the structure's innovative and bold approach, which contributes to its symbolic power. Although the goals set for the future of the newspaper and the new facility could not be fully realized due to several economic factors, discussions about the building's symbolism have persisted.

Although the new facility was designed to meet the newspaper's needs for at least 50 years, the building only served for 12 years due to lower-than-expected circulation figures and economic difficulties. Since the newspaper left the building, it has undergone significant spatial transformations, frequently changing hands for various purposes. Since the revisions for Tercüman High School were carried out by architect Günay Çilingiroğlu, the original structure and character of the building were largely preserved. However, in the following years, each subsequent user made modifications and attempted to alter the spatial organization according to their needs, partially compromising its originality. The building's facade being covered with billboards has gradually erased its identity. Although preservation advocates attempted to register the

building, its protected status lasted only two years. This situation led to the building gradually losing value, being neglected, left idle, and ultimately facing demolition.

The Tercüman Newspaper Building was an important representative of Turkish modern architectural practice, with its architectural and structural design, symbolic value, and ideological mission. One of Türkiye's first newspapers, Tercüman, physically represented press freedom debates in the country through its modern headquarters, located outside the city center. It was also an important part of Türkiye's democratization process, hosting many political and social events. Despite this, the building has not received sufficient recognition in architectural literature, nor has it been sufficiently mentioned by architectural historians and critics issues worthy of discussion. Although there is no documentary evidence, the political and ideological views of the newspaper's owner, Kemal Ilıcak, may have contributed to this lack of interest. Historically, some buildings have been judged by their political and ideological associations. However, an architectural work should be assessed independently of the ideologies of its builders, architects, or the politicians and decision-makers of the period and should be evaluated based on its artistic value. In particular, media buildings that reflect the sociopolitical agenda of their time and have documented recent history are an important part of the country's socio-cultural heritage. Failure to preserve these buildings not only leads to the loss of architectural heritage but also erases historical continuity.

Although the demolition of the newspaper building was justified by claims that it was not earthquake-resistant, the building's location and land value necessitate reconsidering the issue from another perspective. Considering that many buildings throughout history have been destroyed due to political and economic interests, including land speculation, it is evident that the Tercüman Newspaper Building has shared the same fate as others. The demolition of a building erases the memories and collective memory of those who lived in or encountered it. Social media reactions to the building's demolition show that people had established a connection with it, as it held a place in their past and memories. Each demolition gradually erases these memories and experiences. Thus, the shared cultural elements of society, its collective identity, and, consequently, its collective memory suffer irreversible damage.

Buildings that house journalistic activities in Türkiye serve as significant reference points of their time for society and convey media culture through their physical and symbolic values. Preserving these buildings effectively conveys the political and cultural atmosphere of their period to future generations. The Tercüman Newspaper Building was one of the iconic buildings that captured public attention during its 49 years of existence, but it was demolished, sharing the fate of many other unprotected buildings. This demolition erased both the physical space that played a key role in Istanbul's modernization and the building's imprint on public memory. The building held symbolic and

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cultural significance due to its prominent role in press history and served as a unique example of modern architecture. Therefore, its demolition reflects the lack of appreciation for modern heritage in Türkiye. Finally, this study aims to revive interest in the newspaper building, which was underappreciated during its existence, bring it to the forefront following its demolition, and secure its place in collective memory.

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Resume

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Evaluation of Healthcare Staff Satisfaction Regarding Furniture Design for Working and Resting Spaces

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Gizem Güler Nakıp ****

Abstract

The quality of healthcare interiors is considered an important factor in the well-being and satisfaction of healthcare staff. Accordingly, this study evaluates the satisfaction of doctors and nurses with the furniture they use in their working and resting areas in healthcare interiors. This paper's originality lies in examining the perspective of healthcare staff –doctors and nurses– as users and also investigating furniture as a crucial factor in shaping user satisfaction regarding interior spaces. In this research, a qualitative study, including observation and a case study, is supplemented by a quantitative study, including research and a survey. The method of the study includes a literature review, field trips, structured questionnaires, and semi-structured interviews with the healthcare staff of the four selected hospitals in Turkey. The findings from observations, questionnaires, and interviews are evaluated through a literature review conducted in this study, as evidenced at the conclusion of each analysis section. The data regarding user satisfaction of furniture in the hospitals' interior spaces were analyzed in terms of tangible physical attributes of furniture such as ergonomic qualities, functionality in layout, sensory qualities of materials and color, and intangible psycho-social attributes such as a sense of belonging/personalization and privacy/sense of control. These factors, along with belonging and privacy, enhance the awareness of interior design in creating healthy, safe, and comfortable hospital environments. The paper contributes to a gap in knowledge regarding the physical and psycho-social features of furniture that influence healthcare staff's physical and mental health and raises awareness about using interior design to create healthy, safe, and comfortable hospital environments. The research suggests that the interiors of well-designed healthcare facilities have a positive and curative effect on staff and patients; therefore, it should be addressed comprehensively.

Keywords: *Healthcare interiors, Healthcare staff, Physical attributes, Psycho-social attributes, User satisfaction.*

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INTRODUCTION

Designing healthcare buildings involves addressing complex architectural challenges, integrating advanced technology, and prioritizing the protection of human well-being. This necessitates a holistic and empathetic approach to ensure optimal outcomes for all stakeholders (Jablonska & Furmanczyk, 2024). In Turkey, there is the potential to improve the interior spaces used by healthcare staff, especially nurses and doctors in state-owned healthcare facilities. Enhancing these qualities could significantly raise the level of satisfaction and well-being of the healthcare staff. Despite the recent surge in healthcare research and the availability of relevant information on design features, there remains a need for updated data on the beneficial implications of the physical indoor environment, as well as related guidelines and standards (Salonen et al., 2013). Academic literature focusing on the spatial satisfaction of healthcare staff in Turkey is also quite limited. In order to address this gap in the literature, the present study explores user satisfaction in the working and resting spaces of doctors and nurses –doctors' examination rooms, nurse stations, and doctors' and nurses' resting rooms.

Growing evidence of the impact of environmental features on health and well-being in healthcare facilities has led to a greater emphasis on the consequences of design choices in these spaces (Salonen et al., 2013). Within the larger context of healthcare interiors, this study focuses on furniture as a design element that complements an interior space. Careless selection or non-selection of these elements can make an interior space incomplete or unfinished. Inevitably, furniture is used to support people's actions, activities, and needs. Therefore, it has a close connection in various ways with the user. Not just the physical comfort, the furniture and its layout also affect the psycho-social comfort of the user (Xue et al., 2024). So, besides other elements in interiors, furniture should be carefully designed throughout the design process.

Various studies explore the creation of healing environments through both tangible design elements and intangible factors (Schweitzer, 2004; Chrysikou, 2014; Iyendo, 2016; Osonwa, 2023). Tangible elements can be defined as perceivable by the senses, especially by touching. Thus, the physical features of the furniture and its layout can be defined as tangible features, and they affect the overall satisfaction of the user with the other parameters. In contrast, intangible ones do not have any presence or physical entity and cannot be perceived by the senses. So, the furniture directly has a relation with the psycho-social entity of the user. The psycho-social needs of the user, such as having control of the environment or having a sense of belonging, tend to play an important role in this intangible contact with the furniture.

Accordingly, the present study evaluates the furniture with its tangible and intangible properties. Tangible properties cover its physical attributes, such as ergonomic qualities, functionality in layout,

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sensory qualities of materials and color; and intangible ones cover psycho-social attributes, including a sense of belonging/personalization and privacy/sense of control. Elements that positively impact the well-being of healthcare staff are showcased to highlight promising practices that enhance benefits and boost satisfaction.

This study investigated four state hospitals in İzmir, Turkey: Urla State Hospital (UH), Tepecik Education and Research Hospital in Bornova (TEH), Tire State Hospital (TIH), and Çeşme State Hospital (ÇH), which have 200, 180, 150, and 75 beds, respectively. With the findings obtained from the study, it is aimed to determine the deficiencies of the existing healthcare buildings from the user perspective and propose design inputs for future designs to enhance staff satisfaction in healthcare interiors.

