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Editorial

Mehmet Topçu (Editor in-Chief)

JOURNAL of DESIGN for RESILIENCE in ARCHITECTURE and PLANNING (DRArch) has published Volume 4 Issue 2. DRArch commenced its publication journey with enthusiasm and clear goals. The journal is swiftly progressing within its own dynamics. The received feedback demonstrates that it's not only us who believe in DRArch, but also the scientific community. We are receiving messages from academics who are willing to join our editorial board or become reviewers for our journal. The articles in In the Volume 4 Issue 2 primarily consists of theoretical studies.

The first article is written by Ertuğ Erpek and Esin Kömez Dağlıoğlu. The title of this article is "The Oblique Function Theory in search of a dynamic and fluid urban morphology". The aim of this study is to examine the postmodernist urban topo-morphological approaches, which developed in parallel with the French typo-morphological method influenced by the Italian school and the urban space perception studies of Gordon Cullen and Kevin Lynch through the Oblique Function Theory. Another interesting paper deals with theory titled as "An overview of fringe belt literature through studies from different perspectives" by comes from Ezgi Küçük Çalışkan. This study focuses on how the fringe belt concept, which emerged within the Conzenian tradition of urban morphology turn into a phenomenon, has been handled from the time it first appeared to the present, to examine the contribution of different perspectives to the fringe belt literature and to present suggestions for the development of the concept. Further research proposals are emphasized in order to realize the fringe belt phenomenon as durable and sustainable urban spaces. The article titled as "Conceptual analysis of livable cities in the context of Ted Talks" written by Nur Yılmaz and Gamze Atay. The aim of the study is to develop a different perspective by revealing the measurability of more livable and happier cities and the criteria they contain through discussions and discourses on this subject. In this context, the TED platform, which is easily accessible by large masses today and popular in terms of social awareness, has been used. The content of 65 texts focusing on urban research in TED Talks between 2007 and 2023 has been analyzed and a conceptual analysis has been made through NVivo, a qualitative analysis program. Didem Günes Yılmaz's paper "Nature-based Solutions for climate-resilient cities: A proposal of a model for successful implementation" conducts a literature review to lay out the current debates and to highlight the multidimensionality of Nature-based Solutions (NbS). The paper attempted to frame the NbS clearer for scholars interested in the subject. The fascinating piece of work comes from Aytaç Taşkın and F.Duyfu Saban with the article titled "Swallowed by the urbanization: Spatial evolution of Adana Bağlarbaşı District". This study is about vineyard (Turkish: bağ) culture a common urban phenomenon in Çukurova region communities, which have strong ties with the land, due to the favorable climate and soil conditions. The aim of the study is to make a morphological analysis of the transformation of the three neighborhoods formed in Adana where the vineyards, which previously had a rural settlement texture, disappeared as a result of the urbanization pressure that started in the 1950s, starting from 1950 to the present day, and to examine the process dynamics and to determine the general characteristics of the vineyard culture and houses in the study area. Navid Khaleghimoghaddam claims that healthcare facility design can design better regarding effective therapeutic settings by investigating the effects of color and light on human wellness. The article title as "Understanding the interplay of light, color, and interior design in healthcare spaces" investigates the notion of color and light, then explains their impact on physical and mental health disorders, as well as their use in therapeutic settings. The study concludes with the creation of a conceptual model and recommended design solutions for healthcare facilities. The design of an industrial building plays an important role in determining the productivity, efficiency and safety of the facility. Ürün Biçer and Rana Ayça Derviş focused on material selection that has been evaluated as a critical factor in architectural design of industrial-energy facilities. The paper titled as "An approach for the material selection and use in industrial-energy facilities" present a scientific approach to material selection that considers sustainability, performance, and aesthetics criteria. In this context, the aim of the study is to reveal the architectural features, commonly used materials and material

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selection criteria of industrial-energy facilities by determining them through theoretical knowledge, analysis, observation and professional experience.

We believe in the strong relationship between the concept of resilience and education, which is necessary when designing the places, cities, and lives of our future. That is why DrArch try to take place to education in every issue. The article on education in this issue came from Konya Technical University Faculty of Architecture and Design, Department of Architecture. Melih Kurnalı and Ceyhun Şekerci focused on disconnection between academia and the professional process in their article called “Evaluation of an alternative approach to increase productivity in architecture project studios through student projects”. The aim of this study is to discuss the relation between professional life and educational process. We hope this research will be useful to designer and educator.

I would like to extend my deepest gratitude to all participants and all our readers for the support they provide to the Journal. And I would like to a special thanks to the referees. We look forward to your comments, contributions, suggestions, and criticisms.

Best regards...

Following names that provided valuable contribution as referees of articles in this issue are:

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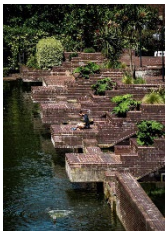

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DRArch's objectives are:

- to question how future building technologies are revolutionizing architectural design, city planning, urban design, landscape design, industrial design, interior design and education,

- to catalyze the processes that lean on interdisciplinary and collaborative design thinking, creating a resilient thinking culture,

- to improve the quality of built environment through encouraging greater sharing of academicians, analysts and specialists to share their experience and answer for issues in various areas, which distributes top-level work,

- to discover role of the designers and design disciplines -architecture, city planning, urban design, landscape design, industrial design, interior design, education and art in creating building and urban resilience,

- to retrofit the existing urban fabric to produce resilience appears and to support making and using technology within the building arts,

- to discuss academic issue about the digital life and its built-up environments, internet of space, digital in architecture, digital data in design, digital fabrication, software development in architecture, photogrammetry software, information technology in architecture, Archi-Walks, virtual design, cyber space, experiences through simulations, 3D technology in design, robotic construction, digital fabrication, parametric design and architecture, Building Information Management (BIM), extraterrestrial architecture, , artificial intelligence (AI) systems, Energy efficiency in buildings, digitization of human, the digitization of the construction, manufacturing, collaborative design, design integration, the accessibility of mobile devices and sensors, augmented reality apps, and GPS, emerging materials, new constructions techniques,

-to express new technology in architecture and planning for parametric urban design, real estate development and design, parametric smart planning (PSP), more human-centered products, sustainable development, sustainable cities, smart cities, vertical cities, urban morphology, urban aesthetics and townscape, urban structure and form, urban transformation, local and regional identity, design control and guidance, property development, practice and implementation.

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Editorial Team

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Research Article
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The Oblique Function Theory in search of a dynamic and fluid urban morphology

Ertuğ Erpek*
Esin Kömez Dağlıoğlu**

Abstract

Today's cities are dynamic nodes where copious urban flows intersect. These flows have distinguished characteristics: the flow of money, the flow of vehicles, the flow of people who migrate, and the flow of information. The flows' amalgamation, intersection, and conflict form contemporary urban configuration and space. Many methods, such as historico-geographical, process typological, and space syntax in urban morphology studies, aspire to analyze, discuss, and design these flows. These, which have been practiced in English, Italian and French schools in Europe since the 1960s, have allowed the development of different research methodologies in the search for urban form. The article examines the postmodernist urban topo-morphological approaches, which developed in parallel with the French typo-morphological method influenced by the Italian school and the urban space perception studies of Gordon Cullen and Kevin Lynch through the Oblique Function Theory. In order to go beyond the Cartesian urban plan analysis of typo-morphological methodologies, topo-morphological approaches reexamine flows with paradigms of urban topological surface, fluid and dynamic morphologies, and architecture-landscape-infrastructure integrity. The Oblique Function Theory was theorized by architect Claude Parent and philosopher and urban theorist Paul Virilio in 1963 under the *Architecture Principe* group as an example of these approaches. Parent and Virilio use and utilize inclined surfaces, rejecting archetypal spatial components such as columns, walls, and roofs. The duo with inclined surfaces extrapolates the concepts of habitable circulation, mediated structure, fluid, and dynamic form in their projects with a topological perspective. Through urban sections rather than urban plans, form a topological and oblique urban order dominated and ushered by flows. The paper discusses Parent's oblique projects: *Les Inclisites* in 1968; *Les Ponts Urbains* in 1971; and *Incision Urbaine* in the 2000s, obtained from slightly researched archival materials and drawings to argue whether contemporary urban dynamics and flows would possibly create a contemporary urban morphology methodology and sui generis tropes with topo-morphological approaches.

Keywords: dynamic form, fluid morphology, the oblique function theory, topology, urban section

*(Corresponding author), Research Assist. Middle East Technical University, Ankara, Türkiye, eerpek@metu.edu.tr
**Assoc. Dr. Middle East Technical University, Ankara, Türkiye, komez@metu.edu.tr

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****The manuscript is an improved and English-translated version of the conference paper presented in "IV. Kentsel Morfoloji Sempozyumu: Morfolojinin Evrimi Geçmişten Geleceğe, Teoriden Pratiğe" and published in the same conference's proceedings under the title "Dinamik ve Akışkan bir Kentsel Form Arayışında Oblik İşlev Teorisi." The manuscript is produced by Ertuğ Erpek from his ongoing master's dissertation, entitled "Unfolding the Oblique Architecture's Trajectory and Archaeologies" at Middle East Technical University, Department of Architecture, under the supervision of Assoc. Prof. Dr. Esin Kömez Dağlıoğlu.*

1. Introduction

Architect Michael Weinstock (2013) denotes today's cities as living organisms having metabolism. Every living organism needs circulatory systems with different functions and is structured due to their relationships with each other. The primary factor that defines circulatory systems is their unceasing flows. In urban discourse, these are; the flow of money due to the emanation of economic models to the globalized world, the flow of vehicles with the developments in transportation infrastructures, the flow of people who have migrated due to war, education, hunger, and financial difficulties to reach a better life, and the flow of information with the proliferation of mass media. In urban space, these flows establish social, cultural, political, and economic linkages between the city's actors by perpetually colliding, overlapping, and intersecting. Urban space not solely contains these flows within itself but also creates itself with their interweaved and connected nexus. It is possible to underline a reciprocal interaction here. Flows constantly alter, develop, and perhaps even destroy spaces; meanwhile, spaces do the same to flows. Sociologist Manuel Castells (1996) defines this process as the emergence of the space of flows and states that they substitute traditional spaces. One can incorporate continuity, density, stratification, and complexity among the concepts that space of flows introduces to the urban discourse and practice. Space of flows has led to changes in urban morphological and typo-morphological studies and quintessential urban form generation practices. The morphogenetic, historico-geographical approach and process typological approach developed in the British, Italian, and French schools in Europe from the 1960s onwards aimed to investigate, predict and design the traces of different flow qualities in urban morphology, rendering that rationalist planning and modernist architectural practices were insufficient to understand the living fabric, context, and circulation systems of the urban and to offer new proposals against this (Moudon, 1997; Ünlü & Baş, 2015; Oliveira, 2016; Bilsel, 2018).

The paper aims to unveil, analyze and discuss the potentials of the postmodernist urban topological approaches (Busbea, 2007), which were developed and theorized in parallel to the new typo-morphological movement foregrounded by the Versailles School of Architecture in France in the 1960s, a paradigm influenced by the typo-morphological studies of Italian architects Saverio Muratori, Carlo Aymonino, and Aldo Rossi, and the studies of urban designers Gordon Cullen and Kevin Lynch in the perception of urban space, in producing dynamic and fluid urban forms through the Oblique Function Theory (*La Théorie de la Fonction Oblique*). Topological approaches, as an understudied aspect of the French school, engages with the effects of multilayered flows on the urban space and the formal proposals that urban architecture can produce against the 1960s context in modern French cities, notably in Paris, characterized by social upheavals such as the 1968 student movements, overpopulation, post-industrial restructurings, post-war ideological interventions in-between Communism and Capitalism, and technological developments. Unlike the typo-morphological understanding, the 'topo-morphological' approaches support that the flows per se create a topological urban form rather than being constructed and configured around type and typology. Lefebvre (1991, p.93) demystifies the differentiation of conventional building types and urban forms under urban flows through the house analogy. According to him, due to different flows and infrastructures - electricity, water, natural gas, telecommunications, and the like - the house dissolves and instantiates a nodal crux that hosts complex mobilities instead of static imagery. In this context, the topological approach aims to design contemporary cities by concretizing flows by analyzing and referring to existing ones in cities rather than urban typological compositions brought by horizontal and vertical architectures. The article examines the Oblique Function Theory and its suggested urban morphology, which was one of the topological approaches in France in the 1960s, theorized by architect Claude Parent and philosopher and urban theorist Paul Virilio under the *Architecture Principe* group between 1963-1968 and then developed by Parent until he died in 2016. While doing so, it perlustrates the new urban order offered with the inclined planes by examining the archival drawings of Parent's projects; *Les Inclisites*, 1968; Les *Ponts Urbains*, 1971; and *Incision Urbaine*, produced in the 2000s. The paper will critically and

interpretively scrutinize the urban potential of this scantly studied and published urban layout to bring contemporary methods and design proposals to urban morphology studies.

2. Methodology

The paper adopts a qualitative historical approach, critically analyzing and engaging with archival materials on the Oblique Function Theory and Parent's oblique projects to propose a novel topo-morphological framework for the present and future urban morphological studies configured by urban flows. By examining distinguished oblique outputs from different periods through diagrammatic abstractions and textual interpretations, the paper aspires to elucidate how the urban proposals against the urban transformations that unfolded during the 1960s have formulated and materialized underlying concepts such as topology, space of flows, connectivity, fluidity, and flexibility, are still vital and valid for the contemporary urban context. Rather than solely relying on the Oblique Function Theory's extrapolations on these phenomena, the paper cross-pollinates them with other tropes of paradigms, such as landscape urbanism, to offer a more comprehensive, responsive, adaptive approach and yet more connected to the current urban morphological discussions. Ultimately, it aspires to constitute a topo-morphological alternative trajectory for urban studies, requiring elaborate research to redefine urban morphology's scope and objectives under further perlustrations.

3. The Oblique Function Theory: Proposing a Third Urban Morphology

The Oblique Function Theory began to be developed in 1963 under the *Architecture Principe* group, founded by the French architect Claude Parent and the philosopher and urban theorist Paul Virilio. The group explicates the theory's starting point, scope, and objectives in the eponymous manifesto magazine in 1966, with nine issues addressing and tackling specific subjects. The issues correlate with Parent's 'critical modernity' and Virilio's 'bunker archaeology' to form the basis of the Oblique Function Theory (Lucan, 1996; Redhead, 2011; Giovannini, 2021). Parent formulates the former by criticizing Rationalism at the *École des Beaux-Arts*, the school where he studied before forming the group, and the Modernism of Le Corbusier, under whom he worked as an architect in his office. Meanwhile, Virilio extrapolates upon the latter by scrutinizing the bunker ruins from World War II along Atlantic Wall. In the manifesto magazine, Parent and Virilio (1997) argue that the epoch's pre-industrial horizontal and industrial vertical cities are ineffective against the contemporary configurations, necessities, and transformations defined by flows, suggesting that a 'third urban order' on oblique is urgently needed. Horizontal cities, which existed before vertical cities, were insufficient to respond to the complexity of urban flows, and this has been known for decades since many urban and architectural projects were proposed to save the day, according to Parent (2023b, p.13). He states that the urban interventions within the scope of the *Renovation de Paris* project, implemented by Haussmann in the pre-industrial city of Paris between 1853-1870, temporarily shelved the problems of the urban arising from the flows. However, the horizontal urban form ultimately failed in the end. Against the failure of horizontality, Parent and Virilio (1996, p.65) underline that the vertical architecture that came with industrialization emerged as a solution. As seen in the examples of Chicago and New York dating from the 1880s to the present, and in Le Corbusier's (1987) projects in *The City of To-morrow and Its Planning*, these approaches, according to them, instead of actualizing around the flows on the urban surface and integrating them with the habitation, draws a definite barrier between urban circulation and dwelling, inevitably creating 'microghettos.' Parent (2023a), by defining these barriers with the analogies of 'wall' (*le mur*) and the spaces they make with 'enclave' (*l'enclos)*, criticizes the paradox that this obsolete urban approach brings, contradicting the novel urban order delineated with concepts such as fluidity, continuity, mobility, and dynamism.

According to Parent and Virilio (1996), as seen in the topological approaches of the period, flows should be considered in the context of 'Structuralism' and seek a flexible, variable, evolutionary, and open built environment (Armand & Drancourt, 1961, p.20, cited in Busbea,2007). However, Parent and Virilio (1996, p.69) also state that while shaping with this understanding, urban

architecture can become excessively 'neutral and undetermined,' leading to dissolution within flows and, at the denouement, losing its autonomous form (Busbea, 2007, p.153). Instead of considering this contradictory situation as a dialectic, Parent and Virilio take the issue similar to the 'diptych' theory, a topological approach of architects Peter Eisenman and Miroslava Brooks (2015). By reformulating the contemporary condition around circulation and habitation, which can be integrative while remaining autonomous, the duo describes and engages with the contemporary encounter between flows and the built environment by amalgamating these topologically. With the conceptual proposal called 'habitable circulation' (*circulation habitable*), their theory embraces an active and mobile understanding that breaks the strict barriers and directionalities created by Euclidean urban and architectural forms, blending the static and neutral state of habitation with the circulatory flows of urban dynamics. Architectural theorist Lee Stickells (2010, p.47) claims this intervention encourages the flows, establishing an 'activated surface' that 'promotes productive, informal interactions and events.' Parent and Virilio utilize ramps, or inclined surfaces, as they put forward, that act as a connector between horizontal and vertical forms to achieve habitable circulation and a living ground. Doing so, they reinvent the means of creating urban and architectural form – the urban tissue on a smaller scale and the archetypal elements such as floors, columns, and walls on a larger scale – with 'inclined topotonic surfaces' (Migayrou, 1996, p.59; Parent & Virilio, 1996, p.71). These surfaces come together and form 'mediated structures,' aiming 'to multiply the usable surface' radically (Lucan, 1996, p.5), providing interaction, integration, and exchange between the habitation and circulation. According to Parent and Virilio (1996), the urban form and its spaces of flow should be organized with these structures, producing new urbanization and urban morphology practices. Inclined surfaces and their mediator role make it impossible for the user to remain neutral as they fall between the horizontal and vertical directions. Parent (2023b) demonstrates that people walking on an inclined surface must choose between descending or ascending; therefore, they are always in a decisive state of conscious thinking. They cannot remain static, inert, and passive. With this feature, dubbed as *potentialisme*, 'potential change,' people are perpetually in motion, changing their position and perspective, meanwhile transforming the space they are in with their perception (Parent, 2023b, p.23). The perception also triggers resistance and prevents the urban and architectural form from being lost in indecision and uncertainty in urban flows, inhibiting the person from being indifferent to these forms (Parent & Virilio, 1996, p.67). Gestalt psychology and Merleau Ponty's (1962) paradigms of the phenomenology of perception explain this approach (Parent & Virilio, 1996). The Oblique Function Theory exemplifies the immanence of urban perception on morphology from a different perspective through building forms, referencing Cullen and Lynch and the typo-morphological approaches in France in 1960.

In 1968, the *Architecture Principe* group disbanded due to political and social dissidence among the actors caused by the student movements; in the aftermath, Virilio ended his study and interest in the Oblique Function Theory. Parent, however, continued to develop the theory and produce new oblique projects until he died in 2016. In his works such as 'Living Obliquely' (*Vivre à l'oblique*, 1970), 'Interlacing of the Oblique' (*Entrelacs de l'oblique*, 1981), 'Wandering in Illusion' (*Errer dans l'illusion*, 2003) and many others, he further explores the theoretical development and design process of the fluid and dynamic forms that the Oblique Function Theory brings to urban and architectural morphology through diagrammatic and conceptual drawings. Architectural theorist André Bideau (2002, p.70) points out that Parent reformulates the flows between 'housing, city, infrastructure, and territory,' demonstrating how a topological approach can be applied to new cities. Parallel to the manifesto of oblique function developed by *Architecture Principe* between 1963 and 1968, Parent (2023a, p.95) proposes that twelve topological and subversive actions can dodge the problematic order imposed by contemporary urban systems. These are, respectively: 'to open the imaginary; to operate in illusion; to dislodge the immobile; to think continuity; to surf on the surface; to live in obliqueness; to destabilize; to use the fall; to fracture; to practice inversion; to orchestrate conflict and to limit without closing.' The Oblique Function Theory has influenced many contemporary urban and architectural spheres with its proposals in this context. The tropes

of 'hybrid and fluid morphologies' and 'variable and flexible programming of the urban surface' (Angélil & Klingmann, 1999; Wall, 1999), which landscape urbanism emphasized in the early 21st century, stand out as contemporary and advanced examples of the morphological approach that the Oblique Function Theory tries to achieve. In addition, Deleuze's (1993) topological and the fold concepts, predominantly used within the scope of parametric urbanism in the search for urban and architectural form with the development of digital tools, are also reflections of the Oblique Function Theory.

4. The Oblique Interpretation of Urban Form: *Les Inclisites* (1968), *Les Ponts Urbains* (1971) and, *Incision Urbaine* (2000s) Projects

One can imply that Parent redesigns the fluid and dynamic urban form of the Oblique Function Theory with project drawings by considering and predicting the transformations of 'urban tissue, natural context, street system, plot system, and building system,' which urban researcher Vitor Oliveira (2016) defines as the fundamental urban components with 'different resolution' (Kropf, 1996). Instead of bringing niche oblique designs to existing cities that burgeon from the context, the projects use the urban flows as a design input to propose a new city. Parent's intention with these proposals resembles influential topological approaches of the epoch, such as Archigram's *Plug-in City* (Busbea, 2007). *Les Inclisites*, 1968; *Les Ponts Urbains*, 1971; and *Incision Urbaine*, 2000s, projects primarily configured by the principle of 'habitable circulation' can be examined with a morphological framework through the morphological evolutionary change of the aforementioned urban components.

Firstly, in the archival drawings of *Les Inclisites*, 1968 (Figure 1), which was unrealized, Parent, with the contribution of Virilio, reproduces an 'oblique dwelling module' in different variations and sizes to obtain an adaptive urban tissue and interaction network (FRAC Center Archives). Indeed, this application is similar to the typo-morphological approaches of the period. Modules are hexagonal, and their derivatives, allowing different inclinations on both sides. The top of the hexagon is a horizontal surface connecting the two inclined surfaces, described by Parent and Virilio as the 'recovery threshold' (FRAC Center Archives). The topological urban form generated by the amalgamation of these surfaces aspires for continuity, connectedness, and fluidity. Parent and Virilio (1996, p.67) emphasize that 'existing modern cities fail to accommodate any flows including migration, energy, and industrial, even the forces of nature' since they do not encourage flow and as an ineluctable result: 'the movement becomes an agent of our cities destruction.' The fluid form obtained with *Les Inclisites* is therefore applied as an extension of topologically active landforms such as mountains and valleys, where the flow of the natural context is felt most intensely. As mentioned earlier, creating a 'mediated structure' is one of the most critical concerns of the inclined surface. The 'mediated structure' approach is achieved by leaving the upper surface of the modules and resulting urban tissue as a 'free circulation area' to integrate the street, that is, the circulation system of the *Les Inclisites* project, with the dwellings. Parent (2023b, p.47) illuminates this upper surface as 'a living surface that contains elements that provide light and ventilation, along with public usages where meeting, social cohesion, and community life will continue by fostering activities,' while the bottom of this surface works as a 'lower surface,' ensuring the 'isolation of private spaces.' This open and flexible approach, which architect Esen Gökçe Özdamar (2022, p.50) associates with 'polyvalent spatiality,' -a concept first theorized by Herman Hertzberger- emphasizes that form can fulfill the most optimal functional requirements with minimum change. However, Parent (2023a, p.35) underlines that open form is not extrapolated enough in cities due to the 'right to ownership' in urban practices prevailing from the past to the present, and thus, there is an intuitive need to limit the land with walls to define the plot, permanently disrupting the continuity and fluidity in recent urban proposals. These boundaries become hierarchical structures that restrictively form plots and building systems in urban layouts. With *Les Inclisites*, Parent and Virilio espouse that these boundaries can be established not as barriers but as fractures in the urban form, differentiating the upper surface from the lower surface with a diptych execution. In that

sense, a continuous but heterogeneous set of systems is conceived, paralleling topological approaches.

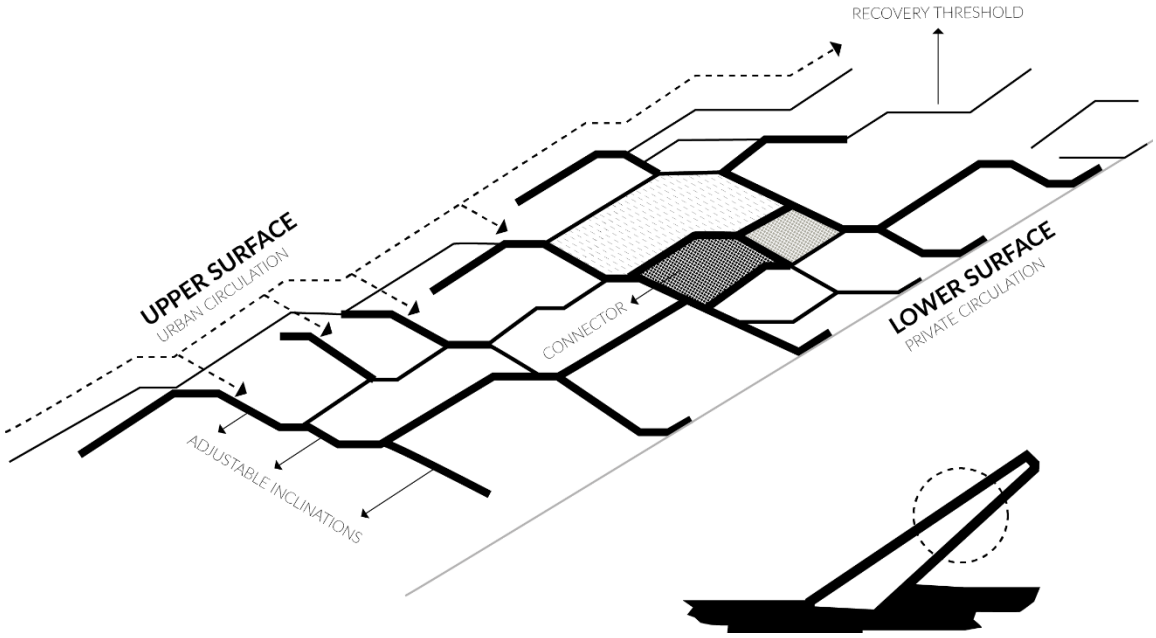

Figure 1 *Les Inclisites*, 1968, urban form diagram; created by authors from Claude Parent's archival drawings

In *Les Ponts Urbains*,1971 (Figure 2), meaning the 'Urban Bridge,' Parent, with a different starting point from *Les Inclisites*, transforms the bridge itself, one of the distinctive morphological infrastructure elements of urban flow, into an urban tissue with inclined surfaces. In many of his oblique urban proposals, Parent (2023b, p.57) designs enormous artificial reliefs and proposes mega-structures that resemble topographic and topological formations, such as hills that exist in nature. The bridge is favored because it is a fluid mega-structure typology and does not interfere with the natural ground (FRAC Centre Archives). Offering a similar conception of urban morphology to *Les Inclisites*, the project focuses on the versatility of flows, their traces, and interconnections to form urban tissue. The neighboring relationships of inclined surfaces in the third dimension shape the macrostructure. What distinguishes *Les Ponts Urbains* from *Les Inclisites* is its axial composition. With this understanding, an inclined central alley is obtained in the project's direction, and the other circulation axes are positioned parallel. The axes form the street system, and the oblique dwellings dissolve within this system. Sections are more critical than plans in the design of the structural tissue. In the 1960s, architects Yona Friedmann, Paul Maymont, and David Georges Emmerich, pioneers of French topological approaches, designed urban projects that allowed individuals to shape their environments through free use. The proposed city provides a physical infrastructure for this. Busbea (2007, p.156) defines this dialectic as 'the coexistence of a physical and a conceptual, syntactic structure, ensuring dialectical configurations that assume the role of combinatory, giving both order and freedom of movement to any type of element in the configuration.' Parent (2023b, p.67) states that oblique cities like the *Les Ponts Urbains* project encourage the individual's personal intervention and design contribution in a participatory manner by creating a flexible structural nexus, which he defines as 'individualization in planned constructions.' Therefore, *Les Ponts Urbains* has no system of plots and buildings but only defined open surfaces, areas, and fields. The design of these would later inspire many influential approaches in contemporary architecture. The urban design proposed by architect Rem Koolhaas for the *Parc De Villette* competition with his architectural office OMA (1982) and the 'field conditions' described in a series of diagrams by architect Stan Allen (1997) are examples of field design in contemporary architecture.

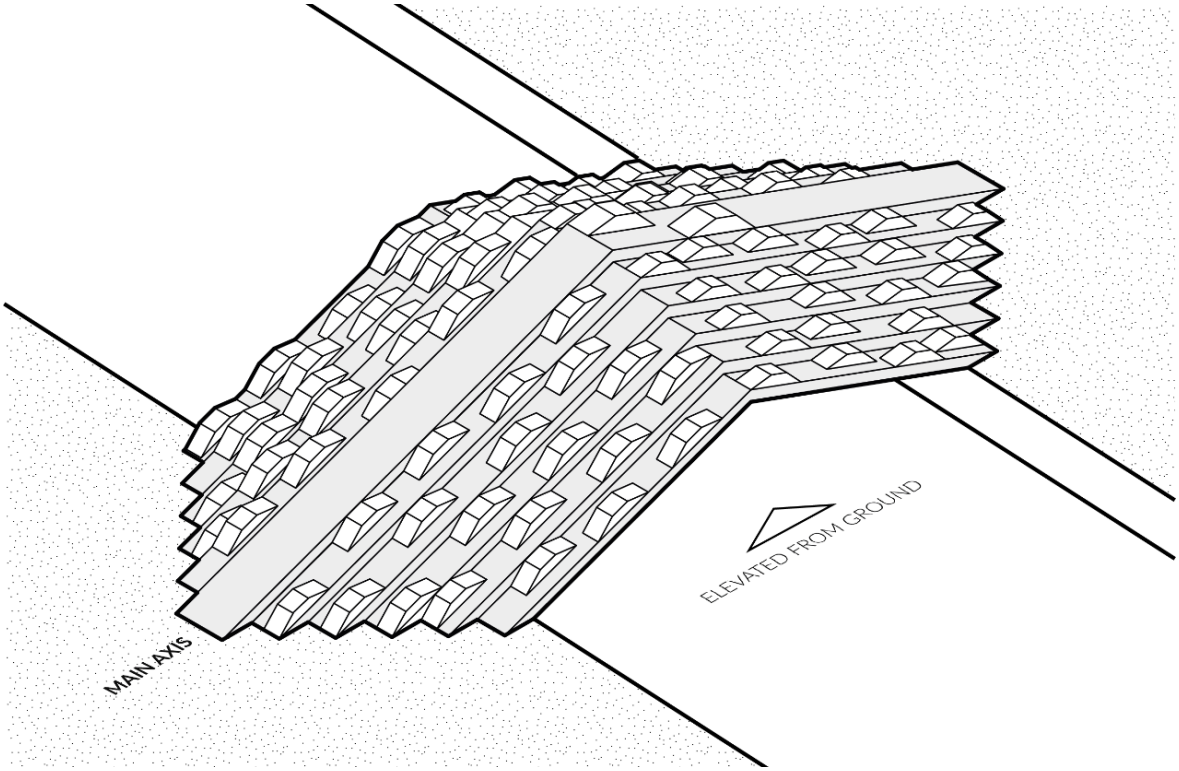

Figure 2 *Les Ponts Urbains,* 1971, 3D Model; created by authors from Claude Parent's archival drawings and architectural models.

Finally, Parent's *Incision Urbaine* (Figure 3), 'Urban Incisions' projects of the 2000s, are crucial as they instantiate an attempt to create urban form from another perspective of the Oblique Function Theory. The initiating point of the projects, the issues they criticize, and their aims are presented in the article *Urbanisme Principe* -derived from the name of their former group *Architecture Principe*- written by Parent and Virilio in 2010 in the 'A'A' magazine's '*Connexions*' (Connections) series. In the publication, the duo discusses the notion of 'habitable circulation' in the context of the problems of contemporary urbanization. Parent and Virilio (2010) argue that compared to the 1970s, urban flows in the 2000s become considerably more complicated by geopolitical restructurings, mass migrations, and climate change brought about by globalization, while urban form and morphology have not taken any measures to counteract these flows, even create more obstacles to them startlingly. In the drawings of the *Incision Urbaine* projects, Parent demonstrates that the way to deal with these flows, especially waves of migration, is to open urban incisions and fissures in the natural surface. In this way, waves of migration will flow across the surface, unimpeded by the urban system of plots and buildings. Parent develops a new understanding of oblique urban order within the incisions, making increasingly invisible flows 'visible through urban systems,' as architectural theorist Mark Wigley (2001, p.111) propounds in his work on urban networks and their spatial reflections. According to Parent (2023a), in this context, the role of the urban designer and architect must change. For him, the design of urban weaving is now more essential than the urban form. The complex urban tissue demonstrated by the *Incision Urbaine* drawings as well, according to Parent (2023a, p.69), is likened to an 'ever-shrinking forest' studied by the painter Michel Carrade. According to them, this forest becomes so compressed and entangled at some level that it is no longer possible to pass through it. The urban designer and architect must create urban form and morphology by opening up new spaces in this densification and reconnecting flows with these spaces. In the drawings of the *Incision Urbaine* projects, Parent tries to design these relationships through multidimensional cross-sections, just like the relations of solid and void in figure-ground plans. In these projects, it is possible to observe the application of the twelve principles presented by Parent (2023a), which are necessary to reinterpret the aforementioned urban system.

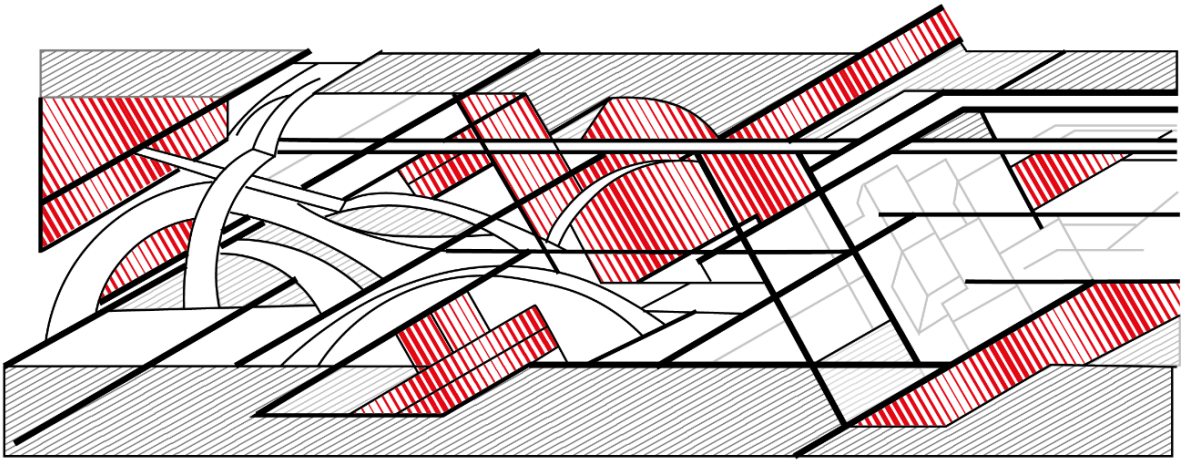

Figure 3 *Incision Urbaine*, the 2000s, urban network, and habitable circulation diagram; red-hatched areas present private spaces, while grey-hatched topography; created by authors from Claude Parent's archival drawings.

5. New Paradigms in Urban Morphology Research: From Urban Plan to Urban Section

Architect Marianna Charitonidou (2022) examines the changing and evolving experience of the urban dweller towards the city through the urban and architectural representations of architects Le Corbusier, Team X, Aldo Rossi, Constantinos Doxiadis, Giancarlo De Carlo, Denise Scott Brown, and Bernard Tschumi in different historical periods. In these drawings, Charitonidou (2022) underlines that the interaction between 'designer, observer and user' is constantly redefined by historical, cultural, political, economic, and social phenomena and that the means of urban and architectural representation need to be reinterpreted, developed, and modified. Therefore, it is clear that the representations of new urban morphology and form research defined by flows also need to be differentiated. When analyzed from this perspective, Parent's *Les Inclisites*, *Les Ponts Urbains,* and *Incision Urbaine* project drawings, which he realized within the scope of the Oblique Function Theory, involve the re-representation of the city as a result of flows. Accordingly, how flows can be understood and investigated and, as an output of this, the urban form can be designed through drawing techniques such as sections and perspective sections instead of the two-dimensional plan representations of the Cartesian approach. The transmission of a world dominated by flows can only be possible through sections illustrating multidirectional topological relationships and the holism they reveal. The Oblique Function Theory regenerates the transformation of urban tissue, natural context, street system, plot system, and building system through urban section drawings. Bideau (2002, p.70) underlines that sections frequently used within the theory to create their own 'series of narratives.' Parent, especially in the *Incision Urbaine* project drawings, expresses the multilayered structure of the city by bringing multiple sections onto each other. This approach, which Bideau (2002, p.70) delineates as 'tomography,' illuminates how overlapping, interweaving, and intersecting flows create a complex yet relational urban narrative. It should be noted that applying the 'tomography' approach, which has been utilized many times based on urban plans within the scope of urban morphology research, on urban sections can entail many fruitful potentials.