Data obtained from literature, observations, and surveys have shown that ergonomics, layout, materials, and colors play an important role in the physical and mental health of healthcare professionals as physical features, and belonging and privacy as psycho-social features. Moreover, these features increase awareness of the use of interior design to create healthy, safe, and comfortable hospital environments. The research findings show that the boundary that healthcare professionals prioritize between themselves and the patient can be defined if the furniture size, proportions, and layout are designed appropriately. Accordingly, the interiors of healthcare facilities should be considered comprehensively in terms of having a positive and healing effect on staff and patients.

LITERATURE REVIEW

According to Postell (2012), dictionaries and encyclopedias define furniture through terms such as accessories, equipment, and movable objects, which describe its physical character and performance. The choice of furniture, its placement within the interior, and its interaction with other furniture create a compositional order. In other words, furniture forms and completes the composition of the interior space (Özel, 2021). According to Ching (2007), furniture acts as an intermediary between architecture and users of the space. By enabling interior activities, furniture provides the transition between the interior and the individual in form and scale. Thus, in the formation of a space, furniture and accessories are as important as structural components such as walls, floors, doors, and windows. The design, selection, manufacture, and arrangement of furniture, which acts in relationship with people, requires theoretical and technical knowledge, making it an interdisciplinary and holistic field of study (Postell, 2012).

In providing the functionality needed in specific places, furniture is shaped according to different types of social use. One of the most important types is healthcare furniture. In order to accommodate different groups of people, from hospital staff to doctors and from patients to patients' relatives, furniture selection for hospital interiors should ensure the users' efficiency and comfort. More specifically, in

healthcare settings, furniture selection should consider the physical condition and frailty of the users (Zaman & Zaman, 2022). Although levels of care vary for patients (from a doctor's office to rehabilitation to critical care), the following criteria should be met in all cases: proper dimensions and weight, durability and quality of upholstery. The furniture must have the appropriate height, depth, and styles to ensure the users' ergonomic convenience. They must also be of appropriate weight to be easily portable and stable for the safety of users. In addition, for some users, the furniture can provide comfort if it supports their movements. Finally, upholstery materials should be easily cleanable, water resistant, and provide antibacterial protection and be easily changed when required (Varol, 2023).

Furniture is tangible in that it can be experienced physically and spatially. However, it also has intangible aspects. Therefore, furniture designers must consider these tangible and intangible attributes together (Postell, 2012). The beneficial design implications of interior physical components are crucial for creating and operating healthcare services that support overall health and well-being. These considerations must meet the current and future needs of Western medicine while integrating essential elements (Salonen et al., 2013). Accordingly, the present study holistically addresses physical attributes as tangible and psycho-social attributes as intangible features in measuring user satisfaction in healthcare interiors through furniture.

Physical Attributes

Physical attributes in interior design refer to the characteristics of a space that influence its functionality, comfort, and overall user experience. These attributes include dimensions, proportions, material properties, and spatial organization, all of which contribute to the usability and aesthetics of an environment. In healthcare settings, physical attributes are particularly critical in ensuring safety, efficiency, and accessibility for both patients and staff. Elements such as furniture design, layout planning, and material selection must be carefully considered to support well-being and operational effectiveness.

Given their significance, the key aspects of physical attributes—including ergonomic qualities, spatial layout, and sensory factors like materials and colors—are further examined in the following sections. These detailed discussions explore how design choices can enhance staff performance, facilitate patient recovery, and create a functional and healing environment for all users.

Ergonomic qualities

Ergonomics is the study of scientifically examining the interaction between humans and the working/living environment and designing this environment according to human characteristics (Attaianese & Duca, 2012). The basic principles of workplace ergonomics are shaped by employees and the nature of their work. Ergonomic designs should

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align with job descriptions, enhance ease of use, optimize tasks, and allow for adaptability and personalization based on the specific requirements of the tasks (Springer, 2007).

To enhance staff efficiency and effectiveness, it is essential to incorporate furniture that can be easily adjusted to meet ergonomic requirements (Chaudhury et al., 2009; Malone & Dellinger, 2011). The use, experience, and comfort provided by furniture in an interior space depend on its ergonomic qualities, which are the basis of human-product relations. Ergonomics, located at the intersection of furniture and human relations, deals with the effects of furniture on the human body and how human movements are affected by it. Ergonomics, which covers every individual, applies universal design principles by addressing users with different needs, including disabled individuals. In healthcare environments, adjustable seats and chairs with armrests can help reduce patient falls, while adequate lighting and configurable furniture can minimize medication errors (Malone & Dellinger, 2011). These standard practices and design strategies will support the creation of healthcare interiors grounded in safety-driven design principles (Reiling et al., 2004).

In some occupations, including medicine and nursing, many diseases, such as musculoskeletal system diseases, are frequent due to the occupation's characteristics and conditions. Besides posture and prevention principles, environmental ergonomic factors also play an important role in determining the prevalence of occupational pain and diseases among healthcare staff (Dıraçoğlu, 2006). Equipment and furniture in patient rooms should be arranged to optimize nurses' mobility and ensure easy access. This is also essential for ensuring optimal performance and fostering a work environment where healthcare professionals can operate effectively, efficiently, and safely. In turn, optimal performance in healthcare directly contributes to higher quality and safer patient care (Carayon et al., 2003).

Layout

Designing a healthcare layout is a complex task due to uncertainties around future patient volumes, patient demographics, and emerging medical technologies. An effective layout must not only align with the hospital's strategic goals but also remain flexible to accommodate evolving needs and unforeseen changes (Vos et al., 2007).

The concept of layout includes both the arrangement of the spaces and the placement of furniture within them. These inevitably impact people and their social interactions as factors that can encourage or discourage social contact. As well as considering social interaction, communication, and isolation, spatial layout has other functions, such as reducing walking distances, providing easy access, enabling visual monitoring, and enhancing the safety of patients. Healthcare is increasingly focused on how hospital design—including technology and equipment—impacts patient safety. Addressing safety issues requires

aligning processes and the physical environment to support staff in delivering safe, effective care (Hughes, 2008). The findings of Vos et al. (2007) underscore the importance of evaluating floor plan design, as the building appears to effectively support system functionality and facilitate intended workflows.

Evans and McCoy (1998) distinguish between sociopetal and sociofugal furniture arrangements. The former refers to arrangements that encourage social interaction through the use of movable elements and strengthen communication with physically comfortable distances and easy eye contact. The latter refers to inflexible arrangements where eye contact is difficult or where distances between people are inappropriate (Evans & McCoy, 1998). Furniture layout and arrangement are also related to spatial proximity, which determines the environmentally shaped limits of people's proximity in social interaction. Proximity studies investigate the position of leaders and small group behaviors (Altman, 1975). In short, furniture arrangements significantly determine the level of socialization in a space. In healthcare spaces, furniture layouts can determine the organization and control of the social relationships that healthcare staff need to establish, both among themselves and with their patients.

In a hospital environment, the spatial layout of each unit should be designed based on specific considerations. The spatial layout areas reserved for patients, visitors, and healthcare staff have different functions to meet different needs. Designing all compartments to be as uniform as possible will help healthcare workers, particularly nurses, quickly adapt whenever they change patients or move to a different area. Key factors, such as proximity to the patient and visual access, as well as job satisfaction and informal learning, should be evaluated at the design stage (Harale, 2010).

Sensory qualities: materials and colors

Sensory qualities, such as the material used and colors, are used to express the quality of an interior and support its function. These elements contribute to the perception of the space while supporting people's actions if they are suitable for the function. Especially for healthcare interiors, furniture requires specific surfaces to perform the activities required in the hospital environment. Therefore, particular attention should be paid to the selection of these elements since color, material, and texture on these surfaces have important effects. Given that the colors used in furniture have a guiding effect on staff and hospital visitors, interior color choices should be made accordingly.