It is also possible to discuss the concept of the urban section as put forward by the Oblique Function Theory through the contemporary examples it influenced subsequently. In particular, the landscape urbanism literature discusses terminologies and phenomena such as 'urban topological surface,' 'architecture-landscape-infrastructure integration,' and 'hybrid and fluid morphologies' that Parent envisions for oblique cities similarly (Koolhaas & Mau, 1995; Angélil & Klingmann, 1999; Wall, 1999; Mostafavi & Najle, 2004; Waldheim, 2016). Architects Marc Angélil and Anna Klingmann (1999, p.24) argue that hybrid and fluid morphologies can no longer be analyzed regarding figure-ground relations, which have played an essential role in urban planning research. According to them, it is no longer possible to identify what is figure and what is ground since the urban surface

and the built environment are so interwoven, and the boundaries between architecture-landscape-infrastructure are blurred and dissolved (Angélil & Klingmann, 1999, p.24). In this context, Parent's urban section approach is also used in landscape urbanism research and design. Besides landscape urbanism, parametric urbanism also cogently avails urban sections through computational tools and scripting parameters for generating multidirectional urban tissue and its iterations. One of the pioneers of parametric urbanism, architect Patrik Schumacher (2013, p.243), delineates it as a process of 'the creative exploitation of parametric design systems in the course of articulating increasingly complex social processes and institutions.' In a sense, Schumacher embodies parameters to design and foresee uncertainties and multilayeredness of urban flows, reconfiguring urban not just with the urban plan but the urban section, even going beyond them using the versatility of parameters to configure the whole urban setting simultaneously and congruently. Yokohama International Airport by FOA Architects, 2002; Kartal Masterplan by Zaha Hadid Architects, 2006; Seattle Art Museum: Olympic Sculpture Park by Weiss Manfredi Architects, 2007; Izmir University of Economics Campus designed by Plasma Architecture Studio, 2016- and many more projects classified under landscape and parametric urbanisms, design by understanding flows through urban sections, producing a novel urban form. However, instead of a new urban order proposed by Parent, these projects are stuck in the plot systems he refused, leading to the inability to examine this understanding at the scale of urban morphology since considering only the flows in a limited land configuring the projects.

Architect Mario Gandelsonas (1995), studying the borough of Red Bank, New Jersey, claims that the influence of the urban planner and the architect in the city is not visible in the site plan anymore and that the site plan is even used as a tool to conceal plurality of voices, including the architect. He emphasizes that the urban form and systems presented in the site plan have lost their inclusiveness in the wheel of dominant urban, architectural, and economic ideologies and therefore fail to understand the contemporary city. Since this restrictive uniformity, which Parent and Virilio criticize through horizontal and vertical urban constructs, still defines today's cities, the continuity of flows between above and below ground cannot be adequately understood. Moreover, these constructions trigger a paradoxical contradiction that leads to the dominance of either the urban plan above ground or the urban section below. Philosophers Gilles Deleuze and Felix Guattari (2005) describe this dichotomy as striated and smooth spaces. In today's urban practices, the urban environment is examined based on plan points to striated spaces. In contrast, the topological and fluid context explored through the urban sections in which it is located is expressed in smooth spaces. Parent's objective, like Deleuze and Guattari, is to advocate for a contemporary urban order and morphology by juxtaposing these two phenomena with mediated inclined surfaces. Architect and landscape architect Christophe Girot (2019) emphasizes the topological ground, highlighting its potential to address the heterogeneous actors on the urban surface in a 'continuous, fluid and inclusive' way in an 'interrelated and cohesive' manner. Girot (2019), like Parent's project drawings, remarks that the relationship between below and above ground can be analyzed and designed with a topological approach through multifarious sectional narratives.

Architect David J. Lewis et al. (2016, p.14) propound that '[the] urban section has been interpreted as an outcome of [urban] planning and therefore ineffective as a mandatory drawing required in [urban] formative and design processes.' Lewis et al. (2016, p.14), underlining the lack of 'critical discourse and writing on the [urban] section,' postulates that the section reveals the 'invisible' processes and qualities that constitute the built environment and its relationships to the topological surface, such as extrusion, stacking, shape, shear, hole, incline, and nesting. With the urban sections produced within the scope of the Oblique Function Theory, Parent introduces a new method for understanding urban flows in urban morphology research, especially by examining and designing the processes of stacking, shaping, holing, inclining, and nesting. The multidimensional research and design methods of urban morphology research, such as morphogenetics, historico-geographical approach, process typological approach, space syntax, fractal analysis, and agent-based modeling, have primarily been developed to understand, critically interpret, and design the urban plan. Parent's methods of understanding and designing the urban section, such as the

methods above of stacking, shaping, holing, inclining, and nesting, may allow these techniques to be reformulated in different spheres to develop a series of new frameworks.

6. Conclusion

Parent's and Virilio's goal with the Oblique Function Theory was to criticize the ineffectiveness of quintessential urban planning and architectural practices, underscoring that modern and Cartesian urban form and site planning are too uniform and flattened to adequately respond to contemporary requirements and expectations. By advocating a 'third urban order' on inclined planes against vertical and horizontal architectures, they have embraced dynamism, fluidity, continuity, and mobility to highlight and engage the urban flows. Many contemporary urban design and architecture practices pursuing this line of thought, such as landscape urbanism, parametric urbanism, and topological architecture, develop dynamic forms and methodologies related to the topological context of flows through urban sections. Parent's oblique proposals are salient as they form the basis of these approaches. The mutual crux of today's multilayered, complex, continuous, and agglomerated cities is their topological grounds that harbor flows. These for different urban forms within the tenets of the Oblique Function Theory can lead to the development of many research methods to study and design topological grounds. The understanding of the urban section, which has developed along with the urban and architectural plans that have been intensively studied in urban morphology research, but has been emphasized scantly, may enable a more inclusive approach to modern cities to solve and portend the problems that urban flows may cause and to engender adaptive, responsive, and mediative mechanisms to meet the new needs brought by flows. The concepts of 'habitable circulation' and 'mediated structure,' which aim to open the urban form as an extension of dynamic interrelationships on the urban ground, may be exhausted not just as means for defining the Oblique Function Theory but also to research existing urban patterns meanwhile projecting what their established effects on multilayeredness through urban sections are. Nowadays, digital modeling tools incorporating various techniques, like point cloud, can easily be implemented within morphological processes by constructing abounding urban sections and tomography extracted from the real-time urban condition, proposing new ones. Therefore, the challenge of creating many urban sections is now obsolete. However, since these tools have a short history, their theoretical, epistemological, and ontological implications have yet to be entirely ascertained. With the Oblique Function Theory, as the paper's findings put forward, one may bridge the gap between these tools and their digital morphologies by constructing a methodological and theoretical framework revolving around 'habitable circulation' and 'mediated structure' meantime also touching upon topology, connectedness, fluidity, and flexibility. Utilizing and amalgamating these concepts with contemporary techniques would further consolidate the topo-morphological approach in urban morphological studies, opening new horizons under the investigations of urban flows and resulting urban form and morphology.

References

Allen, S. (1997). From object to field. *AD Architecture after Geometry, 127,* 24-31.

Angélil, M., & Klingmann, A. (1999). Hybrid morphologies. *Daidalos*, *73*, 16–25.

Armand, L., & Drancourt, M. (1961). *Plaidoyer pour l'avenir*. Calmann-Lévy.

Bideau, A. (2002). Grounding space: Parent, Virilio and the theory platform Architecture Principe (R. O'Donovan, Trans.). *Werk, Bauen + Wohnen*, *11*, 70–72. http://doi.org/10.5169/seals-66469

Bilsel, C. (2018). *Kent mekânlarının yeniden üretiminde kentsel morfoloji ve kent mimarlığı yaklaşımı: Paris örneği*. In A.S. Kubat, E. Kürkçüoğlu, E. Küçük, İ. Kurtuluş, K. Eskidemir, & M. Akay (Eds.), *Türkiye Kentsel Morfoloji Ağı, II. Kentsel Morfoloji Sempozyumu Bildiriler Kitabı* (pp. 35-56). Marmara Birliği Kültür Yayınları.

Busbea, L. (2007). *Topologies: The urban utopia in France, 1960-1970*. MIT Press.

Castells, M. (1996). *The rise of the network society*. Blackwell.

Charitonidou, M. (2022). *Drawing and experiencing architecture: The evolving significance of city's inhabitants in the 20th century*. transcript Verlag.

Corbusier, L. (1987). *The city of to-morrow and its planning* (8th edition). (F. Etchells, Trans.). Dover Publications. (Original work published in 1929)

Deleuze, G. (1993). *The fold: Leibniz, and the baroque* (T.Conley, Trans.). The Athlone Press. (Original work published in 1988)

Deleuze, G. & Guattari, F. (2005). *A thousand plateaus: Capitalism and schizophrenia* (11th edition). (B. Massumi, Trans.). Minnesota Press. (Original work published in 1972)

Eisenman, P. & Brooks, M. (2015). *Diagrammatic analysis: The diptych as a topological diagram.* Retrieved April 5, 2023, from https://www.architecture.yale.edu/courses/23816-diagrammatic-analysis-the-diptych-as-a-topological-diagram

FRAC Centre Archives (n.d). *Architecture Principe (Claude Parent, Paul Virilio), Les Inclisites*. Retrieved April 5, 2023, from https://www.frac-centre.fr/_en/art-and-architecture-collection/architecture-principe/les-inclisites-317.html?authID=10&ensembleID=36

FRAC Centre Archives (n.d). *Claude Parent, Les Ponts Urbains*. Retrieved April 5, 2023, from https://www.frac-centre.fr/collection-art-architecture/rub/rub-64.html?authID=143&ensembleID=371

Gandelsonas, M. (1995). The master plan as a political site. *Assemblage*, *27*, 19–24. https://doi.org/10.2307/3171425

Giovannini, J. (2021). *Architecture unbound: A century of the disruptive avant-garde*. Rizzoli.

Girot, C. (2019, May 23). *Topology: Thinking about ground in landscape architecture*. Retrieved April 5, 2023, from https://girot.arch.ethz.ch/research/topology

Koolhaas, R., & Mau, B. (1995). Whatever happened to urbanism? In J. Sigler (Ed.), *S, M, L, XL: Small, medium, large, extra-large* (pp. 958–972). Monacelli Press.

Kropf, K. (1996). Urban tissue and the character of towns. *Urban Design International*, *1*(3), 247–263. https://doi.org/10.1080/135753196351029

Lefebvre, H. (1991). *The production of space* (D. Nicholson-Smith, Trans.). Blackwell Publishers Ltd. (Original work published in 1974)

Lewis, D. J., Lewis, P., & Tsurumaki, M. (2016). *Manual of section*. Princeton Architectural Press.

Lucan, J. (1996). Introduction. In P. Johnston (Ed.), *The function of the oblique: The architecture of Claude Parent and Paul Virilio 1963-1969* (pp. 5–10). The Architectural Association.

Merleau-Ponty, M. (1962). Phenomenology of perception (C. Smith, Trans.). Routledge & Kegan Paul. (Original work published in 1945)

Migayrou, F. (1996). The definition of a critical architecture. In P. Johnston (Ed.), *The function of the oblique: The architecture of Claude Parent and Paul Virilio 1963-1969* (pp. 59–63). The Architectural Association.

Moudon, A. V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology*, *1*(1), 3–10. https://doi.org/10.51347/jum.v1i1.4047

Mostafavi, M., & Najle, C. (2004). *Landscape urbanism: A manual for the machinic landscape*. Architectural Association.

Oliveira, V. (2016). *Urban morphology: An introduction to the study of the physical form of cities*. Springer.

OMA (1982). *Parc de la Villette*. Retrieved April 5, 2023, from https://www.oma.com/projects/parc-de-la-villette

Özdamar, E. G. (2022). Inclined planes and the oblique function as a resistance to gravity. *Interiors*, *12*(1), 50–74. https://doi.org/10.1080/20419112.2022.2030956

Parent, C. (1970). *Vivre à l'oblique.* L'Aventure Urbaine.

Parent, C. (1981). *Entrelacs de l'oblique*. Editions du Moniteur.

Parent, C., & Virilio, P. (1996). Architecture Principe: Texts from manifesto magazine. In P. Johnston (Ed.), *The function of the oblique: The architecture of Claude Parent and Paul Virilio 1963-1969* (pp. 65–71). The Architectural Association.

Parent, C., & Virilio, P. (1997). *Architecture Principe: 1966 and 1996* (G. Collins, Trans.). Les Editions de l'Imprimeur.

Parent, C. (2003). *Errer dans l'illusion.* Les Architectures Hèrètiques.

Parent, C., & Virilio, P. (2010). Urbanisme Principe. *'A'A' l'architecture d'aujourd'hui: Connexions*, *375*, 97–108.

Parent, C. (2023a). *Errer dans l'illusion*. Bernard Chauveau Édition. (Original work published in 2003)

Parent, C. (2023b). *Vivre à l'oblique*. Bernard Chauveau Édition. (Original work published in 1970)

Redhead, S. (2011). *We have never been postmodern: Theory at the speed of light*. Edinburgh University Press.

Schumacher, P. (2013). Parametricism: A new global style for architecture and urban design. In M. Carpo (Ed.), *The digital turn in architecture 1992-2012* (pp. 241–257). Wiley. (Original work published in 2009)

Stickells, L. (2010). Conceiving an architecture of movement. *Architectural Research Quarterly*, *14*(1), 41–51. https://doi.org/10.1017/s1359135510000564

Ünlü, T., & Baş, Y. (2015). *Mersin'de morfolojik süreçlerin değerlendirilmesi*. In Y. Baş, & S. Burat (Eds.), *Türkiye Kentsel Morfoloji Ağı, I. Kentsel Morfoloji Sempozyumu Bildiriler Kitab*ı (pp.14– 30). Mersin Üniversitesi Yayınları.

Waldheim, C. (2016). *Landscape as urbanism: A general theory*. Princeton University Press.

Wall, A. (1999). Programming the urban surface. In J. Corner (Ed.), *Recovering landscape* (pp. 233–250). Princeton Architectural Press.

Weinstock, M. (Ed.). (2013). *System city: Infrastructure and the space of flows*. Wiley.

Wigley, M. (2001). Network fever. *Grey Room*, (4), 82–122. https://doi.org/10.1162/152638101750420825

Resume

Res. Asst. Ertuğ Erpek is a research assistant/student at the Middle East Technical University (METU) Department of Architecture who graduated from the same department (BArch) as the top student in his class. He is currently doing a master's degree (MArch) in architectural design and theory, focusing on the history of deconstructivism, computational design, and their reflections on urban discourse. His interests are contemporary architectural theory, urban architecture, virtual place design, and digital design theory. He participated in several architectural competitions throughout his architectural career and received prizes. He recently claimed second prize in the Virtual Home Competition with his team, which was organized by Bee Breeders (Buildner).

Assoc. Dr. Esin Kömez Dağlıoğlu received her BArch and MArch magna cum laude from Middle East Technical University (METU) Department of Architecture, where she also worked as a research and teaching assistant from 2008 to 2012. She completed her PhD research in 2017 at Delft University of Technology, Department of Architecture where she also taught design and theory courses at the Chair of Architectural Composition and Public Building. Currently, she is working as an associate professor at METU, Department of Architecture. She has published numerous articles in journals such as Architectural Theory Review, OASE, and METU JFA.

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An overview of fringe belt literature through studies from different perspectives

Ezgi Küçük Çalışkan*

Abstract

The fringe belt phenomenon, which was conceptually put forth by Herbert Luis in 1936, developed by M.R.G. Conzen starting from 1960, and placed on a historico-geographical basis in the context of urban rent theories by J.W.R. Whitehand, has been studied by researchers with different perspectives in cities developed with distinct socio-economic and cultural dynamics in various parts of the world. This paper aims to reveal how the fringe belt concept, which emerged within the Conzenian tradition of urban morphology turn into a phenomenon, has been handled from the time it first appeared to the present, to examine the contribution of different perspectives to the fringe belt literature and to present suggestions for the development of the concept. Selected from peer-viewed journals and academic conferences, 53 different fringe belt studies were examined according to their publication periods, within the framework of spatial, economic, social, and planning perspectives previously discussed by Ünlü (2013) as well as the ecological perspective. In this context, the selected studies are examined based on the case areas, methodology, and main findings on fringe belt formation and change. Property perspective is discussed as a hybrid approach in fringe belt studies. Finally, further research proposals are emphasized in order to realize the fringe belt phenomenon as durable and sustainable urban spaces.

Keywords: cross-cultural studies, different perspectives, fringe belt, literature

1. Introduction

When residential areas, commercial areas, and non-residential forests and agricultural areas are split from a city, the remaining open, recreational, industrial, institutional, or only villa-type housing areas with a continuous belt-like form within the city as well as with less dense forms, and generally larger and cheaper plots than the city center are defined as fringe belts (Larkham, 1998; Conzen, 2009). The streets and plots can remain unchanged for longer periods compared to buildings in the fringe belt areas which formed regarding a fixation line and consolidated in the city (Whitehand, 2001, p. 106). Fringe belts in a city are categorized as inner fringe belt (IFB), middle fringe belt (MFB), and outer fringe belt (OFB) (Conzen, 2009). These morphological regions formed in city peripheries become embedded within a growing city over time, and they usually change in various ways by different urban dynamics. These transformations can result in the complete integration of fringe belt areas by transforming into the urban fabric by losing the fringe belt character, literally defined as fringe belt alienation or the consolidation of the fringe belt character (Barke, 1982; Conzen, 2009).

*Dr. (Urban Planner), Marmara Municipalities Union, Istanbul, Türkiye, ezgikucukcaliskan@gmail.com
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The perspectives of researchers from different cities, different backgrounds, and cultures who have conducted their studies on different periods contributed to the formation of the theoretical framework on fringe belts. The concept of fringe belt, first appeared in Herbert Louis's Berlin study in 1936 (Conzen, 1960, p. 58), and gained conceptual clarity and terminology through M.R.G. Conzen's detailed morphological examinations in the study of Alnwick (Figure 1). Conzen (2009) emphasizes that the most significant contribution of M.R.G. Conzen is the inclusion of fringe belt patterns within a city, including the activity between urban form evolution, especially commercial, industrial, residential, and institutional developments and the evolutionary structures to a detailed morphological theory that considers all formative and transformative spatial processes in a city, as can be seen from the detailed cartographic documents produced by him as well (Conzen, 2009, p. 31).

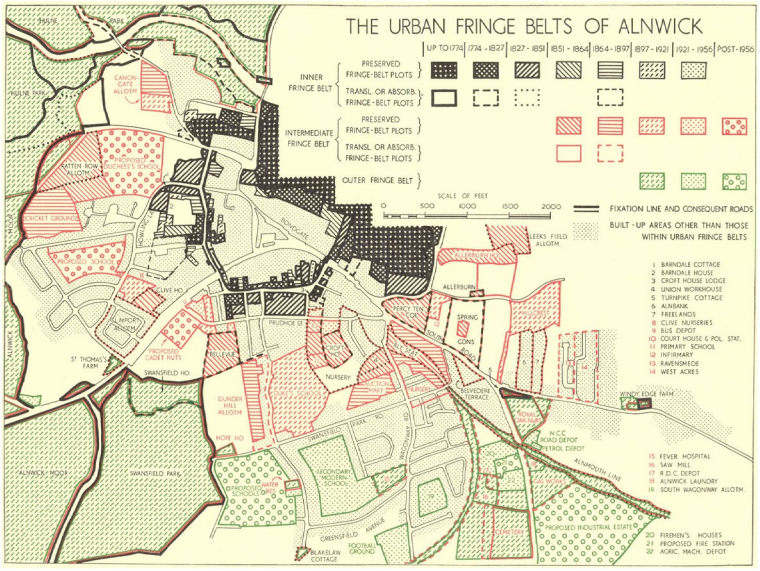

Figure 1 Fringe belt areas of Alnwick in different periods (Conzen, 1960)

This study provides an examination of the research in the fringe belt literature by analyzing a group of selected studies published in peer-reviewed journals and international or national symposiums. The aim is to unveil both the concept development so far and the areas that have not been addressed yet by exploring each case by geographic-cultural regions, the methodologies applied to identify fringe belt areas, the major findings on the phases of fringe belt formation, fixation lines, the number and sizes of fringe belts, continuity in fringe belt areas and fringe belt transformation. In this regard, 53 pieces of research are examined. These studies are categorized and analyzed according to the spatial, economic, social, and planning perspectives grouped by Ünlü (2013) in his fringe belt research and also the ecological perspective is included in this classification. The evaluation section presents the findings derived from the basic text analyses and graphical representations for each research. In the final part, suggestions for future research are made to conclude the study.

2. Fringe Belt Studies

Conzen's (2009) study, which compiles a set of studies on fringe belts, reveals the development of fringe belt literature by presenting Conzen's study areas, the formation and population of the study locations, the identified number of fringe belts, the publication dates of the studies, and the researchers involved. Ünlü's (2013) study examines fringe belt studies from four perspectives namely, spatial, economic, social, and planning, and highlights noteworthy studies from the 1960s to the 2010s. The evolution of the fringe belt concept is summarized into three periods (Table 1): The first period is from 1936 to the early 1960s when the concept was developed, defined, and visualized by European geographers; the second period is from the mid-1960s to the late 1990s when the concept was discussed by geographers in conjunction with economic concepts and

utilized in defining and explaining urban form; and the third period is from the late 1990s to the present when processes related to fringe belts were examined, the concept was studied in a multidisciplinary way, and it was associated with urban planning, landscape management, and ecology (Kubat, 2019).

Table 1 Focus areas of fringe belt studies according to periods (Kubat, 2019)

Periods	*First Period:* 1936 – mid 1960's	*Second Period:* mid 1960's – end of the 1990's	*Third Period:* end of the 1990's – today
Researchers	European geographers	Geographers	Multi-disciplined researchers
Focus Areas	Fringe belt concept described	Associated with the economic perspective and concerned with the description and explanation of urban form rather than its relation to planning	Explores the relation between the fringe belt concept and planning practices and urban landscape management

2.1. Spatial perspective in fringe belt studies

The aim of the studies handled with this perspective is to reveal the urban development by identifying the fringe belt areas of the cities. Besides providing cartographic records from the case areas, most of the literature focus on the physical transformation of fringe belts through a spatial perspective considering morphological periods (Ünlü, 2013). Conzen's (1960) study in Alnwick, which determines fringe belt areas based on land use and plot sizes using various maps from 1774 to 1956, stands out among these studies. His study illustrating the development of inner, middle, and outer fringe belts in Alnwick also introduces other morphological terms such as the burgage cycle and morphological frame. Also, Whitehand's (1967) Newcastle study presents the development of fringe belts from the period up to 1868 to the 1930s (Figure 2) and discusses a special fringe belt area that emerged during the Edwardian period.

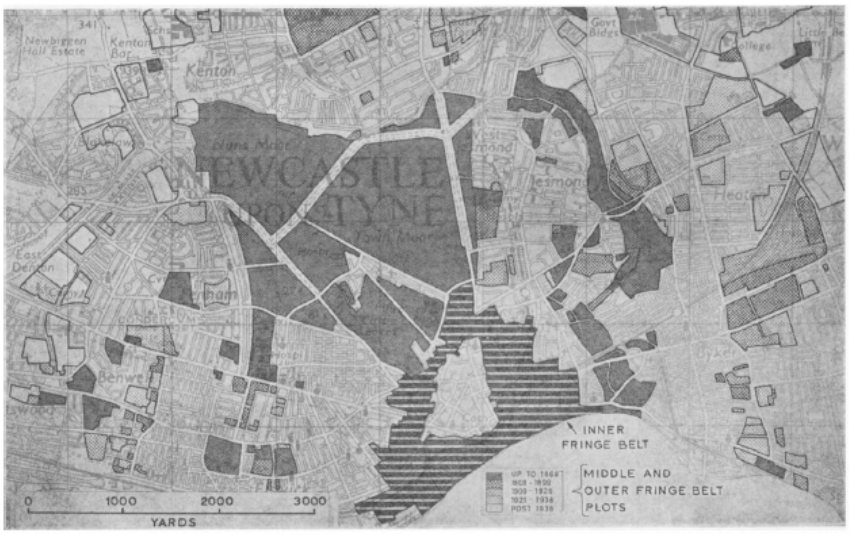

Figure 2 Fringe belt study of Newcastle upon Tyne (Whitehand, 1967, p.225)

Al-Ashab's (1974) PhD thesis, which is studied under the supervision of M.R.G. Conzen reveals the formation of fringe belts in Baghdad from 1925 to 1974 and includes squatter settlements within the fringe belt areas. This study stands out due to its focus on different geography and its unique perspective on fringe belt areas, revealing that fringe belt characteristics of Middle Eastern cities are similar to European cities and share many common features. During this period, Barke's (1974; 1976) studies in Falkirk, Scotland, suggest that fringe belt transformation is influenced by pre-existing land-use patterns. Ünlü's (2013) study in Mersin highlights the distinctive characteristics of fringe belt development in coastal cities in Turkey, while Meneguetti and Pereira Costa's (2015) study in Maringa, Brazil, demonstrates that the formation of three fringe belts — inner, middle, and outer— is possible even in new planned city. Hazar and Kubat's (2015) studies

on fringe belt development in Istanbul and Barcelona, respectively, compare the inner fringe belt areas of the two metropolises based on planning and conservation policies. Fringe belt studies in Istanbul progressed by Kubat's (2019) study examining fringe belt development along the central business district axis in Istanbul (Figure 3). Additionally, keeping the focus on Istanbul, Kubat et al. (2022) contribute to the literature with their research on the existence of fringe belt areas in the Historic Peninsula following the route of the Constantine Walls, the development of fringe belt areas in Yedikule, the fringe belt areas of Üsküdar, the development of fringe belt areas in the Taksim-Pera region (Soygüzeloğlu & Kubat, 2022), and the transformation of industrial fringe belt areas in Istanbul (Küçük Çalışkan & Kubat, 2022a).

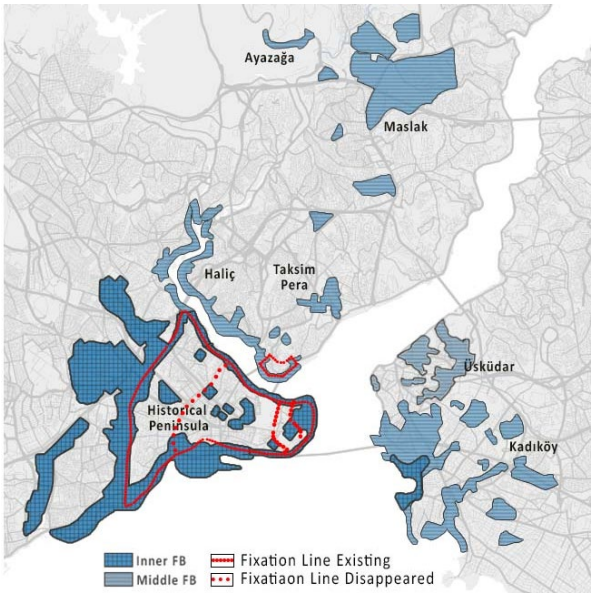

Figure 3 Istanbul fringe belt study, revised after 2019 (Kubat, 2019)

The study of Ünlü and Baş (2016), focusing on the formation of fringe belts in sub-centers in Mersin reveals an individual fringe belt development model, namely the umbrella fringe belt (Figure 4). Karaulan and Kubat's (2018) study on Milan examines the impact of fringe belt formation on other land uses, while Zhang's (2019) study on Birmingham examines Edwardian fringe belts in relation to green areas, revealing findings on ground surface types, street patterns, accessibility, and property ownership. Šćitaroci and Marić's (2019) article, which examines the green areas of 26 different European fortress cities within the framework of the fringe belt concept, emphasizes the relationship between these areas and international conservation policies. Hazar and Özkan's (2020) study on the fringe belts of Izmir focuses on military areas from an ecological perspective.

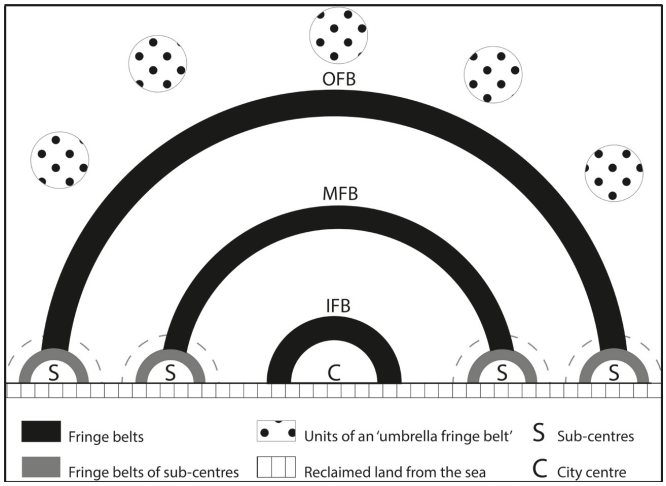

Figure 4 Umbrella fringe belt model explained in fringe belt study of Mersin (Ünlü & Baş, 2016, p. 119)

In addition to these studies, some notable conference papers have the spatial perspective as well, as follows; Simão and Costa's (2014) study on fringe belt transformations in Belo Horizonte, Chen and Lin's (2014) study on macro-level changes in Tainan, Geddes's (2014) study on the middle fringe belt in Limassol, in which the fringe belts are recognised within two regions based on plot sizes, Lammers et al.'s (2015) study on the city of Eindhove in which a unique fringe belt model to the city also identified, Gu et al.'s (2015) comparative study on Nanjing and Pingyao, and Logunova's (2017) study revealing the presence of four fringe belt areas in Krasnoyarsk.

2.2. Economic perspective in fringe belt studies

Studies dealt with from an economic perspective generally focus on determining the dynamics of fringe belt formation. Whitehand's (1972a, 1972b, 1988) economic perspective in the fringe belt studies opened up a new field of research. He explored the mutual relationship among fringe belt formation, modification, bid-rent theory, construction cycles, and innovation (Ünlü, 2013). Whitehand (1972a) studied on urban land-use patterns in British cities by examining construction cycles and explained the housing and institutional land-use location preferences based on land rental values and distances from the city center using graphs (Figure 5) with the example of Glasgow (Whitehand, 1972b).

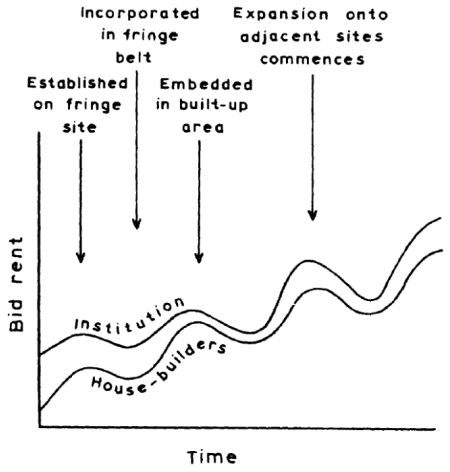

Figure 5 The hypothetical bid rent of institutions and homebuilders over time as revealed in the Glasgow study (Whitehand, 1972b, p. 220)

Openshaw (1974) and Barke (1982; 1990) conducted studies on fringe belt processes and economic development-based models. Barke's (1982) study in Derby and Newcastle illustrated graphs on contrasting supply conditions of residential and institutional land use at a distance from the city center (Figure 6). Whitehand (1988) stated that fringe belt formation occurs during economic downturns, concentrating on large, cheap lands and fringe areas. Vilagrasa's (1990) study in Lleida emphasized the formation of slum areas due to unmet housing demand and highlighted that the newly formed fringe belts through planning in the 1980s in competition with land-use types such as housing preferred locations that were difficult to access and had low land value. Whitehand's (1994) research focused on the University of Birmingham campus, revealing the impact of land value indices and transportation modes on fringe belt formations and highlighting the morphological characteristics of fringe belt plots from different periods.

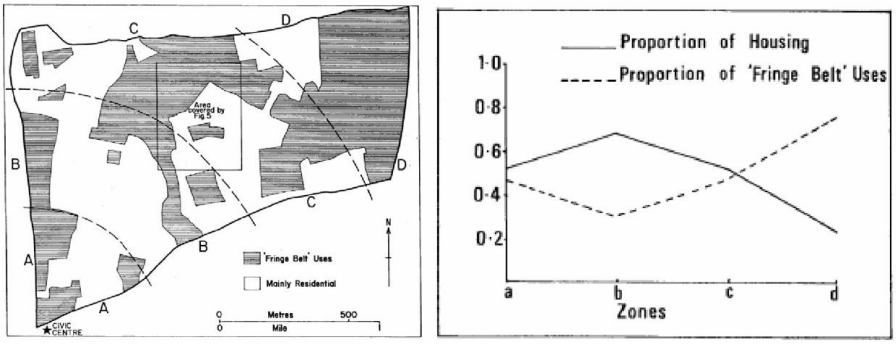

Figure 6 Derby and Newcastle fringe belt study and residential area-fringe belt development graph (Barke, 1982)

2.3. Social perspective in fringe belt studies

Studies from social perspective aims to examine the effect of social, cultural and political factors on the formation and transformation of fringe belts. Therefore, the studies held from a social perspective have been categorized and analyzed in terms of socio-spatial, socio-political, and socio-cultural aspects. As a typical example of socio-spatial studies, there is Carter and Wheatley's (1979) research on the transition of the upper class to inner fringe belt areas by examining the boundaries of the inner fringe belt and the transition of the upper class to the middle fringe belt in the later period. Besides, Del Monaco's (2015) studies on African metropolises and rapidly developing cities in the Far East as unstable examples, and cities with a deep historical background such as Rome and Beijing as stable examples, emphasizing the impact of different cultural dynamics on fringe belt formations.

Studies conducted from a socio-political perspective include Deputla's (2014) research on the fringe belt developments of Torun in Poland, interpreting them within the framework of war periods and the effects of the socialist era, and Camiz and Bruccoleri's (2015) studies on the fringe belt formations of Kyrenia in Northern Cyprus, which highlight the impact of border policies and political processes. Whitehand and Gu (2017) emphasize the presence of city walls as a fixation line in European cities, which has a more prolonged lifespan in Chinese cities due to socio-political reasons, and their articles focusing on Nanjing's fringe belt development from the 10th century to the 2000s reveal the effects of city walls on fringe belt formations.

In the socio-cultural context, Conzen's (2009) paper stands out as it provides a comparison of exemplary studies in fringe belt literature and discusses the absence of a distinct fringe belt formation in the Chicago metropolis in light of the influence of different cultural dynamics. Additionally, the study by Whitehand et al. (2011) on Pingyao highlights the role of tourism-focused policies in fringe belt development, and Marques de Sousa Safe and Pereira Costa's (2016) research in Rabat, Morocco, and cities in Morocco, which suggests that understanding the urban layers and examining fringe belt formations can help to define historical hierarchies in a historic center, are also among the notable examples in this context.

2.4. Ecological perspective in fringe belt studies

The aim of the studies handled with an ecological perspective is to examine the ecological value of the fringe belt areas and to emphasize their ecological importance. Ecological perspective began to emerge in the 2010s, and they consider environmental inputs and outcomes in general. Ünlü (2022) emphasizes that global issues such as climate change have increased ecological perspective in fringe belt studies. Hopkins's (2012) study on Birmingham, which reveals the ratios of tree in the city center, fringe belts, old suburban areas, and outer suburban areas, highlights the high tree ratios in fringe belt areas and emphasizes Birmingham's Edwardian fringe belts in terms of fringe settlements, other fringe belt formations, wildlife corridors, and average species in the city center (Figure 7).

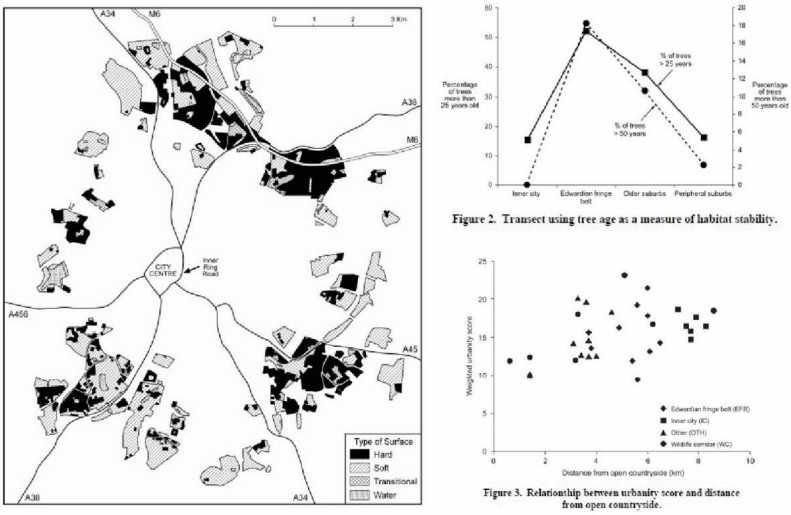

Figure 7 Fringe belt study focusing on Birmingham's ecological features (Hopkins, 2012)

Hazar and Kubat's (2016) study summarizing the inner fringe belt formation and change in Istanbul highlights the ecological value of agricultural uses and green belt-like areas such as Yedikule urban garden and touches the conversion of urban gardens into slum areas. Whitehand's (2019) article focusing on green spaces within fringe belt areas in Visby, Gotland in Sweden, Krakow in Poland, Birmingham in England, and the London metropolis suggests that these areas have remained undisturbed due to the absence of specific land uses and property ownership, and also they are buried within the city, and associated with cultural heritage sites, highlighting the importance of evaluating them from an ecological perspective by city administrators.