Furniture color choices also have psychological effects on patients and healthcare staff. Color perception is closely linked to a patient's mental and emotional states (Kwon, 2010). Hence, colors should be chosen to encourage healing in patients, increase motivation, and improve the mood of healthcare staff. For example, the use of dominant colors and materials can help avoid a clinical appearance and

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differentiate between nursing units (Malkin, 1992). A healing environment offers stimulating yet varied sensory experiences, promoting relaxation through therapeutic sounds, soothing colors, comfortable furniture, and an overall sense of harmony. In healthcare environments, providing pleasant colors and artwork for patients to enjoy while in bed, along with comfortable seating for family members and thoughtfully designed ceiling tiles, enhances the healing atmosphere (Stichler, 2001). Blue, green, and purple are known for their calming and relaxing effects, while pastel hues create a more uplifting atmosphere compared to darker tones. Soft, muted colors without stark contrasts promote relaxation (Cannava, 1994). Duffy and Florell (1990) suggest using softer colors in patient areas, with brighter accents in draperies, upholstery, and artwork to add vibrancy.

Oak counters avoid giving a corporate impression and evoking associated emotions. Nurse station areas should have semi-closed areas with transparent materials to ensure privacy and confidentiality while allowing them to maintain contact with other staff members and monitor patients (Morelli, 2007). The choice of flooring in hospitals significantly affects the safety, health, and comfort of individuals within that environment. Selecting suitable flooring materials for patient rooms depends on the material's composition, its impact on the room's environmental conditions, and its influence on patient comfort and satisfaction (Harris, 2000).

The color of a space significantly influences how environmental features, such as acoustic and thermal conditions, are perceived. For instance, a noise might seem quieter when surrounded by cool colors, whereas the same noise levels can feel more intense in spaces dominated by yellow or red hues (Tofle et al., 2004). Numerous studies have demonstrated that noise significantly impacts human health and well-being, contributing to increased stress, diminished sleep quality, and a rise in headaches. It heightens patient anxiety and undermines their confidence in the clinical competence of staff, while also contributing to falls, confusion, and greater reliance on medications and restraints (Mazer, 2006). Excessive noise can disrupt patients' sleep and trigger harmful physiological responses. For staff, it impairs communication and has been linked to increased errors and burnout (Ampt et al., 2008). These findings highlight the importance of considering noise control in the design of healthcare interiors. Effective noise reduction strategies encompass the use of sound-absorbing ceiling tiles or panels, noise-reducing finishes, and designing single-bed rooms (Ampt et al., 2008; Ulrich et al., 2008).

In conclusion, regarding physical attributes in healthcare environments, ergonomic design, furniture layout, and sensory qualities provided by materials and colors together shape staff efficiency and well-being. Carefully considered furniture layout affects social interactions and work efficiency, ensuring communication and accessibility. Material and color selections impact safety, comfort, and

well-being, highlighting the significance of acoustic control, standardized materials, and visually appealing environments. A holistic approach that combines these components improves the overall experience of healthcare staff.

Psycho-social Attributes

Psycho-social attributes in interior design refer to the ways in which physical spaces influence human emotions, behavior, and social interactions (Karol & Smith, 2018). These attributes play a significant role in shaping users' experiences, particularly in healthcare environments where factors like belonging/personalization and privacy/control can directly impact well-being and performance (Payne et al., 2014). A well-designed space should foster a sense of comfort, security, and autonomy while also enabling appropriate social interactions (Olanusi & Oluwadepo, 2023). In healthcare settings, creating environments that support both patients' and staff's psychological needs can enhance healing processes, reduce stress, and improve overall efficiency (Soh et al., 2015).

The following subtitles explore key psycho-social attributes in detail, including the role of belonging/personalization in fostering emotional connections with spaces, as well as the importance of privacy/control in maintaining comfort and reducing stress. These discussions highlight how thoughtful design interventions can positively influence user satisfaction, staff productivity, and patient recovery.

Belonging/personalization

People's sense of belonging takes the form of emotional, functional, or conceptual connections. While users establish emotional connections with places that are valuable and meaningful to them, they establish a functional connection to perform their activities (Tuan, 1977; Relph, 1976). These physical and psychological needs lead to the concept of personalizing the space.

The users can reinforce their sense of belonging by organizing a space in line with their preferences. Little (1987) studied personality and space relationships through spatial selection and usage. According to Wells (2000), workplace personalization can affect physiological and psychological health.

Personalization is also affected by occupation. People in different occupations may have different tendencies to customize the space (Goodrich, 1986). Lack of personalization can have negative consequences on spaces and users' psychological satisfaction (Wells, 2000). In short, the personalization of space creates a sense of intimacy and helps relieve their worries in their workspace.

Personalization in healthcare interiors is essential for expressing self-identity, which significantly enhances psychological well-being. According to Chrysikou (2014), it is closely tied to critical factors such as privacy, territoriality, and social interaction. Personalization

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empowers patients and healthcare staff to manage and protect their personal space, fostering a sense of security and autonomy. Moreover, it facilitates the creation of specialized areas where healthcare staff can efficiently perform their duties or find respite. This approach not only improves the therapeutic environment for patients but also supports the well-being and productivity of healthcare staff (Chrysikou, 2014).

Healthcare staff may find personalization challenging in hospitals. Since each unit is unique, it can make personalization confusing (Shumaker & Reizenstein, 1982). This, in turn, may negatively affect employee performance and the experience of patients and hospital visitors. Thus, the personalization required by hospital staff should be achieved by keeping it as compact as possible and with certain limits.

Privacy/control

According to Levin and Groner (1992), privacy is defined as the condition whereby the ability of others to approach a person or a group is maintained at the optimum level. It encompasses required auditory, visual, and social privacy. People instinctively avoid being visually monitored, and architectural elements such as walls, dividers, and furniture can enhance privacy. Similarly, acoustic privacy can be achieved through ceilings, partitions, and specialized materials (Levin & Groner, 1992).

In hospitals, privacy supports patients, visitors, and staff by fostering security and reducing stress. Since privacy needs vary by unit, spaces should be designed accordingly. Prioritizing patient privacy not only ensures legal compliance but also fosters trust in the confidentiality and quality of care. Equally, staff privacy influences perceptions of safety, supports effective communication, reduces errors, and improves patient outcomes. Acoustic privacy, achieved via panels and strategic layouts, prevents the overhearing of sensitive information, while designated staff-only areas further enhance security. Designating hospital employee-only areas, offices, workstations, and limited-access staff corridors can further address this concern, ensuring a more secure and focused work environment (Zamani et al., 2023).

Hospitals should optimize privacy levels by selecting adaptable furniture and arranging spaces to allow users to control their level of privacy (Evans & McCoy, 1998). The space's spatial qualities balance the level of social interaction, while interior qualities like size and location determine the level of privacy.

A sense of control is a crucial factor that influences stress levels across various user groups and situations (Steptoe & Appels, 1989). People inherently need control and self-efficacy; lacking control can result in high blood pressure, stress, depression, weakened immune function, and passivity. This applies equally in healthcare settings, where a lack of control heightens stress and adversely impacts health. Staff often face high responsibility with low control, exacerbated by

inadequate rest spaces and poorly designed work environments (Shumaker & Pequegnat, 1989; Ulrich, 1997).

In conclusion, regarding psycho-social attributes, personalization, belonging, and privacy play an important role in shaping the well-being and efficiency of healthcare staff. Allowing healthcare staff to personalize their space improves their sense of belonging, creating familiarity and reducing their stress level. Similarly, privacy that is achieved through acoustic control and carefully designed furniture layout encourages autonomy and well-being. Balancing these factors with social interaction confirms that healthcare interiors enhance both psycho-social comfort and functional efficiency and thus improve both efficiency and the overall healthcare experience of staff.

METHODOLOGY

This study focused on the mixed method using quantitative and qualitative methods that complement each other. Here, a qualitative study, including observation and case study, is supplemented by a quantitative study, including research and survey. Primary data were collected through literature review, a questionnaire, face-to-face interviews, and observations of the hospitals. Ethics approval for the study was obtained from [Yaşar University Ethics Committee] (Approval number: 4, dated 21 December 2016), and all participants gave their informed consent prior to data collection. As part of the study, face-to-face questionnaires were conducted with 199 doctors and 453 nurses from the four selected hospitals in İzmir. Based on the reviewed literature, the questionnaire focused on five aspects of the furniture: ergonomic qualities, plan layout, sensory qualities, belonging/personalization, and privacy/control. Some questions employed a 5-point Likert scale ranging from 1 to 5 while others presented the participants with adjective couples, such as warm-cool, comfortable-uncomfortable, hygienic-unhygienic, aesthetic-unesthetic, relaxing-stressful, spacious-crowded, and heavy-light, from which respondents could choose more than one option. Regarding the satisfaction of doctors and nurses for each aspect, there were six questions for ergonomic qualities, two for plan layout, three for sensory qualities, four for belonging/personalization, and four for privacy/control. Stratified simple random sampling was used to select the participants. The required sample size was calculated (Figure 1) based on each hospital's population of doctors and nurses (Table 1). The data were analyzed using SPSS software. In the analysis of the data obtained through the SPSS program, frequency values were taken separately for each area in order to evaluate the satisfaction of doctors and nurses in the areas of their own use, and comparative analyses were excluded.