2.5. Planning perspective in fringe belt studies

In the studies handled with the planning perspective, the investigation of the relationship between fringe belts and urban planning is the main objective. The planning perspective in fringe belt studies, which has been approached since the 2000s (Ünlü, 2013), can be observed early in the works of Whitehand and Morton (2003, 2004, 2006), Ducom (2005), Gu (2010), and Conzen et al. (2012), as well as in some studies presented in conferences. Whitehand and Morton's (2003) elaborated fringe belt study in Birmingham includes interviews with planning authorities of the city besides using maps and plans, and it revealed that fringe belts are overlooked in urban planning, however the concept of green belt is more prominent in praxis. In the next study, the sources such as Birmingham City Council's land development documents and urban development control files are utilized. Within the scope of the study, in which the pressure of transformation to housing on the Edwardian fringe belt plots was examined in detail, how many of the total number of parcels were about to be transformed (alienated) actually and on the plan was also analyzed (Whitehand & Morton, 2004). Whitehand and Morton (2006) also addressed environmentalists' lobbying and inter-actor processes in fringe belt transformations in Birmingham.

Ducom's (2005) study in Nantes and Rennes argued that planners can assist in decision-making and implementation processes. Gu's (2010) study in Auckland discussed how alienations in fringe belt areas along the coasts restrict public use of the coastline. Conzen et al. (2012) examined the city of Pingyao in China and the city of Como in Italy in regard to tourism decisions in urban planning, and Lammers et al. (2017) integrated the fringe belt concept with strategic planning processes in their study on Eindhoven. Ünlü and Baş's (2019) research emphasized the importance of incorporating effective planning decisions in the formation and transformations of fringe belts in Turkish cities based on morphological periods. The study of Küçük Çalışkan and Kubat (2022b), in which the transformations in fringe belt plots in Istanbul within the context of property relations are revealed, presents a perspective that focuses on agents beyond planning and development processes.

3. Evaluation of the Research

The examined studies from the literature of fringe belt concept are evaluated based on the regional distribution of case areas, the major methodological structures that are used to identify fringe belts of the case areas, stages of fringe belt formation, fixed lines of demarcation, quantitative characteristics, and change processes.

3.1. Regional distribution and case areas

Looking at the geographical distribution of the case cities within the scope of 53 different studies that have been selected and examined from the fringe belt studies conducted to date (Figure 5), the majority of the studies focused on Western European cities (17 cities), followed by studies on East Asian (7) and West Asian (14) cities. There is also an increasing number of studies from Southern European cities (5). Among the examined studies, there are also examples from Central European (2), Northern European (2), South American (2), North American (1), Northern Asian (1), Southern African (1), and Northern African (1) cities. It can be observed that the majority of the literature is concentrated in Western European and West Asian cities with a focus on spatial perspective.

3.2. Methods and sources for fringe belt identification

As in all urban morphology studies, which are handled with a historico-geographical point of view, all drawn and written documents are used, from the oldest settlement maps of the city to be studied, to other maps and plans that will teach the periodical change. The land uses are extracted and mapped based on the periods considered for all studies. In some studies, quantitative analyses are conducted by considering plot sizes in addition to land uses. Change rates according to land use types and changes in plots are measured and visualised with graphs.

In studies from the spatial perspective, fringe belt analysis, comparative analysis, and historical maps of different periods are used. Perimeter analysis, graphic analysis of housing construction, institutional construction, and other construction data, and land value indices were used in studies from the economic perspective. In the research from the social perspective, besides the analyses of fringe belt evolution, various comparative analyses, the use of historical maps from different periods, historical documents, and the use of social data have been observed. While analyses of green areas in fringe belt areas, utilization of ecological data, and comparative analyzes are observed in ecological perspective studies, it is noteworthy that plans, plan notes, and interviews with planning actors are used in the fringe belt studies made from the planning perspective.

3.3. Phases of fringe belt formation and fixation lines

The formation processes of fringe belts are observed in the fixation, expansion, and consolidation phases. The majority of the studies address the fixation and consolidation phases. In some studies, the expansion phase is revealed through land use types that require larger plots, such as industrial areas, schools, and hospitals.

What emerges from the literature review in general is that the inner fringe belts form along a fixed line, with an integrated and continuous structure. Also, the physical integrity of the middle fringe belts is weaker compared to the inner fringe belts. These fringe belts are built on larger lands, closely intertwined with green areas and agricultural lands, and with a sparser road network. As for outer fringe belts, it can be stated that many of them were formed in the 20th century and consist of very large and fragmented plots.

Most of the cases shows that rivers, mountains, and the sea act as natural fixation lines. The matter that fringe belts generally begin to form along a fixation line was put forward in the early studies on fringe belt concept. The studies in the literature also indicate that fringe belts may develop due to economic conditions, in addition to the influence of the fixation lines.

3.4. Number and sizes of fringe belts

The studies indicate that generally three separate fringe belts are identified in cities. In cities with a small scale and a historical urban fabric, especially in European cities that have experienced the Middle Ages and modernization process, an inner fringe belt, a middle fringe belt, and an outer fringe belt can be observed. A single fringe belt has been found in East Asian cities that experienced the industrial revolution at a later period, but these fringe belt areas are remarkable in terms of their size. According to the samples examined, in cities with a younger history, there may be only one or two fringe belts. Developing West Asian cities, on the other hand, include a large number of overlapping fringe belt formations within different sub-centers of the city. Umbrella-type fringe belt model, which is seen as campus-type fringe belt units in Ünlü and Baş's (2016) study, is also among the remarkable findings.

3.5. Continuity and change in fringe belts

The examined fringe belt studies from different periods shows that some fringe belt areas are under pressure for change for residential and commercial uses. In particular, it can be said that controlled processes such as the economic investments of the city, urbanization strategies, and planning decisions, as well as unplanned factors such as migration, population growth, and war, have an impact on the change in fringe belt areas. The changes and transformations in fringe belt areas are categorized as consolidation, alienation, reduction, migration, or continuity of the fringe belt, which is consistent with the literature.

It is determined that fringe belt areas undergoing alienation generally turn into residential and commercial areas, losing the fringe belt characteristics completely. In the examined studies, the continuity of fringe belt areas is observed more in middle fringe belts and outer fringe belts due to reasons such as their formation in a later period of urban development, the presence of permanent fixation lines, larger plot sizes, and not being able to migrate because of the difficulty of finding places with similar spatial characteristics. It has been emphasized that inner fringe belt areas are quite dynamic and open to change due to their proximity to the city center and found in smaller plots.

4. Property Perspective as a Hybrid Approach

Understanding the future of an urban system requires a realistic assessment of the processes behind the changes and the direction in which the social system as a whole is being driven (Harvey, 2009). Although there are approaches to the evaluations in this framework among the researches in the fringe belt literature, it has been understood that there has not been a study that examines the property factor in the formation, development, or transformation of the urban form and that deals with it from the perspective of property relations. Following the studies of Hazar and Kubat (2015) and Kubat (2019), Küçük Çalışkan and Kubat (2022b) emphasized the alienation process in the fringe belt plots based on the transition from public property to private property. In the study inner, middle, and outer fringe belt areas of Istanbul are revealed (Figure 8), and selected cases are examined by the agency network in the transformation phase of the plot.

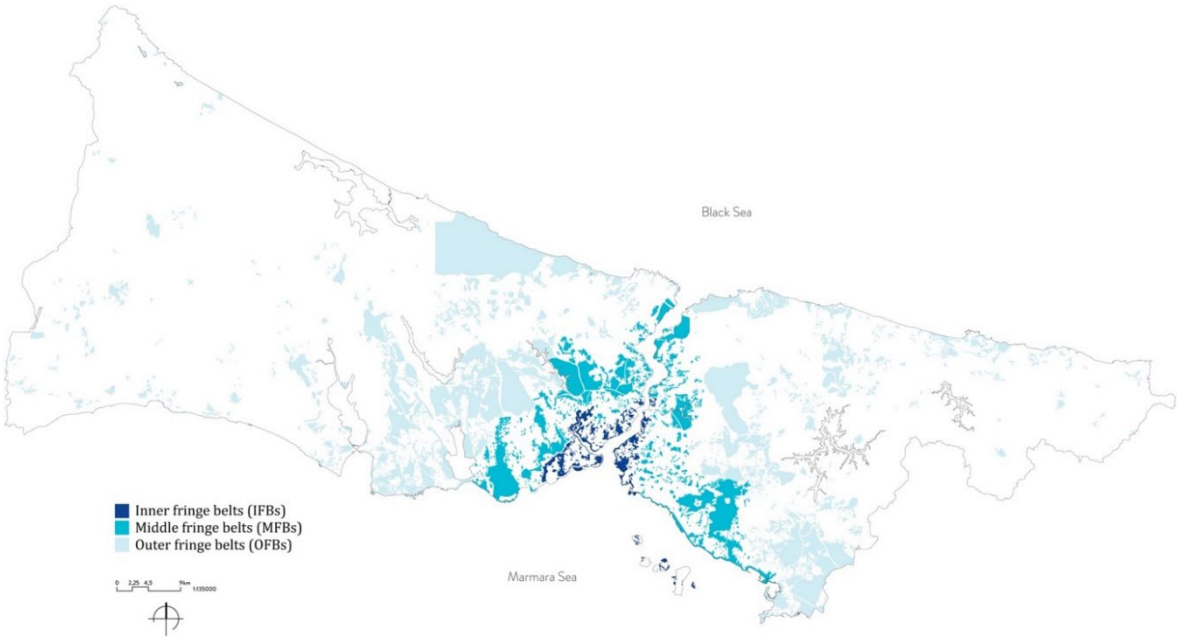

Figure 8 Fringe belt areas of Istanbul (Küçük Çalışkan & Kubat, 2022b)

It is determined that fringe belt areas undergoing alienation generally turn into residential and commercial areas, losing the fringe belt characteristics completely. In the examined studies, the continuity of fringe belt areas is observed more in middle fringe belts and outer fringe belts due to reasons such as their formation in a later period of urban development, the presence of permanent fixation lines, larger plot sizes, and not being able to migrate because of the difficulty of finding places with similar spatial characteristics. It has been emphasized that inner fringe belt areas are quite dynamic and open to change due to their proximity to the city center and found in smaller plots. Kropf and Malfroy (2017) raises the question of if the process of formation of cities involves both human agency and some causal (or structural) determinism that needs to be explained. Lefebvre (2014) highlights that a large number of relations and various means of production form the urban fabric. Günay (1999) claims that the property pattern is the main factor affecting the production of urban space. He states that urban space is both a production element and a product, and that urban space takes its final form in accordance with valid property relations. In urban space, the ways in which immovable property benefits and the agents that play a role in the dynamics of change in these forms of use as factors that reveal property relations should be considered. Their impact in the context of the fringe belt concept can provide an introduction to the morphology of the agent networks as well as the urban form (Küçük Çalışkan, 2023).

Küçük Çalışkan's (2023) thesis study, in which the development and transformation of the fringe belt concept in Istanbul are examined at different scales, the investigation of property relations in the fringe belt areas put forth. Case areas selected from different fringe belt areas of Istanbul were subjected to a typological analysis and a detailed investigation of four cases with similar characteristics was emphasized. In what direction and how the transformations in the fringe belt parcels will take place can be determined by the state's view of the property and the powers of the actors over the property, their relations with each other, and the basic tools they use to create the urban form. Therefore, in the study, a detailed analysis of the relations between the parcel and the agents was held as can be seen from the work shown in Figure 9 (Küçük Çalışkan, 2023).

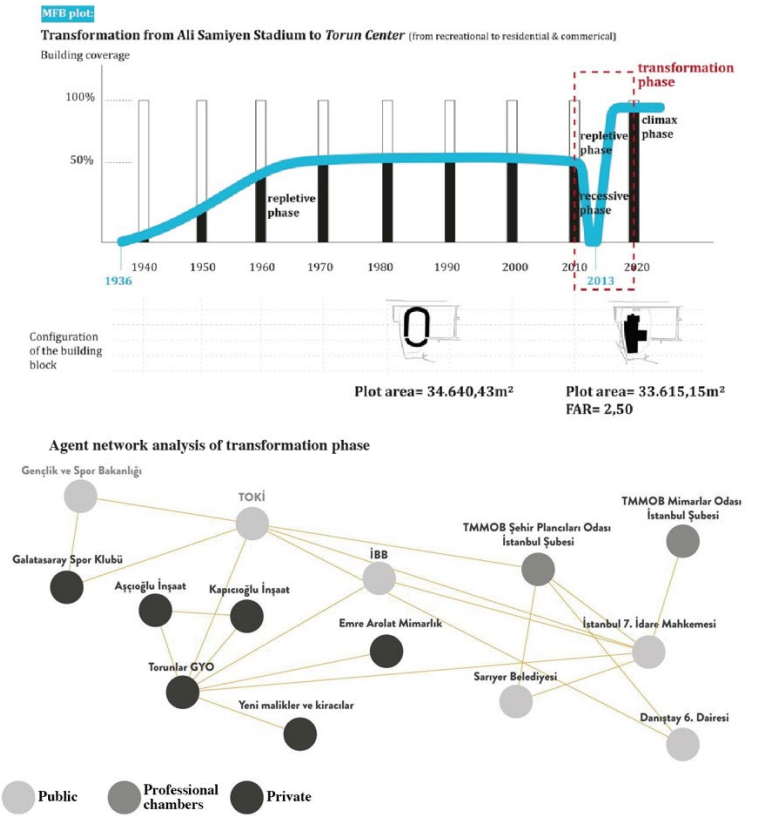

Figure 9 Exploration based on plot development cycle and agent network analysis for the transformation phase of an alienated fringe belt plot of Istanbul, namely the transformation case of Ali Sami Yen Stadium to Torun Center (Küçük Çalışkan, 2023)

The property perspective basically includes the spatial perspective within, and it provides a broad examination and multi-faceted evaluation, including planning, politics, as well as economic, ecological, and social perspectives.

5. Conclusion

This study, while summarizing the contributions of the research in the literature to the fringe belt concept, highlights the need to diversify research areas that are predominantly concentrated in European and Asian cities; beyond the spatial perspective, the need to increase studies focusing on social, economic and ecological perspectives as well as planning by making use of interdisciplinary studies and approaches; and finally, the importance of conducting more comparative research to reveal unique qualities in the examination of not only urban form but also other development dynamics of the city.

In the studies conducted from a spatial perspective, findings such as the number of fringe belts, land use and form of the fringe belts, city-specific fringe development models, fringe belt formation phases and transformations, and fixation lines have been reached. From an economic perspective, the relationships between housing supply and the formation of the fringe belt areas have been discussed. The studies handled with a social perspective include the characteristics of the fringe belts, the formation phases and transformation processes of the fringe belts, the social dynamics specific to each case, and the characteristics of the fringe belt interaction. The findings on the fixation lines, the formation phases and transformations of the fringe belts, and the accessibility, use, and protection of the fringe belts are among the major outputs of fringe belt research from the ecological perspective. Studies carried out with planning perspective present findings on the formation phases and transformation of the fringe belts, the absence of the fringe belt concept in the planning literature, and the possible position of the fringe belt concept in the policy making and planning process. The summary of each perspective is given in Table 2.

Table 2 Aim, methods and sources, and evidence in fringe belt studies from spatial, economic, social, ecological, planning based and property based perspectives

Perspectives	Aim	Methods and sources	Evidence
Spatial	To reveal the urban development by identifying the fringe belts	Fringe belt analysis, comparative analysis, using historical maps from different periods	The number of fringe belts of cities, features of fringe belts such as land use and form, urban-specific fringe belt development models, fringe belt formation phases and transformations, fixation lines
Economic	To determine the dynamics of fringe belt formation	Using data such as fringe belt analysis, graphical analysis of residential construction, corporate construction and other construction data, land value indices	Relationships between housing supply and the formation of fringe belt areas
Social	To examine the effect of social, cultural and political factors on the formation and transformation of fringe belts	Fringe belt analysis, comparative analysis, use of historical maps from different periods, historical documents, use of social data	Fringe belt characteristics of cities, formation phases and transformations of fringe belt areas, social dynamics specific to each case, and characteristics of fringe belt interaction.
Ecological	To examine the ecological value of the fringe belt areas and to emphasize their ecological importance	Analysis of green areas in fringe belts, use of ecological data, comparative analyzes	Outputs on the ecological dimension of the fringe belts, fixation lines, formation phases and transformations of the fringe belts, accessibility, use and protection of the fringe belt areas
Planning	Examining the relationship of fringe belts and urban planning	Fringe belt analysis, comparative analysis, using different historical maps, plans, plan notes, interviews with planning agents	Formation phases and transformation processes of the fringe belts, the absence of the fringe belt concept in the planning literature, the possible position of the fringe belt concept in the policy making and planning process
Property	To reveal effective property relations in the formation and transformation processes of fringe belt areas	Fringe belt analysis from different scales, historical maps, plans, plan notes, news texts, court case files, plot-based analyzes typological analyzes	The formation and transformation characteristics of fringe belts, the characteristics of change in various aspects of property in fringe belt transformations, the political and critical role of fringe belt areas in urban planning and policy making processes

Specific to the fringe belt concept, it is possible to see the processes that are effective in the development of the urban form in a more comprehensive and relational way by examining property relations. Therefore, covering all the other approaches, the property perspective in fringe belt studies provides critical findings on other possible dynamics in shaping the relationship between the main elements of the urban block as the basis of urban form and the agents who have roles within the whole process.

Particularly, studies that reveal the potential of fringe belt areas for planning cities that are fair, sustainable, and resilient to crises and disasters should be taken into account. Other areas that need to be developed include data-driven processes, mapping methods, and interpretation processes in the detailed identification process of fringe belt areas.

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References

Al-Ashab, K. H. (1974). The urban geography of Baghdad. (PhD thesis). University of Newcastle upon Tyne, Erişim: http://hdl.handle.net/10443/1059.

Barke, M. (1974). The changing urban fringe of Falkirk, Scottish Geographical Magazine. 90(2), 85-97.

Barke, M. (1976). Land Use Succession: A Factor in Fringe-Belt Modification. The Royal Geographical Society (with the Institute of British Geographers), 8(4), 303-306.

Barke, M. (1982) Beyond the Urban Growth Map: Suggestions for More Analytical Work in Urban Morphology, Teaching Geography, 7(3), pp. 111-115.

Barke, M. (1990). Morphogenesis, fringe belts and urban size: an exploratory essay. T.R. Slater (Ed.). The built form of Western cities. (279-297). Leicester: Leicester University Press.

Camiz, A. & Bruccoleri A. (2015). Morphology of the urban organism in Cyprus. The effect of borders and political changes in the fringe belts of Girne, TRNC. proceedings of 22nd International Seminar on Urban Form, (1481-1488). Rome.

Carter, H. & Wheatley, S. (1979). Fixation lines and fringe belts, land uses and social areas: nineteenth century changes in the small town. Transactions of the Institute of British Geographers NS 4, 214-38.

Chen, C. & Lin W. (2014). Morphological process as an instrument for knowing chronological character: a case study in Tainan. Oliveira, V. et al. (Eds). ISUF 2014: Our common future in Urban Morphology / 21st International Seminar on Urban Form. 21st International Seminar on Urban Form: ISUF 2014, Porto (FEUP).

Cihanlı, G., Küçük Çalışkan, E., Kubat, A. S. (2022). Morfolojik Bölgeler ve Çeper Kuşak Alanları Üzerinden Bir Okuma: İstanbul Yedikule Örneği. TNUM III. Kentsel Morfoloji Sempozyumu Bildiriler Kitabı, (413-435). ODTÜ Mimarlık Fakültesi

Conzen, M. P. (2009). How cities internalize their former urban fringes: a cross-cultural comparison. Urban Morphology 13(1), 29-51.

Conzen, M. P. & Gu, K., Whitehand J. W. R. (2012). Comparing Traditional Urban Form in Chine and Europe: A Fringe-Belt Approach. Urban Geography 33(1), 22-45.

Conzen, M. R. G. (1960). Alnwick: Northumberland: a study in town-plan analysis. Institute of British Geographers Publication 27. Londra.

Conzen, M. R. G. (1969). Alnwick, Northumberland: a study in town-plan analysis, Institute of British Geographers Publication 27, 2nd publication, Institute of British Geographers, Londra.

Çakmak, E., Belli, B., Kubat, A. S. (2022). Üsküdar'ın Çeper Kuşak Gelişim Süreci. TNUM III. Kentsel Morfoloji Sempozyumu Bildiriler Kitabı, (1077-1098). ODTÜ Mimarlık Fakültesi.

Del Monaco, A. I. (2015). Old-new studies on city limits and fringe belts. Expanding-shrinking urban events. Brief notes on the internal and external frontiers in Chinese and African cities and on a new European limes on the Mediterranean Sea. proceedings of 22nd International Seminar on Urban Form (ISUF), Roma.

Deputla, M. (2014). Polish city from Conzenian perspective – fringe belt phenomenon in Torun. Oliveira, V. et al. (Eds). ISUF 2014: Our common future in Urban Morphology / 21st International Seminar on Urban Form. 21st International Seminar on Urban Form: ISUF 2014, Porto (FEUP).

Ducom, E. (2005). Fringe belts in French cities: Comparative study of Rennes, Nantes, Tours. Approaches in Urban Geography, Newcastle Upon Tyne: Northumbria University Publication.

Ducom, E. (2008). Fringe-belt analysis in France: A Conzenian approach to urban renewal. Environment and Planning B: Planning and Design.

Geddes, I. (2014). From 'a miserable town of 150 mud houses' to 'the city that never sleeps': the transformation of Limassol's urban form over the past 200 years. Oliveira, V. et al. (Eds). ISUF 2014: Our common future in Urban Morphology / 21st International Seminar on Urban Form. 21st International Seminar on Urban Form: ISUF 2014, Porto (FEUP).

Gu, K. (2010). Exploring the fringe belt concept in Auckland: An urban morphological idea and planning practice. New Zealand Geographer, 66, 44-60.

Gu, K., Whitehand, J. W. R., Whitehand, S. (2015). Urban morphogenetic grain: extending fringe-belt research in China. proceedings of 22nd International Seminar on Urban Form (ISUF), Roma.

Günay, B. (1999). Property Relations and Urban Space. METU Faculty of Architecture Press, Ankara.

Harvey, D. (2009). Sosyal Adalet ve Şehir. M. Moralı (Çev.). Metis Yayınları.

Hazar, D. & Kubat, A. S. (2015). Fringe belts in the process of urban planning and design: Comparative analyses of Istanbul and Barcelona. ITU A|Z, 12(1), 53-65.

Hazar, D. & Kubat, A. S. (2016). The fringe belt development process of Istanbul. proceedings of 23rd International Seminar on Urban Form (ISUF), Nanjing.

Hazar, D. & Özkan, S. P. (2020). Çeper Kuşakların Kamusal ve Ekolojik Değeri: İzmir Askeri Aalanlar Örneği. Kent Akademisi 13(1), 10-21.

He, S. (2018). Exploring the fringe-belt phenomenon in a Sino-Portuguese environment: the case of Macao. Urban Morphology, 22(1), 35-52.

Hopkins, M. I. W. (2012). The ecological significance of urban fringe belts. Urban Morphology, 16(1), 41-54.

Karaulan, D. & Kubat, A. S. (2018). Analyzing Fringe Belt Phenomenon in The Historico-Geographical Structure of Milan, Italy. ICONARP International Journal of Architecture and Planning, 6(2), 304-332. https://doi.org/10.15320/ICONARP.2018.56

Kropf, K. & Malfroy, S. (2013). What is urban morphology supposed to be about? Specialization and the growth of a discipline. Urban Morphology, 17(2), 128-131.

Kubat, A. S. (2019). Exploring the Fringe-Belt Phenomenon in a Multi-Nuclear City: The Case of Istanbul. ICONARP International Journal of Architecture and Planning 7, 95-134. https://doi.org/10.15320/ICONARP.2019.83

Kubat, A. S., Ünlü T., Kuru, Ö. (2022). Tarihi Yarımada İç Çeper Kuşak Alanlarının İncelenmesi: Konstantin Surları. TNUM III. Kentsel Morfoloji Sempozyumu Bildiriler Kitabı, (397-412). ODTÜ Mimarlık Fakültesi

Küçük Çalışkan, E. (2023). Çeper Kuşak Alanlarının Gelişiminde ve Dönüşümünde Mülkiyet Perspektifi: İstanbul İncelemesi. (PhD thesis). İstanbul Teknik Üniversitesi.

Küçük Çalışkan, E. & Kubat, A. (2021). Policies and facts for mega-urbanization: middle and outer fringe belt developments of Istanbul. ISUF 2020 Virtual Conference Proceedings, 1. doi:10.26051/0D-4S8D-08CR

Küçük Çalışkan, E., Kubat, A. S. (2022a). İstanbul Sanayi Alanları Dönüşümlerinin Çeper Kuşak Analizi ile İzlenmesi. TNUM III. Kentsel Morfoloji Sempozyumu Bildiriler Kitabı, (1099-1113). ODTÜ Mimarlık Fakültesi.

Küçük Çalışkan, E. & Kubat, A. S. (2022b). Tracking Morphological Agencies in the Alienated Fringe Belt Plots of Istanbul. ICONARP International Journal of Architecture and Planning, 10(2), 711-734. DOI: https://doi.org/10.15320/ICONARP.2022.222

Lammers, D. & Roders, A. P., Wesmael, P. (2015). Radial fringe-belt formation. proceedings of 22nd International Seminar on Urban Form. Rome, 1495-1506.

Lammers, D. & Roders, A. P., Wesmael, P. (2017). Future scenarios for post-industrial Eindhoven. A fringe-belt perspective. proceedings of 24th International Seminar on Urban Form (ISUF), Valencia.

Larkham, P. J. (1998). Urban Morphology and Typology in the United Kingdom.

Lefebvre, H. (2014). Mekânın Üretimi. Işık Ergüden (Çev.), Sel Yayıncılık.

Logunova, E. (2017). Morphological evolution of the fringe-belts of Krasnoyarsk. proceedings of 24th International Seminar on Urban Form (ISUF), Valencia.

Marques de Sousa Safe, S. & de Alvarenga Pereira Costa, S. (2017). Fringe belt analysis: A method for confirming the establishment of the historical boundaries of Rabat. Acta Universitatis Lodziensis. Folia Geographica Socio-Oeconomica, 25, 39-62.

Meneguetti, S. K. & Pereira Costa, S.A. (2015). The fringe-belt concept and planned new towns: a Brazilian case study. Urban Morphology, 19(1), 25-33.

Monaco, A. I. (2015). Old-New studies on City limits and Fringe belts. Expanding-Shrinking urban events. Brief notes on the internal and external frontiers in Chinese and African cities on a new European limes on the Mediterranean Sea. proceedings of 22nd International Seminar on Urban Form, Rome, 1485-1494.

Openshaw S. (1974) A Theory of the Morphological and Functional Development of the Townscape in an Historical Context, University of Newcastle upon Tyne, Department of Geography, Seminar Papers, Number 24.

Šćitaroci, M. O., Marić, M. (2019). Morphological characteristics of green spaces in fortified towns and cities. Urban Morphology, 23(1), 27-44.

Simão and Costa (2014). Tranformation of the fringe belt units at the perimeter of Avenida do Contorno/Belo Horizante/MG. Oliveira, V. et al. (Eds). ISUF 2014: Our common future in Urban Morphology / 21st International Seminar on Urban Form. 21st International Seminar on Urban Form: ISUF 2014, Porto (FEUP).

Soygüzeloğlu, B., Kubat, A. S. (2022). Tarihsel Süreçte Çeper Kuşak Alanlarının Analizi: Taksim-Pera Örneği. TNUM III. Kentsel Morfoloji Sempozyumu Bildiriler Kitabı, (437-454). ODTÜ Mimarlık Fakültesi.

Ünlü, T. (2013). Thinking about Urban Fringe belts: A Mediterranean Perspective. Urban Morphology, 17(1), 5-20.

Ünlü, T. & Baş, Y. (2016). Multi-nuclear growth patterns in a rapidly changing Turkish city: a fringe-belt perspective. Urban Morphology, 20(2), 107-21.

Ünlü, T. & Baş, Y. (2019). The Urban Growth and Development Periods of Turkish Cities: A Fringe-Belt Perspective. B. Ö. Sarı (Ed.). Urban and Regional Planning in Turkey. (107-128). Springer.

Ünlü, T. (2022). Urban Fringe Belts: Roots, Developments and Prospects. Journal of Urban Research and Development, 3(1), 4-15.

Vilagrasa, J. (1990). The fringe-belt concept in a Spanish context: the case of Lleida. Slater T. R. (Ed.) in The Built Form of Western Cities. (300-318). Leicester University Press.

Whitehand, J. W. R. (1967). Fringe belts: a neglected aspect of urban geography. Transactions of the Institute of British Geographers, 41, 223-33.

Whitehand, J. W. R. (1972a). Building cycles and the spatial pattern of urban growth. Transactions of the Institute of British Geographers, 56, 39-55.

Whitehand, J. W. R. (1972b). Urban-rent theory, time series and morphogenesis: an example of eclecticism in geographical research. Area, 4(2), 215-222.

Whitehand, J. W. R. (1977). The basis for an historico-geographical theory of urban form. Transactions of the Institute of British Geographers, 2(3), Change in the Town (1977). 400-416.

Whitehand, J.W.R. (1981). Background to the urban morphogenetic tradition. J.W.R. Whitehand (Ed.) The Urban Landscape: Historical Development and Management Institute of British Geographers Special Publication 13 içinde, 1-24. Academic Press, London.

Whitehand, J. W. R. (1988). Urban fringe belts: development of an idea. Planning Perspectives, 3(1), 47-58.

Whitehand, J. W. R. (1994). Development Cycles and Urban Landscapes. Geography, 79(1), 3-17.

Whitehand, J. W. R. (2001). British urban morphology: the Conzenian tradition. Urban Morphology, 5(2), 3-10.

Whitehand, J. W. R. & Morton, N. J. (2003). Fringe belts and the recycling of urban land: an academic concept and planning practice. Environment and Planning B: Planning and Design, 30, 819-39.

Whitehand, J. W. R. & Morton, N. J. (2004). Urban morphology and planning: the case of fringe belts. Cities, 21(4), 275-289.

Whitehand, J. W. R. & Morton, N. J. (2006). The fringe belt phenomenon and socioeconomic change. Urban Studies, 43, 2047-66.

Whitehand, J. W. R. (2011). Issues in urban morphology. Urban Morphology, 16(1), 55-65.

Whitehand, J. W. R., Gu, K., Whitehand, S. (2011). Fringe belts and socioeconomic change in China. Environment and Planning B: Planning and Design, 38, 41-60.

Whitehand, J. W. R., Gu, K., Conzen, M. P., Whitehand, S. M. (2014). The typological process and the morphological period: a cross-cultural assessment. Environment and Planning B: Planning and Design, 41, 512-533.

Whitehand, J. W. R. & Gu, K. (2017) Urban fringe belts: evidence from China. Environment and Planning B: Urban Analytics and City Science, 44(1), 80-99.

Whitehand, J. W. R. (2019). Green space in urban morphology: a historico-geographical approach. Urban Morphology, 23(1), 5-17.

Zhang, Y. (2019). A spatio-temporal study of fringe belts and urban green spaces in Birmingham, UK. Urban Morphology, 23(1), 27-44.

Resume

Dr. Ezgi KÜÇÜK ÇALIŞKAN is the Urban Planning Coordinator at Marmara Municipalities Union. She graduated from Izmir Institute of Technology, Faculty of Architecture, Department of City and Regional Planning. She holds a master's in urban design from Istanbul Technical University. She received a Ph.D. in Urban and Regional Planning at Istanbul Technical University, with her dissertation dealing with property relations in urban fringe belt areas. Her academic studies continue at the Turkish Network of Urban Morphology.

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Conceptual analysis of livable cities in the context of Ted Talks

Nur Yılmaz*
Gamze Atay**

Abstract

Today, livable urban spaces are very important in terms of the healthy conduct of both individual and social life. Shaped in line with human needs such as education, housing, economy, cultural and social life, the city and the livability of the city is one of the current discussion topics with its variable and dynamic structure in addition to the factors it contains. From this point of view, the concept of "livability" has been questioned in the context of urban planning. Considering the temporal resilience of cities, the semantic dimension - qualitative studies - and therefore concepts are very powerful tools. Concepts are the basis of interpretation or theorizing. The aim of the study is to develop a different perspective by revealing the measurability of more livable and happier cities and the criteria they contain through discussions and discourses on this subject. In this context, the TED platform, which is easily accessible by large masses today and popular in terms of social awareness, has been used. The content of 65 texts focusing on urban research in TED Talks between 2007 and 2023 has been analyzed and a conceptual analysis has been made through NVivo, a qualitative analysis program. The content analysis method has been used in the evaluation of the texts, and discussions and interpretations have been made based on frequency frequencies. In light of the data obtained, it has been seen that more livable cities have been associated with the codes "architectural design", "technology", "energy" and "climate" respectively. As a result; it can be said that the concept of urban livability cannot be independent of the climate crisis, ecology discussions, and energy efficiency discourses as a solution to this crisis, and architectural designs that follow the technological level of the age, and the parameters discussed in the face of changing needs and situations over time can also change.

Keywords: content analysis, livability concept, nvivo, ted talks, urban planning

1. Introduction

People spend a large part of their lives in urban spaces, where they work, raise their children, and engage in social, cultural and economic relations. Urban spaces are designed with laws and standards determined in line with the needs of the people living in them. As people shape the city, cities shape the behaviours of the people living in them. Therefore, the living conditions, design features, strategies developed against security problems, administrative and economic situation in the city where people live are of vital importance for people to continue their lives in a healthy way. Today, when the majority of people live in cities for more than one reason, including economic and educational reasons, the issue of how cities can be made more livable, sustainable and human-oriented is of crucial importance.

The issue of the livability of a city has become a frequently discussed issue throughout the world in terms of environmental problems, economy, education, living standards and other issues affecting urban life. In addition to scientific research, livability has become a term emphasized by

*(Corresponding author), Dr. Department of Architecture, Cukurova University, Türkiye, nsurbahanli@cu.edu.tr
** Research Asistant Dr. Department of Architecture, Cukurova University, Türkiye, gatay@cu.edu.tr
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politicians in their discourses, used as an advertising element, and heard in mass media for the promotion of cities.

All levels of government, the private sector and the non-profit sector address the concept of livability in one way or another. However, despite its widespread use, the definition of a "liveable city" cannot be clearly defined. Livable city is considered together with other terms such as sustainable city, smart city, eco-city, resilient city or green city. The qualities defined as the common feature of these definitions include multiple political, social, economic and design concepts such as the need for walkability, the need for a variety of housing types, mixed land uses, protection of open spaces, community participation, job opportunities for all, respect for community character and local heritage, quality educational facilities, low crime rates, balanced transport options (Caves & Wagner, 2018).

The main purpose of urban design is to improve the places where people live and to increase the quality of life. Therefore, the concept of livability should be at the center of urban design. In this study, which focuses on the semantic dimension of the discourse of "livability" in urban design;

- Questioning the concept of livability by focusing on city, human and life factors,
- Incorporating the concept of liveability into urban planning research in a more effective way,
- It is aimed to raise awareness on urban liveability.

The study focuses on TED (Technology, Entertainment and Design) talks that offer different perspectives on the concept of livability, which is a current debate in the literature. Within the scope of the study, content analysis has been made on TED Talks under the title of 'urban planning', the concept of livability has been analyzed through the triangle of human, city and life, and it has been evaluated how design can contribute to human needs, comfort and health with the question of livability.

2. Urban Livability Concept

The concept of 'livability' is often discussed in planning and design decisions, but there is no clear consensus on what 'livability' actually means, how to measure it, and therefore how to appropriately prioritize actions towards the goal of achieving a liveable city (Appleyard, 2021).

"Livability" is a multiple concept without a precise and universal definition; a living environment that may be characterised as liveable in one part of the world may not be perceived as such in another part of the world. The reason for the lack of a clear and single definition of livability is that it is argued that each city should be considered within its own context. The journey each city has taken or is currently taking is unique and context-specific. In this sense, there cannot be expected to be a universal, one-size-fits-all approach to livability. Some cities have a long history of developing livability policies and programs that focus on equity, economic and environmental concerns, while others are relatively new (Caves & Wagner, 2018).

The concept of livability is evaluated in different contexts for cities, but it also has a personal aspect. A city where an individual finds an environment where the living standards of his/her dreams are realised can be defined as livable. The fact that the qualities of the city are suitable for the people to sustain their lives is an indication that it is a livable city. Livability refers to the spatial, social and environmental characteristics and quality that will contribute to the individual and collective welfare of people and their sense of satisfaction from being a resident of that settlement (Keleş, 2010).