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$$n = \frac{N \times Z^2 \times 0{,}25}{(d^2 \times (N-1)) + (Z^2 \times 0{,}25)}$$

Figure 1. Sample size calculation.

n: sample size required

N: total population size (known or estimated)

d: precision level (usually 0,25 or 0,10)

Z: number of standard deviation units of the sampling distribution corresponding to the desired confidence level

Table 1. Population and required sample size for each hospital.

Hospital	Number of Doctors (Total)	Number of Doctors (Sample)	Number of Nurses (Total)	Number of Nurses (Sample)
Çeşme Hospital	25	7	42	11
Tepecik Hospital	51	14	154	42
Tire Hospital	76	21	137	37
Urla Hospital	47	12	120	32
Total	199	54	453	122

In addition to the questionnaires, 20 staff members (the chief physician or his assistant, two doctors, and two nurses from each of the four hospitals) were interviewed. Purposive sampling was used to identify the required interviewees in line with a qualitative approach (Salmons, 2014). The oral interview results were not segmented into codes; instead, the speeches were assessed qualitatively. This approach allows for a detailed exploration of interview content, capturing nuances and contextual insights without the structured categorization of coding. The data obtained from the four different data collection methods were analyzed in terms of the proposed hypothesis by overlapping each other. The findings from observations, questionnaires, and interviews were then evaluated alongside a literature review conducted as part of this study, as indicated in the conclusion of each analysis section. This analysis is based on the measurement of “heating load”, “cooling load” and the sum of these two loads as "total thermal load" of indoor air temperature and annual energy consumption. Three criteria of heating, cooling, and air temperature are considered to achieve thermal comfort. Finally, the results of the studies are compared, and an optimal example is presented in line with the purpose of the research, as shown in (Table 1).

ANALYSIS

This section presents a comprehensive analysis of the physical and psycho-social attributes of healthcare environments. Each subsection is supported by questionnaire percentage data/results presented in tables,

alongside visual collages and detailed plan diagrams for four selected hospitals and doctors' and nurses' units (Figures 2-17). Direct quotations from participants further enrich the analysis, providing valuable insights into user experiences and perceptions.

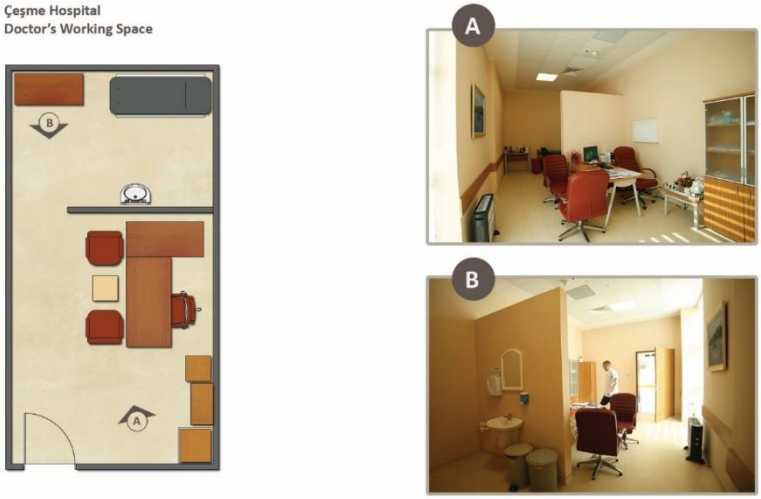

Figure 2. Çeşme Hospital doctor's working space.

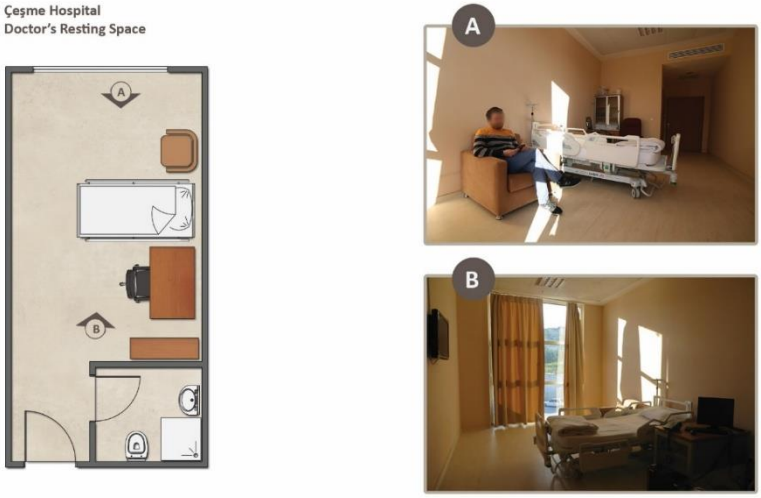

Figure 3. Çeşme Hospital doctor's resting space.

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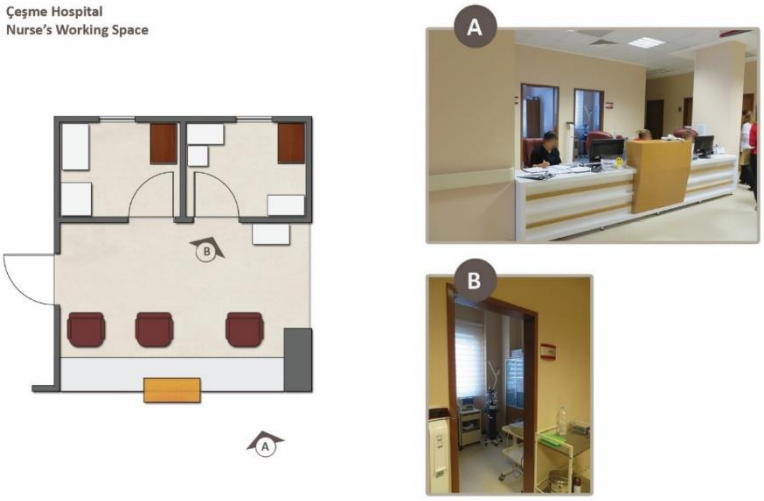

Figure 4. Çeşme Hospital nurse's working space.

Figure 5. Çeşme Hospital nurse's resting space.

Figure 6. Tepecik Hospital doctor's working space.

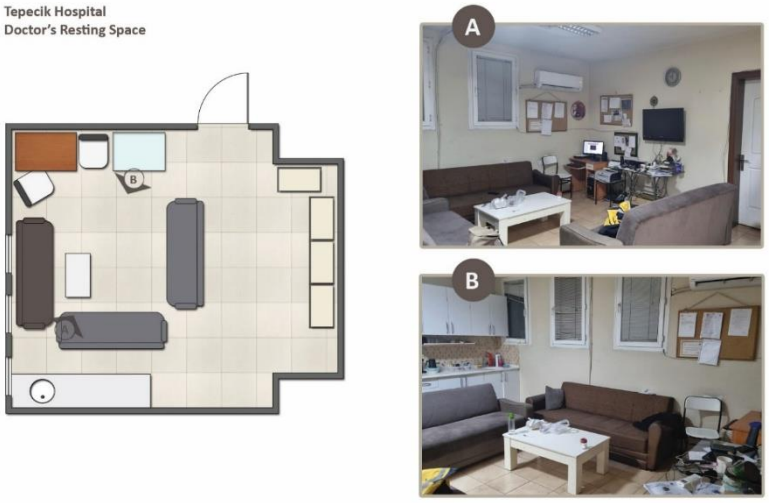

Figure 7. Tepecik Hospital doctor's resting space.

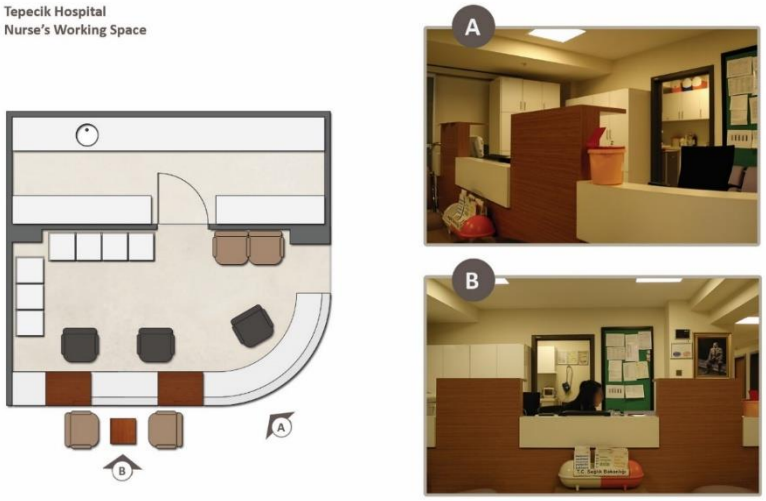

Figure 8. Tepecik Hospital nurse's working space.

Figure 9. Tepecik Hospital nurse's resting space.

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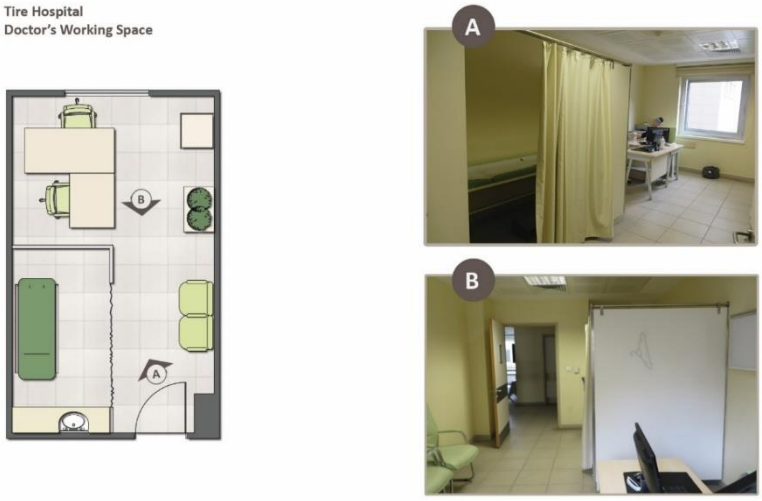

Figure 10. Tire Hospital doctor's working space.

Figure 11. Tire Hospital doctor's resting space.

Figure 12. Tire Hospital nurse's working space.

Figure 13. Tire Hospital nurse's resting space.

Figure 14. Urla Hospital doctor's working space.

Figure 15. Urla Hospital doctor's resting space.

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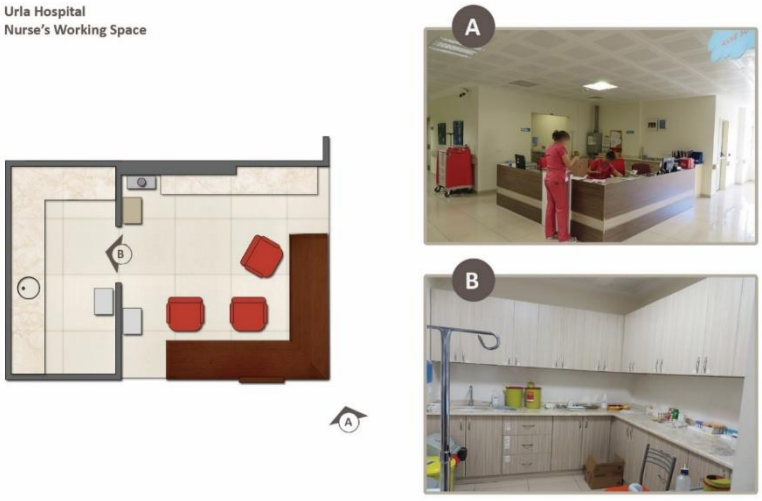

Figure 16. Urla Hospital nurse's working space.

Figure 17. Urla Hospital nurse's resting space.

Physical Attributes

The physical attributes of healthcare staff areas play a critical role in shaping both comfort and functionality for healthcare professionals. This subsection evaluates these physical elements in detail, focusing on their ergonomic qualities, spatial organization, and sensory characteristics, based on both quantitative survey data and qualitative staff feedback across four different hospitals.

Ergonomic qualities

Regarding the seating material, a significant portion of doctors across hospitals found the seating in working and resting areas comfortable, although a notable number reported discomfort specifically with the resting area seating (Table 2). Nurses' comfort levels with seating material varied among the hospitals. Overall, leather was preferred for workspaces, whereas fabric was in resting spaces.

Table 2. Questionnaire percentage results for "comfortable seating element" (DW: doctor working area, DR: Doctor resting area, NW: Nurse working area, NR: Nurse resting area, SD: Strongly disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly agree).

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	-	-	-	-	-	-	21,7	26,1	-	-	18,4	18,4	-	-	26,7	13,3
D	12,5	25	15,4	23,1	38,5	30,8	19,6	13	23,8	28,6	47,4	44,7	42,9	28,6	33,3	23,3
N	25	25	23,1	15,4	15,4	23,1	8,7	4,3	23,8	9,5	10,5	13,2	-	-	23,3	23,3
A	25	12,5	30,8	30,8	38,5	30,8	32,6	41,3	42,9	52,4	15,8	15,8	42.9	57,1	13,3	36,7
SA	37,5	37,5	30,8	30,8	7,7	15,4	17,4	15,2	9,5	9,5	7,9	7,9	14,3	14,3	3,3	3,3

Opinions on the ergonomic characteristics of the seating units (e.g., size and form) varied across hospitals and between nurses and doctors (Table 3). ÇH doctors had the highest level of agreement regarding the ergonomic suitability of the seating. A TEH doctor mentioned that the lounge seating was uncomfortable and not suitable for resting. Regarding ergonomic suitability, nurses from ÇH generally gave more positive evaluations for seating in both areas, while feedback from nurses at TEH, UH, and TIH was more mixed, with fewer reporting a positive experience. A UH nurse noted issues such as improper screen height, lack of lumbar and foot support, and poor alignment of chairs, tables, and monitors—citing back and neck pain as a result. Similarly, a TIH nurse criticized the fixed, heavy furniture and the lack of adjustable chairs. As the literature suggests, ergonomically inappropriate furniture triggers musculoskeletal diseases, indicating potential harm in UH, TIH, and TEH workspaces.

Table 3. Questionnaire percentage results for "ergonomic characteristics of the seating units".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	-	-	7,7	7,7	7,7	7,7	26,1	30,4	14,3	4,8	21,1	23,7	-	-	13,3	10
D	25	25	7,7	7,7	23,1	30,8	17,4	19,6	28,6	23,8	39,5	36,8	42,9	28,6	26,7	33,3
ND	-	-	23,1	23,1	7,7	7,7	13	6,5	4,8	14,3	10,5	10,5	-	14,3	13,3	13,3
A	50	50	46,2	46,2	46,2	46,2	34,8	39,1	47,6	42,9	26,3	28,9	57,1	57,1	46,7	36,7
SA	25	25	15,4	15,4	15,4	7,7	8,7	4,3	4,8	14,3	2,6	-	-	-	-	6,7

Regarding the ergonomic suitability of tables, most doctors at ÇH, TEH, and TIH gave positive evaluations for the workspaces, while a

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slightly smaller portion did so for the resting areas. At TEH, fewer nurses found the desks to be ergonomically appropriate (Table 4).

Laminate coating was the main tabletop material in all hospitals, and TIH received the highest number of positive evaluations regarding its comfort. In some doctors' rooms, the desks had light-colored, laminated metal legs; in others, the desks were made of dark, solid wood. In ÇH, many doctors and a good number of nurses were satisfied with the ergonomics of the chairs, as they offered adjustable height and features such as back, waist, and neck support. A moderate level of satisfaction was also observed among staff in TIH, UH, and ÇH.