It is a known fact that people are in a flow towards cities for many reasons such as the industrial revolution, rural-urban conflict, and the excess of socio-economic opportunities in the city. Regardless of the reason why people prefer to live in cities, the general opinion shows that people come to cities with the demand to have certain living standards. Many factors affect the level of access to these standards (Şolt, 2018). Creating livable urban spaces has been the main field of endeavor of many different disciplines such as economics, politics, education, health, sociology and

primarily urban planning discipline. The ever-increasing urban population in today's world geography and the environmental and health problems that arise accordingly have made it important to conduct research on the livability of cities, urban life quality and the criteria that make cities livable. In the most general definition, livability is the relationship between social, economic, structural and environmental elements affecting human beings (Kuru & Özkök, 2007).

The meaning of urban livability varies according to place, time, the purpose of the assessment and the value systems of the assessor. The concept of livability remains up to date and can be a common public policy objective of different stakeholder groups. The concept of "livable city" has been associated with population and size by some theorists since Plato, and with the ability of the entire urban population to manage the city with effective participation in the Greek civilisation. The contemporary meaning of livability is generally associated with the concepts of health, job opportunities, income status, good housing areas, schools, shopping and entertainment activities, accessibility, public spaces, and community (Oktay, 2007).

Urban research has argued that the discourse of livability often reflects the interests of the upper and middle classes. Livability has been characterized as a discourse that privileges consumption and individual choice over collective responsibility and civic ethos (Hankins & Powers, 2009). In response, urban researchers have argued against the notion of a 'just', 'good' or 'right' city. Although the discourse of livability has behen used by governments and housing corporations to promote their neo-liberal, profit-centered agendas, it is argued that the concept should be human-centered (Uitermark, 2009).

According to Kaal (2011), the concept of livability has assumed various roles in different contexts over the past half-century. In Europe in the late 1950s, 'livability' has been considered a citizenship right in terms of adequate housing, health services, employment opportunities, education and consumption, and leisure opportunities. However, the concept of livability has subsequently turned into political propaganda. The concept started to be included in the academic literature in the 1960s. In the 1990s, it became an important concept and started to be used frequently in daily life and in the media with the works of local governments (Kaal, 2011).

Livability principles have been taken as the concepts on which some city rehabilitation programs are based. For example, the city of Copenhagen has adopted livability elements based on sustainable environmental principles to improve the quality of life. In the last 30 years, Copenhagen has undergone a major transformation from a city in decline to one of the happiest and most prosperous cities in Europe. It has been emphasised that Copenhagen's responsibility as a liveable city goes beyond affordable housing, clean air, jobs and transport infrastructure, but also to create recreational spaces in the city where people can meet, gather and socialise. The aim is to build and maintain the social fabric that is so fundamental to resilient societies (URL-1).

The proposals for Barcelona addressed livability in the following terms. The debate on reclaiming street space for citizens has been one of the main themes in the history of contemporary urbanism. Vehicle restriction policies in central areas, the reconversion of motorways, efforts to mitigate the effects of infrastructure, planning for public transport networks, sustainable mobility schemes or the design of superblocks or sectors are just a few examples that always have the same objective: to humanize urban space, to make streets qualitatively more interesting and to ensure that the construction of infrastructure does not have too decisive an impact on the quality of life in urban areas and neighborhoods. In addition to creating political and technical solutions that bring balance and spatial justice to the city, it is increasingly important to promote more environmentally friendly urban environments and streets (Cárdenas & Maria Gravante, 2023).

The ability of cities to respond to human life, social and cultural needs, and to provide opportunities to live in a healthy environment have led some cities to be defined as liveable. Which city meets which criterion and to what extent is provided by analytical measurement of livability.

2.1. Measuring the Livability

Measuring urban livability aims to assess how well a city or region offers a good living environment for people. For this purpose, various indicators and parameters have been developed for livability assessment. Measuring livability is important for understanding and assessing how well a city or region offers a good living environment for people. This measurement is carried out in order to guide urban planning and design processes, to utilise resources effectively and to meet the needs of the society.

The concept of livability has been formulated by various organisations conducting research on cities around the world by using certain criteria and livability indices have been created. When the criteria used by these studies to measure the quality of urban life are analysed, it is seen that the main headings such as political environment, social environment, physical and cultural environment quality, quality of public services such as education and health, and accessibility are used in common (Kuru & Özkök, 2017).

Livability research is a research process in which reputable research units, journals or websites around the world subject cities to a research process in line with specified criteria. Within the scope of this study, *Mercer Quality of Life Survey, Economist Intelligence Unit Livability Ranking, AARP Livability Index and Monocle's Most Liveable City Index* have been analysed (Table 1).

Table 1 The livability studies evaluated within the scope of the study

Livability Research Name	Definition	Parameters
Mercer Quality of Life Survey	Mercer's Quality of Living Ranking is an annual survey conducted by Mercer, a global consulting firm, to assess the quality of life in cities around the world (URL-2).	• Climate, • Disease and sanitation standards, Physical remoteness and ease of communication, • Political and social environment, Violence and crime
Economist Intelligence Unit Livability Ranking	The Economist Intelligence Unit (EIU) Livability Ranking is an annual survey conducted by the Economist Intelligence Unit, a part of The Economist Group. This ranking assesses the quality of life and livability of cities around the world. Cities are scored and ranked based on these factors to provide insights into the overall quality of life in different locations (URL-3).	• Stability • Healthcare • Culture And Environment • Education • Infrastructure

AARP (American Association of Retired Persons) Livability Index	It is a research developed by AARP, a US-based retirement age association. This index aims to assess the livability level of different regions in the USA. It is designed to measure the quality of life of elderly individuals and their capacity to meet their daily living needs (URL-4).	• Housing
		  ○ Affordability and access
		• Neighborhood
		  ○ Proximity and Security
		• Transportation
		  ○ Safety and Convenience
		• Environment
		  ○ Clean Air and Water
		• Engagement
		  ○ Civic and Social Involvement
		• Health
		  ○ Prevention, Access and Quality
		• Opportunity
		  ○ Inclusion and Possibilities

Monocle's Most Liveable City Index	It is a ranking published by an international publishing organisation called Monocle that evaluates cities around the world in terms of livability. This index is a research prepared annually by Monocle magazine and evaluates cities according to different criteria (URL-5).	• Safety/Crime • İnternational Connectivity • Climate/Sunshine • Quality of Architecture • Public Transport • Tolerance • Environmental İssues • Access To Nature • Urban Design • Business Conditions • Proactive Policy Developments Medical Care.

3. Technology, Entertainment, Design (TED) Talks under Urban Planning Topic

TED (Technology, Entertainment and Design) conferences are events where experts, thinkers, artists, scientists and leaders from all over the world come together to share impressive speeches. TED Conferences, which first started in 1984, have inspired independent organizations such as TEDx in the following years (URL-6).

Speakers are specialized in a wide range of subjects. They cover a wide range of topics such as science, technology, art, psychology, leadership, and human rights. The topics of the talks refer to the world agenda, as well as changing discourses, scientific and technological developments and social problems around the world. TED talks usually last 18 minutes or less. This limited time is important in terms of effective use of time, which is the most valuable asset of people in modern times. In addition, this time constraint encourages speakers to express their thoughts clearly and effectively. Another important advantage of TED talks is their worldwide visibility and easy accessibility. Since the talks are broadcast over the internet, people all over the world can access this content for free.

The discipline of urban design, which is shaped by the intersection of social, cultural, political, historical, economic and technological developments affecting the city and people, is an important discussion area for TED talks. In this context, the contents of TED talks, which offer inspiring ideas to the audience on how urban life can be designed in a more sustainable, livable and effective way, are the focus of the study. Within the scope of the study, 65 TED talks published between 2007-2023 have been analyzed (Table 2).

Table 2 Talks analysed under the subheading "Urban Design" (URL-6)

Speaker	Title of video	Year
1. Steven Johnson	How The "Ghost Map" Helped End a Killer Disease	2007
2. Stewart Brand	What Squatter Cities Can Teach Us	2007
3. David Rockwell	A Memorial at Ground Zero	2007
4. Nate Silver	Does Racism Affect How You Vote?	2009
5. Stewart Brand	4 Environmental 'Heresies'	2009
6. Ellen Dunham-Jones	Retrofitting Suburbia	2010
7. Mitchell Joachim	Don't Build Your Home, Grow İt!	2010
8. Eduardo Paes	The 4 Commandments of Cities	2012
9. Noah Wilson-Rich	Every City Needs Healthy Honeybees	2012
10. Kent Larson	Brilliant Designs to Fit More People İn Every City	2012
11. Edi Rama	Take Back Your City with Paint	2013
12. Erik Schlangen	A "Self-Healing" Asphalt	2013
13. Vance Kite	Urbanization And the Evolution of Cities Across 10,000 Years	2013
14. Chris Downey	Design With the Blind İn Mind	2013
15. Catherine Bracy	Why Good Hackers Make Good Citizens	2014
16. Theaster Gates	How To Revive a Neighborhood: With İmagination, Beauty And Art	2015
17. David Sedlak	4 ways we can avoid a catastrophic drought	2016
18. Ole Scheeren	Why great architecture should tell a story	2016
19. Joe Gebbia	How Airbnb designs for trust	2016
20. Parag Khanna	How megacities are changing the map of the world	2016

21. Tom Hulme	What can we learn from shortcuts?	2016
22. Marwa Al-Sabouni	How Syria's architecture laid the foundation for brutal war	2016
23. Shubhendu Sharma	How to grow a forest in your backyard	2016
24. Wanis Kabbaj	What a driverless world could look like	2016
25. Ryan Gravel	How an old loop of railroads is changing the face of a city	2016
26. Jeff Speck	4 ways to make a city more walkable	2017
27. Justin Davidson	Why glass towers are bad for city life — and what we need instead	2017
28. Grace Kim	How cohousing can make us happier (and live longer)	2017
29. Peter Calthorpe	7 principles for building better cities	2017
30. Thomas Madrecki	Can we design cities for happiness?	2017
31. Karoliina Korppoo	How a video game might help us build better cities	2017
32. Robert Muggah	The biggest risks facing cities — and some solutions	2017
33. Liz Ogbu	What if gentrification was about healing communities instead of displacing them?	2018
34. Sarah Murray	A playful solution to the housing crisis	2018
35. Vishaan Chakrabarti	How we can design timeless cities for our collective future	2018
36. Rodin Lyasoff	How autonomous flying taxis could change the way you travel	2018
37. Stephen DeBerry	Why the "wrong side of the tracks" is usually the east side of cities	2018
38. Esther Sullivan	America's most invisible communities — mobile home parks	2018
39. Kate Wagner	I hate McMansions — and you should too	2018
40. Yale Fox	Home renters are powerless. Here's how to fix that	2018
41. Mara Mintzer	How kids can help design cities	2018
42. Kotchakorn Voraakhom	How to transform sinking cities into landscapes that fight floods	2019
43. Bjarke Ingels	Floating cities, the LEGO House and other architectural forms of the future	2019
44. Rahul Mehrotra	The architectural wonder of impermanent cities	2019
45. Eli Pariser	What obligation do social media platforms have to the greater good?	2019
46. Ma Yansong	Urban architecture inspired by mountains, clouds and volcanoes	2019
47. Stuart Oda	Are indoor vertical farms the future of agriculture?	2020
48. Smruti Jukur Johari	What if the poor were part of city planning?	2020
49. Stefan Al	What happens if you cut down all of a city's trees?	2020
50. Vishaan Chakrabarti	3 ways we can redesign cities for equity and inclusion	2020
51. Carlos Moreno	The 15-minute city	2021
52. Elizabeth Diller	A stealthy reimagining of urban public space	2021
53. Jota Samper	The informal settlements reshaping the world	2021
54. Kevin J. Krizek	How COVID-19 reshaped US cities	2021
55. Liam Young	Planet City — a sci-fi vision of an astonishing regenerative future	2021
56. Vishaan Chakrabarti	A vision of sustainable housing for all of humanity	2021
57. Liu Thai Ker	The architectural mastermind behind modern Singapore	2022
58. Cameron Webb	How to design mosquitoes out of cities	2022
59. Marvin Ree	How is your city tackling the climate crisis?	2022
60. Thomas Heatherwick	The rise of boring architecture — and the case for radically human buildings	2022
61. Eleni Myrivili	A 3-part plan to take on extreme heat waves	2022
62. Scott Fitsimones	Could a DAO build the next great city?	2022
63. Zineb Sqalli	Climate action's hidden opportunities for women	2022
64. Heidi Sørensen	5 lessons on building an emissions-free city	2022
65. Emily Grubert	What happens to gas stations when the world goes electric?	2023

4. Method of Research

In the study focusing on the meaning and reading of urban livability, research techniques under the umbrella of qualitative research have been examined in order to analyse the complex and multifaceted structure of the concept of livability, which is the main element. Among these techniques, content analysis overlaps with the purpose and method of the study since it supports the hidden meanings in qualitative data with both qualitative and quantitative findings. Within the framework of content analysis, categorical analysis has been made based on frequency frequencies (Figure 1). Speeches by educators, artists, designers, architecture critics, experts, thinkers and scientists who participated in TED Talks on urban planning have been analysed using NVivo qualitative data analysis software.

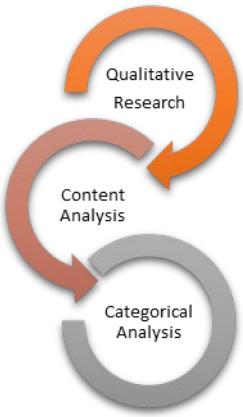

Figure 1 Hierarchical flow chart of the method applied in the study

4.1. Analysis

Maanen (1979) considers qualitative research as an umbrella term and defines it as "a set of processes involving techniques that seek to define, analyze, interpret and arrive at terms related to meaning" (Van Maanen, 1979).

Qualitative research starts with assumptions, a broad perspective, the use of theoretical approaches as much as possible, and research problem that focus on social or individual problems and the people and groups associated with them. In order to work on these problems, the qualitative researcher uses one of the existing qualitative research methods or approaches, collects data in a natural environment related to the people or regions that are the subject in the light of this method, analyses the data to see the big picture for the purpose of deduction, and creates themes or models. The report or presentation to be written at the end of the research includes the voices of the participants, the researcher's reflection on these voices, a broad definition of the problem and comments on this problem (Creswell, 2007).

4.2. Content Analysis

Just as people looking at the same place cannot see the same thing, the same word, text or picture can be perceived differently by the people who come into contact with it. People who are the recipients of discourse may perceive it differently due to differences in their perceptions. For this reason, Bilgin (2014) stated that all discourses, no matter what type they are, need to be deciphered, decoded, interpreted and inferred because they are language elements (Bilgin, 2014).

The main purpose of content analysis is to summarise and broadly define a concept with codes and categories. The general purpose of these codes and categories is to create a model, conceptual system, conceptual map or conceptual categories (Güler et al., 2015).

Content analysis is the quantitative and qualitative analysis of the meanings hidden in texts or transcripts or the messages that are intended to be given there, by following a certain systematic in the form of codes and categories and analyzing these concepts and categories quantitatively and qualitatively (Bazeley, 2003; Güler et al., 2015).

4.3. NVIVO Qualitative Analysis Software

Computer software is a tool that helps the researcher to make his/her study more accurate, faster and more comprehensive through recorded or analyzed data. Through such software, the data analysis process is made more understandable and systematic. Such software organizes, categorizes and codes the data collected through various methods and is used for reporting the whole process. At the same time, this software also offers various opportunities to researchers in the process of visualizing qualitative data (Yakut Çayır & Sarıtaş, 2017).

In this context, there are various software that can be used in computer-aided qualitative data analysis. NVivo qualitative data analysis software is the most widely used package program in qualitative data analysis studies because it is a program about which the most books have been written and introduced to researchers (Yakut Çayır & Sarıtaş, 2017). For this reason, NVivo /14 program has been preferred for the analysis of the data compiled within the scope of the study and visual models.

4.4. Research Model

A well-designed research model in highly patterned subjects where the meaning does not give itself directly, clarifies the steps of the study and makes it easy to comprehend and not to move too far away from the starting point as the process progresses.

For this purpose, a research model has been created by using qualitative and quantitative analysis techniques in the context of qualitative research method (Figure 2). Based on the first research question, it has been focused on the existence and quantitative frequencies of words and concepts related to liveable cities. This research model consists of five main steps: extraction of livability concepts from the literature, reducing concepts to codes, determination of the sample group, conceptual analysis of texts via NVivo and discussion (Figure 2).

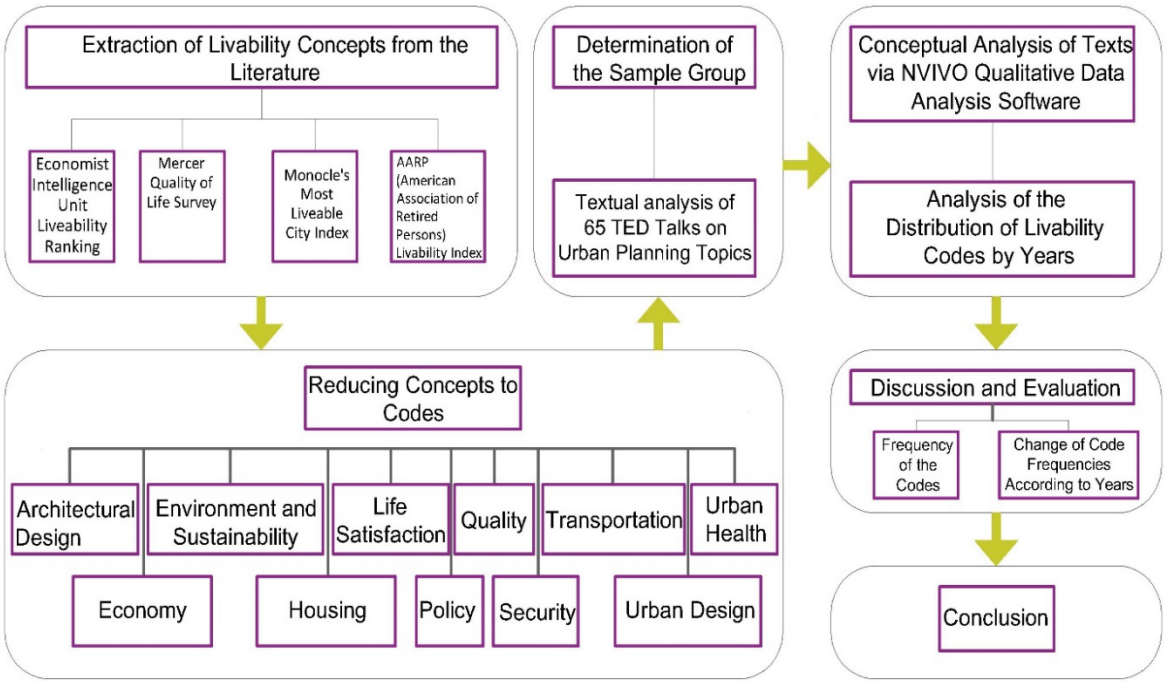

Figure 2 Methodology of the Research

The first two steps in the study model are the determination of the codes, which are the basis for the content analysis to be carried out in the NVivo-14 interface, through the literature. In obtaining the codes, the parameters of the Mercer Quality of Life Survey, Economist Intelligence Unit Livability Ranking and AARP Livability Index and Monocle's Most Liveable City Index, which have been used in the livability measurements of cities, have been utilized. Among these parameters, 11 main codes have been identified, which are targeted to provide data to urban and architectural design disciplines since they are suitable for the research question and purpose. The concepts obtained from urban and livability readings and selected with the foresight that they will directly affect the design consist of architectural design, economy, environment and sustainability, housing, life satisfaction, policy, quality, security, transportation, urban design and urban health, and these codes include related sub-codes (Figure 3).