Most doctors in ÇH, TEH, and TIH expressed satisfaction with the ergonomic design of their desks, whereas in UH, a notable portion of doctors reported dissatisfaction. Doctors mentioned standard desk dimensions, printer placement, and limited leg movement under-desk caissons as key issues. Across all hospitals, many doctors found the tables in the resting areas to be ergonomically satisfactory (Table 4).

In ÇH and TEH, a considerable number of nurses were satisfied with the coffee tables in the resting areas. However, satisfaction was noticeably lower in UH and TIH. The main concerns were that the tables were too small, too low, and had irregular shapes. They were selected for visual harmony rather than ergonomic suitability.

Table 4. Questionnaire percentage results for "ergonomic suitability of tables".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	-	-	-	-	-	-	17,4	21,7	-	4,8	10,5	18,4	-	14,3	16,7	20
D	25	25	38,5	38,5	15,4	23,1	17,4	10,9	14,3	19	39,5	52,6	42,9	28,6	33,3	40
ND	-	12,5	23,1	15,4	15,4	15,4	17,4	21,7	14,3	14,3	18,4	15,8	-	-	10	10
A	37,5	37,5	15,4	23,1	53,8	61,5	34,8	39,1	61,9	47,6	28,9	13,2	57,1	57,1	40	30
SA	37,5	25	23,1	23,1	15,4	-	13	6,5	9,5	14,3	2,6	-	-	-	-	-

Regarding the ergonomic suitability of workspace storage units, doctors in TIH gave the most positive feedback, followed by those in ÇH, UH, and TEH, with satisfaction levels varying across hospitals. Among nurses, satisfaction with storage unit ergonomics in ÇH and TEH was moderate (Table 5). When it came to the size and number of storage units in workspaces, doctors across hospitals expressed varying degrees of satisfaction, generally falling within a similar range (Table 6). A TEH doctor noted the need for an additional cabinet for personal items in outpatient clinics. Among nurses, those in ÇH and TEH reported greater satisfaction compared to their counterparts in TIH and UH. Supporting these results, UH nurses emphasized the need for closed storage to reduce infection risk, particularly for storing personal items and drinks.

Table 5. Questionnaire percentage results for "ergonomic suitability of the storage units".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	12,5	-	7,7	-	7,7	7,7	21,7	26,1	-	-	28,9	31,6	-	-	16,7	13,3
D	37,5	50	15,4	23,1	46,2	61,5	15,2	17,4	23,8	38,1	31,6	31,6	28,6	28,6	40	33,3
ND	-	12,5	30,8	38,5	7,7	7,7	10,9	13	9,5	9,5	23,7	18,4	28,6	42,9	30	26,7
A	25	12,5	23,1	15,4	23,1	15,4	43,5	39,1	57,1	42,9	15,8	18,4	42,9	28,6	13,3	26,7
SA	25	25	23,1	23,1	15,4	7,7	8,7	4,3	9,5	9,5	-	-	-	-	-	-

Table 6. Questionnaire percentage results for "adequacy of size and number of workspace storage units".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	12,5	12,5	7,7	7,7	-	-	21,7	23,9	9,5	4,8	18,4	21,1	-	-	13,3	20
D	37,5	37,5	15,4	15,4	30,8	46,2	15,2	19,6	14,3	33,3	31,6	42,1	28,6	28,6	30	26,7
ND	-	-	23,1	23,1	7,7	7,7	8,7	10,9	9,5	19	13,2	10,5	14,3	28,6	20	16,7
A	37,5	37,5	30,8	23,1	38,5	23,1	41,3	32,6	52,4	28,6	34,2	23,7	57,1	42,9	36,7	36,7
SA	12,5	12,5	23,1	30,8	23,1	23,1	13	13	14,3	14,3	2,6	2,6	-	-	-	-

In UH, one doctor emphasized that ergonomics was the most important furniture criterion. Another highlighted four key parameters—ergonomics, durability, visual appeal, and cleanability—noting that all are interconnected. He stressed that in hospital settings, easy-to-clean and body-compatible materials are essential for both hygiene and user health, while visual appeal affects psychological well-being. Durability was also seen as crucial for long-term usability and cost-effectiveness.

In healthcare interiors, meeting the needs of staff is as important as meeting those of patients. This supports staff efficiency, safety, and well-being in both work and rest. Survey and interview findings, along with existing literature, highlight that easily adjustable, ergonomically designed furniture can improve staff performance. Given the physical demands of medical and nursing work, musculoskeletal diseases are common. Beyond posture and prevention practices, environmental ergonomic factors play a significant role in the occurrence of work-related pain and illness among healthcare staff.

Leather seating is appropriate in hospitals where hygiene, durability, antibacterial properties, and easy maintenance are priorities. However, such materials may be perceived as visually and functionally

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uncomfortable in certain contexts due to limited fabric quality and color variety. Conversely, while fabric seating in resting areas may offer more visual comfort, it poses higher risks of infection and bacterial transmission.

The analysis can be summarized as follows:

- Comfort: Materials and colors affect spatial perception and functionality. When appropriately selected, they support activities. Laminate is effective for tabletops, balancing function and aesthetics.
- Ergonomics: Well-designed seating, tables, and workspace desks enhance staff efficiency, safety, and rest by addressing size and form.
- Storage: Staff need versatile storage units in both work and rest areas to accommodate institutional and personal items efficiently.

Key design recommendations emphasize that seating, tables, and work desks should be ergonomically designed to support posture, offer adjustability, and incorporate comfortable materials to reduce musculoskeletal problems and enhance staff well-being. Additionally, future furniture design should balance ergonomics, durability, aesthetics, and ease of cleaning to better support healthcare professionals.

Layout

Except for UH, more doctors than nurses found the furniture layout in all spaces functionally convenient. The proportions of positive and negative responses were similar for doctors and nurses (Table 7). Most of the ÇH doctors agreed that the furniture layout was appropriate for the functions, in contrast to the UH doctors.

The nurses' opinions about the furniture layout varied between hospitals. For all spaces, nearly half of UH nurses did not find the furniture layout appropriate, while a majority of TIH nurses found it inappropriate. UH nurses stated that they had no need for flexibility in furniture placements in their workplace, emphasizing that a fixed layout ensures order, supports habitual use, and enables quicker access to patients.

Table 7. Questionnaire percentage results for "appropriateness of furniture layout for the functions".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	12,5	12,5	-	-	7,7	23,1	23,9	30,4	-	4,8	13,2	21,1	14,3	14,3	13,3	13,3
D	-	12,5	38,5	30,8	23,1	7,7	8,7	21,7	14,3	4,8	52,6	57,9	28,6	28,6	30	33,3
ND	-	-	23,1	30,8	-	7,7	8,7	4,3	14,3	28,6	5,3	5,3	14,3	28,6	23,3	13,3

A	50	37,5	30,8	30,8	61,5	61,5	52,2	37	47,6	47,6	28,9	15,8	42,9	28,6	33,3	40
SA	37,5	37,5	7,7	7,7	7,7	-	6,5	6,5	23,8	14,3	-	-	-	-	-	-

Except in UH, more nurses than doctors perceived furniture density as high. In TIH, both groups reported lower density, suggesting better circulation compared to other hospitals. As shown in Table 8, more doctors in ÇH and UH reported high furniture density across all spaces. All ÇH nurses shared this view, whereas TIH nurses did not.

A ÇH nurse stated that workspaces were narrow, desks resembled secretarial counters, and space was insufficient for multiple users. She also emphasized the lack of a sink and storage, forcing her to place a medicine fridge in the break room. Similarly, a TEH nurse stated that the work desks were too small and the resting rooms too crowded, preventing all staff from sitting together. Many nurses at TEH and a significant portion at UH reported that the resting areas had a high density of furniture.

Table 8. Questionnaire percentage results for "appropriateness of density of furniture".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
SD	-	-	-	-	-	-	15,2	15,2	4,8	-	18,4	21,1	-	-	3,3	6,7
D	25	25	23,1	23,1	53,8	46,2	43,5	28,3	66,7	76,2	44,7	36,8	42,9	42,9	40	26,7
ND	37,5	37,5	30,8	38,5	15,4	7,7	8,7	6,5	19	19	13,2	10,5	-	14,3	16,7	20
A	37,5	37,5	23,1	15,4	23,1	30,8	21,7	34,8	9,5	4,8	18,4	21,1	42,9	28,6	30	33,3
SA	-	-	23,1	23,1	7,7	15,4	10,9	15,2	-	-	5,3	10,5	14,3	14,3	10	13,3

This study's findings reinforce that tailored furniture layouts and densities in healthcare environments are critical. Inappropriate placements impair social interaction and reduce staff's control over communication. Furniture should meet such needs rather than prioritize density and suitability.

The analysis can be summarized as follows:

- Functionality and Efficiency: Positive feedback highlights that effective layouts support operations. Conversely, some negative comments indicate workflow problems resulting from poor spatial arrangements.
- Social Interaction: Sociopetal setups enhance communication and satisfaction; sociofugal arrangements may hinder interaction and lower satisfaction.
- Flexibility and Adaptability: Feedback emphasizes the need for adaptable furniture to meet spatial and functional

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demands; lack of flexibility affects workflow, especially in treatment and storage areas.

- Density and Comfort: Perceptions vary; high density — particularly in nurses' stations— can hinder movement and reduce satisfaction and efficiency.

The design recommendations include promoting adaptable furniture arrangements for diverse healthcare spaces, addressing space limitations, visibility, and accessibility to essential amenities, and focusing on staff satisfaction, operational efficiency, and social dynamics. Future design should prioritize functionality, ergonomic comfort, and functionality to support varied workflows and improve care delivery quality.

Sensory qualities: Materials and colors

The participants were asked to match their expectations of the upholstery material of the seating elements with the adjectives (Table 9). The most frequently matched adjective for the seating elements used by doctors and nurses regarding all spaces was "simple". The least matched adjective for the upholstery material was "slippery". Among the adjectives questioned, the most preferred ones were "bright" for the TEH doctors' workspace, "slippery" for the TIH nurses' workspace, "textured" for the TEH doctors' resting space, and "patterned" for the UH doctors' resting space (Table 9).

Table 9. Questionnaire percentage results for "expectations of the upholstery material of the seating elements".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
bright	-	-	-	-	30,8	7,7	17,4	17,4	-	9,5	13,2	10,5	28,6	28,6	-	3,3
slippery	12,5	12,5	-	-.	-	-	-	-	9,5	9,5	15,8	10,5	-	-	6,7	
textured	37,5	12,5	15,4	23,1	30,8	53,8	28,3	30,4	19	38,1	28,9	34,2	14,3	-	40	26,7
patterned	-.	25	15,4	15,4	7,7	15,4	10,9	23,9	-	9,5	13,2	21,1	28,6	42,9	3,3	13,3
simple	87,5	75	69,2	61,5	61,5	30,8	69,6	54,3	85,7	47,6	55,3	50	57,1	57,1	70	73,3

For table surfaces, "patterned" was the most selected; "slippery" was the least. Among the adjectives questioned, the most preferred ones for "bright" were TEH doctors' resting space, "slippery" for the UH doctors' workspace, and "textured" for the TEH doctors' resting space (Table 10).

Table 10. Questionnaire percentage results for "expectations of the table surface materials".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
bright	25	25	15,4	15,4	30,8	38,5	34,8	37	4,8	14,3	21,1	15,8	14,3	14,3	13,3	13,3
slippery	12,5	12,5	-	-.	-	-	8,7	6,5	4,8	9,5	23,7	13,2	42,9	28,6	-	-
textured	25	12,5	15,4	23,1	30,8	30,8	19,6	17,4	4,8	9,5	13,2	26,3	14,3	14,3	13,3	10
patterned	50	75	76,9	69,2	69,2	53,8	71,7	71,7	95,2	81	65,8	63,2	71,4	85,7	83,3	86,7
simple	-	-	-	-	38,5	-	-	-	-	-	-	-	-	-	-	-

Participants chose the top three preferred colors for furniture based on the options in Tables 11 and 12. ÇH participants gave the clearest preferences in that the first color preference of most doctors for working and resting spaces was D141-Ash Gray, followed by A319-Maple and A415-Bianco. The majority of ÇH nurses preferred the workspaces A338-Venetian Walnut and A415-Bianco, followed by A339-Newish Oak and D140-Pebble, and D126-Cappuccino. For the resting spaces, the nurses most preferred A415-Bianco and D102-Beige, followed by D104-Ivory and D126-Cappuccino.

Table 11. Codes of wood colors.

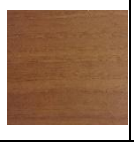
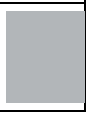
A319 Maple	A338 Venetian Walnut	A339 Newish Oak	A348 Ihlara	A402 Natural Oak	A412 Arcadia	A415 Bianco
						

Table 12. Codes of solid colors.

D102 Beige	D104 Ivory	D108 Blue	D120 Pink	D125 Candy Pink	D126 Cappuccino	D129 White Lacquer	D135 Verde	D140 Pebble	D141 Ash Gray
									

These findings underscore the importance of varied material surfaces and colors for furniture elements within hospital environments. Effective healthcare interior design relies on the integration of materials and colors that support both functional needs and sensory experiences. Doctors and nurses typically favor plain upholstery for seating elements but show a preference for patterned materials for tables. Slippery materials are seldom preferred for either seating or tables. In terms of colors, hospital staff generally gravitate

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towards neutral hues like creams and browns across all spaces, although staff at UH exhibit a preference for candy pink, pink, and blue tones. These preferences highlight a balance sought by hospital staff between functionality and aesthetic appeal in material choices.

The analysis can be summarized as follows:

- Functional Materials Selection: Upholstery and table surface preferences reflect a desire for simplicity and patterned textures, emphasizing practicality and ease of maintenance. Materials should balance aesthetic appeal with functionality to support healthcare activities and patient comfort.
- Color Psychology and Mood Enhancement: Healthcare interiors should consider color choices carefully to create environments conducive to relaxation and stress reduction while avoiding stimulating colors.
- Adaptive Design Choices: Upholstery preferences indicate a need for comfort and privacy, crucial for patient and staff satisfaction.

The design recommendations include using calming colors and durable and easy-to-maintain materials, enhancing safety and privacy, and promoting adaptability and evidence-based practices to support effective and comforting care environments.

Psycho-social Attributes

The psycho-social attributes of work and rest environments are essential for supporting staff satisfaction, identity, and performance. Drawing on questionnaire results and interviews, the findings emphasize that designed interiors contribute not only to physical comfort but also to psychological security, motivation, and a sense of ownership in the workplace.

Belonging/personalization

To evaluate sense of belonging in their working and resting spaces, the participants responded to positive-negative adjective pairs (Table 13). The effect of warmth was evaluated for seating elements, table materials, and furniture color. UH doctors most frequently rated the seating elements in their workspaces as warm, while fewer nurses in TEH and UH did so. Regarding the seating elements in the resting spaces, a larger proportion of UH doctors and nurses rated them as warmer than in the other hospitals. Regarding the table materials, doctors in TEH and ÇH were most likely to rate the workspace as warm. Nurses in ÇH mostly like to evaluate their workspace desk materials as warm. A UH doctor emphasized the importance of furniture material for a sense of belonging: “It is definitely effective in adopting bad materials, but the materials are of a normal standard; the standards in recent years are suitable for the working environment.” Regarding the warmth of furniture colors, the largest proportion of positive ratings was in ÇH. Regarding the sense of belonging, ÇH nurse stated that she prefers an

atmosphere close to the home environment, which the hospital can create through the colors and textiles used.

Table 13. Questionnaire percentage results for "the effect of surface materials of the sitting units".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
warm	12,5	25	15,4	15,4	23,1	30,8	19,6	19,6	14,3	9,5	2,6	2,6	28,6	57,1	16,7	20
cool	12,5	25	-	-	23,1	23,1	4,3	4,3	28,6	14,3	15,8	15,8	-	-	16,7	20
comfortable	87,5	75	61,5	53,8	53,8	69,2	50	54,3	47,6	76,2	34,2	42,1	42,9	42,9	33,3	53,3
uncomfortable	-	-	23,1	23,1	23,1	23,1	47,8	41,3	14,3	4,8	63,2	52,6	57,1	42,9	43,3	30
hygenic	37,5	37,5	15,4	15,4	30,8	7,7	19,6	15,2	23,8	14,3	10,5	5,3	14,3	14,3	3,3	10
unhygenic	-	-	7,7	7,7	7,7	7,7	32,6	30,4	4,8	-	18,4	23,7	28,6	28,6	13,3	6,7
aesthetic	50	50	7,7	15,4	23,1	23,1	30,4	30,4	14,3	19	5,3	2,6	14,3	28,6	10	23,3
unaesthetic	25	37,5	30,8	30,8	38,5	38,5	41,3	34,8	28,6	23,8	42,1	39,5	42,9	28,6	33,3	20

For seating material hygiene, the largest proportion of positive responses among doctors was in ÇH for the working and resting spaces. For nurses, it was in TEH for the workspace and in ÇH and in TEH for the resting space. Regarding table material hygiene, the largest proportion of positive evaluations among doctors was in TEH for working and resting. For nurses, it was in ÇH. In terms of the aesthetics of the seating elements, ÇH had the highest proportions of positive responses among doctors for the working and resting spaces, whereas TEH had the largest proportions among nurses for the working and resting spaces.

Regarding the relaxing effect of furniture colors, ÇH had the largest proportion of positive responses for all spaces for doctors and nurses. The relaxing effect of the table materials and the proportions of positive responses were similar for all spaces.

One of the TEH nurses stated that this hospital had the strongest feeling of belonging among those she had worked at and how she feels at home, which significantly affects her work performance. She stated that modular furniture allows for different uses, while sliding door systems in the drug preparation room would reduce space loss.

One of the TEH doctors stated that the furniture followed standard designs in state hospitals and that it was not possible to personalize it by arranging the room according to his needs, such as a refrigerator, coffee machine, and glasses. Another doctor at TEH said that the furniture in the workspaces provided a sense of belonging to the place. Similarly, among nurses, one UH nurse felt a sense of belonging in the workspace: "I feel like I have my own workspace. Of course, I live there."

Regarding seating materials, the participants did not prefer leather in their working and resting spaces, although it feels hygienic. Although

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the same material (PVC-coated wood) was used in all four hospitals, the light surface colors (maple, etc.) of the table materials gave doctors and nurses a sense of warmth, hygiene, and relaxation. Thus, the light-dark balance of furniture colors must be well-adjusted. Doctors and nurses found their working and resting spaces more spacious, light, and hygienic if light tones were used. Regarding the furniture plan layout, doctors found their workspaces more spacious and relaxing if the part for examining patients was screened off by a vertical separator.

The findings support the literature in that user and space are in a connection emotionally and functionally. Only if the psycho-social and physical needs are met could it be possible to talk about personalization in a space. The adjectives that the study determines as a holistic approach (physical and psycho-social) can give personalization to a space. As revealed from the findings, healthcare staff prefer warm colors for seating elements in terms of personalization in their working and resting areas. When it comes to the table surface, the healthcare staff evaluates lighter colors more personally. They claim that the standard can meet physical needs, but it is not enough for psycho-social needs.

The analysis can be summarized as follows:

- Color Effect: Light colors on tables and warm colors on seating elements make people feel more warmth and are preferred by healthcare staff in the sense of belonging.
- Workspace Personalization: However, the standards define many elements in a healthcare environment, and staff needs more control capability for expressing more of their self-identity.

The design recommendations include supporting staff identity through diverse preferences, using clean-looking surfaces to enhance hygiene and belonging, and balancing spatial elements to foster personalization.

Privacy/control

Regarding the role of the furniture layout in defining borders, nearly half of TEH and UH doctors responded positively about the workspaces, most of UH doctors for the resting space, and nearly half of TIH nurses for the working and resting spaces, respectively (Table 14).

Table 14. Questionnaire percentage results for "the role of the furniture layout in defining borders".

	ÇH				TEH				TIH				UH			
	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR	DW	DR	NW	NR
Border	12,5	12,5	30,8	30,8	46,2	30,8	32,6	37	28,6	23,8	44,7	47,4	42,9	71,4	23,3	33,3

One of the ÇH doctors said that the table created a border between doctor and patient, and this formal arrangement helps in being taken seriously by the patient. The ÇH chief physician stated that he did not prefer furniture to create borders and that he was not bothered by close

contact with people due to his working style and habits. One ÇH nurse stated that the slightly higher work desk is suitable for one-to-one meetings with patients, while another nurse found a desk at table height problematic as it allows direct contact with patients or their relatives.

TEH Deputy Chief Physician reported feeling discomfort because the furniture arrangement in his study room meant that personnel bringing documents could come directly to him and see the computer screen. TIH Deputy Chief Physician stated that the border function of the furniture is important, that he wanted to see the door from where he sits, and that he saw the table as a protective element. TIH nurses stated that they were satisfied with the height of the work desk and were not disturbed by it, as patient contact was necessary.

The UH Chief Physician thought that the furniture arrangement is important for security and borders. He said that the table should be a border between him and the patient, but in its current position, patients can approach his individual space.

One of the UH doctors stated that a wide table creates a border between doctor and patient. An UH nurse said placing the counter in the workspace corner creates a border by preventing patients from approaching. Doctors preferred a vertical divider to separate the patient examination area. A TEH doctor stated that, "I would like a curtain while I examine. It is a desired limit. But if there is no patient, I definitely open the curtain, because the place becomes spacious."

It could be possible to evaluate from the interview data that some healthcare staff perceive the term "border" positively regarding security and privacy, whereas others do not. As mentioned in the literature, the space reinforces the privacy effect while creating a personal zone for people. The former believe that their work desks create a positive border between them and the patients, and some require these tables to be of optimal height and width for efficient working, given the role of the work desk in direct contact with patients. The participants' concerns about borders in their workspace were ensuring privacy for them and the patient.

The analysis can be summarized as follows:

- The border is perceived mostly positively by the healthcare staff: the healthcare staff, especially nurses, prefer more height in nurse desks for controlling their privacy.
- Furniture size, dimensions, and layout are important parameters for providing borders. The corners, the width, or the length of the table can be a critical piece of furniture for controlling healthcare staff's borders.
- Staff generally express a preference for boundaries with patients: Doctors and nurses emphasize the role of furniture in creating separation between themselves and patients.

The design recommendations include ensuring doctor privacy by positioning tables to block patient views of screens and designing nurse

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desk heights to limit excessive direct contact while maintaining effective communication.

CONCLUSION

As our understanding of architecture expands, we recognize the responsibility of designers to promote individual well-being. As reported in the literature and hypothesized in the present study, enhancing the physical and psycho-social attributes of furniture in the hospital working and resting spaces of doctors and nurses can increase their spatial satisfaction. The study's findings thus fill an important gap in knowledge regarding the interior design factors that influence their physical and mental health and raise awareness about using interior design to create healthy, safe, and comfortable hospital environments.

From a spatial perspective, the study underscores the importance of furniture selection and adaptable layouts in creating efficient healthcare environments. The study also highlights unit-specific challenges, such as the difficulty of achieving privacy in shared staff rooms, the impact of noise in high-traffic areas, and the lack of spatial personalization options in standardized hospital settings. From a psycho-social perspective, the study findings indicate that well-designed hospital spaces help reduce stress, fatigue, and emotional exhaustion of healthcare staff by promoting a sense of control, privacy, and personalization.

The research and analysis conducted in the field study demonstrated that the four components of the methodology (literature review, field trips, structured questionnaires, and semi-structured interviews) complemented each other, emphasizing the importance of considering the needs of healthcare staff and highlighting furniture design as a crucial element influencing user satisfaction in healthcare interiors.

Previous research strongly suggests that the interiors of well-designed healthcare facilities have a positive and curative effect on staff and patients; therefore, it should be addressed comprehensively. The conclusions of this study can be transformed into criteria to guide the design of healthcare staff spaces, which will greatly benefit health administrators, healthcare staff, other decision-makers, and individuals in the healthcare industry, as well as designers and design students. In short, the study findings will increase awareness of the significance of design quality in healthcare working and resting environments.

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