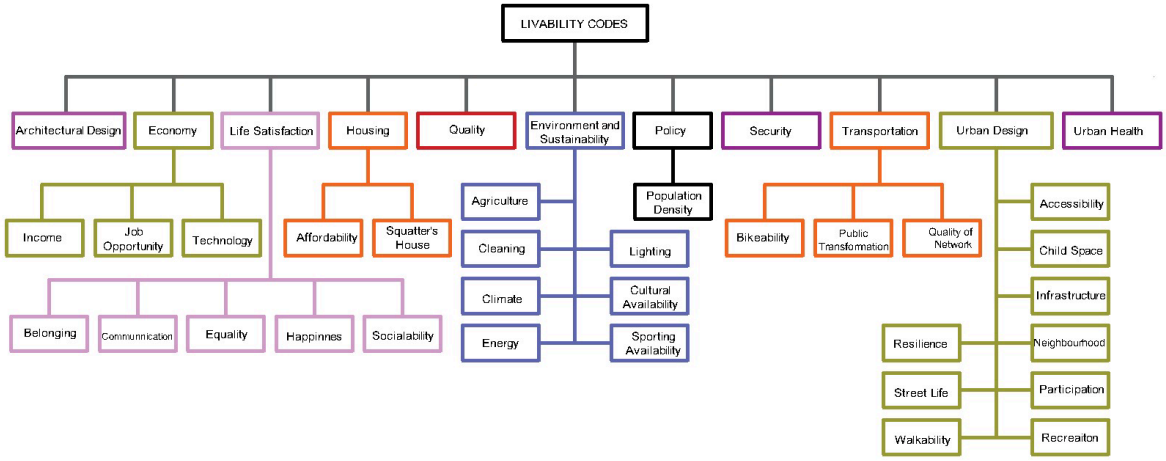

Figure 3 Methodology of the Research

In order to determine the expressions used as material when questioning the concepts related to "livability" in urban planning research, TED Talks, which deal with current and popular topics, have been consulted. In the third step in which the sample group has been determined, 65 videos on the TED homepage on the topic of "Urban Planning" from 2007 to the present day have been accessed (URL-6). The speeches in these videos have been transcribed and converted into text and transferred to the Nvivo interface.

At the stage where intensive readings and conceptual analyses have been made over the speech texts, 2 types of analyses have been conducted. Firstly, while reading the text, the contents have been categorized according to the upper and lower codes. With this categorization, it has been seen which codes each text responded to. Secondly, file classification has been made and the texts have been categorized on the basis of year. With the analysis of the video texts, year and code frequencies have been obtained, thus completing the content analysis process.

In the discussion and Evaluation phase, which is the next step of the model, categorical analysis, which can be expressed as measuring the numerical, percentage and proportional frequency of repetition of the determined categories (Bilgin, 2014), has been applied and the change of these frequencies over the years has been read.

5. Discussion

5.1. Discussion of Code Frequency

The concept of livability consists of codes and sub-codes. As a result of the analyses on the livability of cities, it has been observed that the codes and quantitative values of these codes in the speech texts have changed. The existence of this variable and various parameters represents the unique differences in the definition of livable cities.

In the context of content analysis, the texts of TED talks titled "Urban Planning" between 2007 and 2023 have been compiled by the authors and questioned through "Livability Codes" consisting of 11 main codes and sub-codes. This preliminary study is a working base for the content analysis to be conducted.

After the content analysis of all texts constituting the sample group, the data obtained have been analyzed and interpreted from a holistic perspective. In this direction, the order of main codes and sub-codes according to code frequency is given in Table 3.

Table 3 Most frequently repeated codes

Main Codes	Sub-Codes	Total Frequency
Urban Design (9)	Infrastructure (29) Neighborhood(29) Street Life (29) Walkability (28)	230

	Resilience (25) Recreation (23) Child Space (22) Accessibility (18) Participation (18)	
Environment and Sustainability (23)	Energy (42) Climate (40) Agriculture (23) Cultural Availability (22) Cleaning (18) Sporting Availability (7) Lighting (4)	179
Life Satisfaction (10)	Socialability (26) Equality (19) Beloning (18) Communication (17) Happiness (16)	106
Economy (29)	Technology (50) Job Opportunity (12) Income (9)	100
Architectural Design (57)		57
Housing (28)	Affordability (18) Squatter's House (9)	55
Transportation (20)	Quality of Network (12) Bikeability (11) Public Transformation (11)	54
Policy (22)	Population Density (14)	36
Urban Health (21)		21
Security (19)		19

In Table 3, the data obtained through the frequency distributions of the graphics and codes are discussed. Accordingly, in the content analysis of the speeches, the emphasis on "urban design", which is associated with the human-oriented and livable nature of cities and includes sub-codes such as participation, sociability and accessibility, comes to the fore. The sub-codes of "infrastructure, neighborhood and street life" have been discussed in the top ranks in the quantitative data query under the upper heading of urban design. The frequent use of these concepts is based on the fact that they are the factors that primarily affect the design of the city and human relations.

Then, the discussions on "environment and sustainability", "life satisfaction" and "economy", which are essential in terms of the quality of the built environment of cities, have been repeated frequently. The most frequently discussed codes under the subheading "environment and sustainability" have been energy and climate, referring to today's ecological discoursesThe most common code under the concept of life satisfaction, which expresses the semantic bond that people establish with the city in liveable cities, has been sociability. In line with this data, it is inferred that liveability and human relations are handled together with each other. In the data obtained, the fact that the concept of "economy", which is an essential parameter in the livability of cities, is handled in the top ranks and the emphasis on the concept of technology within the sub-codes has emphasized the importance of technological developments in urban design discussions and it has been seen that cities with these developments are considered as livable.

When all the concepts independent of the main and sub-codes have been analyzed, it has been found that the concepts of "architectural design", "technology", "energy" and "climate" have been repeated most intensively (Figure 4). This data, on the other hand, showed the primary effect of architectural design elements on urban living opportunities, and the human-oriented, standard-compliant design of the architectural design that constitutes the urban built environment and access to these designs have been overlapped with the concept of livability. Finally, it has been

determined that the concept of lighting, which has been handled under the title of "environment and sustainability", has been the least discussed code.

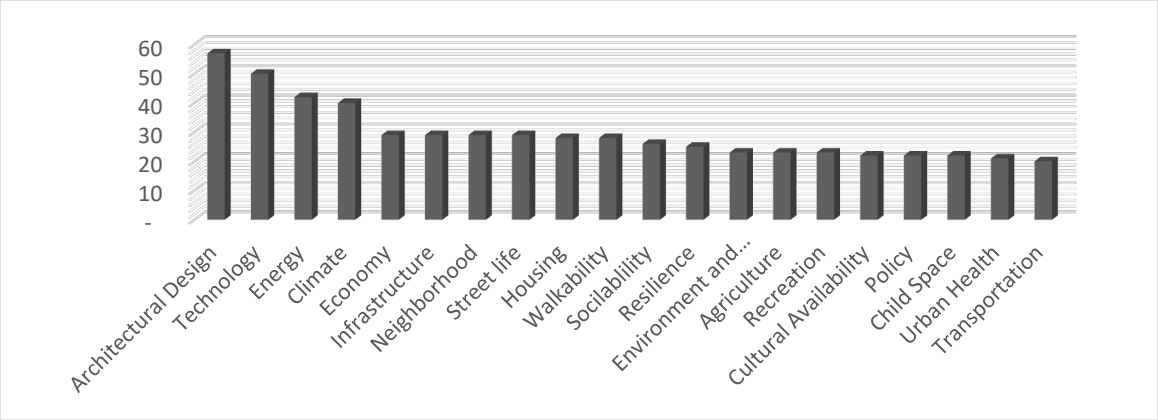

Figure 4 Frequency distribution of liveability codes

5.2. Changing of Code Frequencies between 2007 and 2023

In order to discuss the changes in the main and sub-concepts of all readings made in the context of the study over the years, the matrix code frequency image obtained from the Nvivo program is given (Figure 5). In this visual, as can be read from the colour changes, the frequency of use of the codes is directly proportional to the darkness of the colour tone.

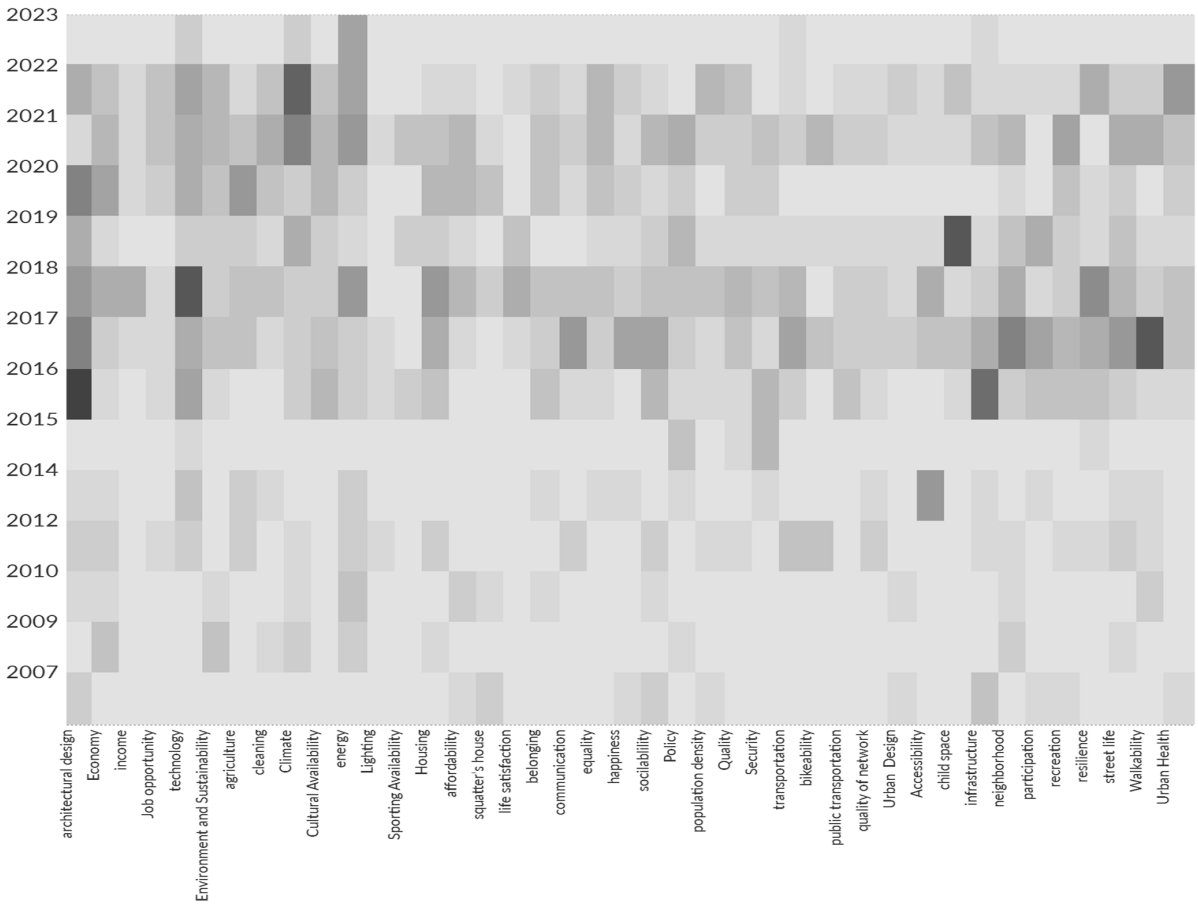

Figure 5 Matrix Coding Results

In line with the data obtained according to the analysis outputs;

- Between 2007-2015, a homogenous situation has been observed in code frequency distributions, but in 2012, the concept of "child space" has been emphasized,

- The concept of "environment and sustainability", which started to be discussed in 2009, has been frequently repeated in all speeches until today; even with the 2020 pandemic process, it ranked 1st every year with an intense frequency difference,
- In 2012 and afterward, the concept of "economy" is frequently used in speeches by associating it with other concepts,
- Unlike other years, in 2015, the concept of "security" and the concepts of "policy" and "quality" associated with this concept have been emphasized by the speaker,
- Between 2015-2019, the codes have been concentrated around "architectural design", "economy" and "urban design"; According to the year-based analyzes, the "urban design" headline is the most discussed and the "walkability" and "accessibility" codes are emphasized,
- It has been observed that the concept of "transportation" has been included in the content of speeches as of 2016 due to uncontrolled growing cities, vehicle and pedestrian density and has been frequently emphasized until today.

6. Conclusion

Livability is an important concept in terms of design, planning and management of cities. Livable cities are places that provide people with the opportunity to establish social relations with other people in a healthy and safe environment and offer an economically sustainable life. Based on the assumption that the concept of urban liveability has a very important place in today's discussions, a conceptual reading has been made on liveability and data have been obtained through content analysis.

The aim of this study is to present a qualitative research proposal for the determination of effective concepts in the formation of livable cities. The content of the research is considered important in terms of making sense of liveability and creating conceptual data in the field of urban design and offers an innovative approach to literature research by referring to current discussion platforms within the scope of the study.

Within the scope of the limitations of the study, according to the content analyses, it has been seen that the codes "architectural design", "technology", "energy" and "climate" have been predominantly discussed about livable cities, respectively. In this respect, it can be said that the livability of cities can be revealed within the framework of the climate crisis, ecology discussions and energy efficiency discourses that are frequently discussed today, and architectural designs that follow the technological level of the age.

As a result, the design of livable cities is a vital issue affecting the quality of life of society. In this sense, the factors in the formation of livable cities as a result of the analyses constitute the main results of the study:

- Multidisciplinary Approach: It is important that different fields such as architectural design, urban planning, landscape design, sustainability, sociology and economy come together and work together on the livability of cities, since the concepts obtained are the priority discussion topics of different disciplines.
- Environment and Sustainability: It states that sustainable energy use and reduction of environmental impacts are important in the creation of livable cities. It focuses on issues such as green buildings, energy efficient systems. Recreation areas, children's playgrounds, access to sports and cultural areas and natural environment elements increase the quality of life in cities and are important in terms of livability as they are considered as solutions to environmental problems.
- Walkability and Transportation: Effective and sustainable transport is one of the basic elements of livable cities. Accessibility factors such as public transport systems, pedestrian and bicycle routes have an important place in livable city design.

- Equality and participation: It emphasizes that livable cities should be based on the principles of social equality and participation. It is important that all segments of society are represented and their needs are taken into account in urban design and planning processes.
- Sociability and Communication: Promoting public spaces and social interaction helps to strengthen social life. This is important for liveability.

As a result, making sense of the concept of liveability guides the urban design process and helps to shape the design in a way that contributes to human needs, comfort and quality of life. In this way, it is aimed to create more sustainable, healthy and liveable cities. The concept of liveability, which shapes the future of cities and includes parameters such as ecology, technology, security, design and politics, can evolve over time with social, economic and technological changes. Future needs and trends may affect the concept of urban liveability.

References

Appleyard, B. D. (2021). Chapter 17 - *Livability Ethics for Street and Urban Empathy, Equity, And Justice: A Guide for Planning, Design, & Engineering*, Editor(s): Bruce, Donald Appleyard, Livable Streets 2.0, Elsevier, 277-306. Doi:10.1016/B978-0-12-816028-2.00017-4

Bazeley, P. (2003). *Computerized Data Analysis for Mixed Methods Research.* (Teddlie, C. and Tashakkori, A., Eds.). Handbook of Mixed Methods in Social & Behavioral Research. Sage Publications, Unites States, 404.

Bilgin, N. (2014). Sosyal Bilimlerde İçerik Analizi; Teknikler ve Örnek Çalışmalar. 3. Baskı. Siyasal Kitabevi, Ankara, vii, 18-28.

Caves, R. & Wagner, F. (Eds.)., (2018). *Livable Cities from a Global Perspective* (1st ed.). Routledge. https://doi.org/10.4324/9781315523415

Creswell, J. W. (2014). *Research Design; Qualitative, Quantitative, and Mixed Methods Approaches*. 4. Baskı. Sage Publications, California, 37.

Güler, A., Halıcıoğlu, M. B. ve Taşğın, S. (2015). Sosyal Bilimlerde Nitel Araştırma. 2. Baskı. Seçkin Yayıncılık, Ankara, 332-333.

Hankins, K.B. and Powers, E.M. (2009). 'The disappearance of the state from "livable" urban spaces', Antipode 41(5), pp. 845–866.

Kaal, H. (2011). A conceptual history of livability, City, 15: 5, 532-547, DOI: 10.1080/13604813.2011.595094.

Keleş, R. (2010). *Kentleşme Politikası*. İmge Kitabevi Yayınları,752 pages.

Kuru, A. & Özkök, M. K. (2017). Yaşanabilirlik Kavrami Bağlaminda Kamusal/Açık Mekânların Değerlendirilmesi: Kırklareli Kent Merkezi Örneği. *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, (28)*, 43-60.

Mayorga Cárdenas, M. Y. & Fontana Gravante, M. P. (2023). For a close and livable public space: four proposals in Barcelona, Editor(s): Zaheer Allam, Didier Chabaud, Catherine Gall, Florent Pratlong, Carlos Moreno, Resilient and Sustainable *Cities, Elsevier,* Pages 295-304.

Şolt, H. B. (2018). Kentsel Yaşanabilirlik Kavramı ve Sosyo Ekonomik Gelişmişlik. *Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi, 5* (6), 71-85. Retrieved from https://dergipark.org.tr/tr/pub/asead/issue/41000/494897

Oktay, D. (2007). Sürdürülebilirlik, Yaşanılabilirlik ve Kentsel Yaşam Kalitesi. *Mimarlık Dergisi*, 335. http://www.mimarlikdergisi.com/index.cfm?sayfa=mimarlik&DergiSayi=53&RecID=1329

Uitermark, J. (2009). *An in memoriam for the just city of Amsterdam*, City, 13:2-3, 347-361, DOI: 10.1080/13604810902982813

Van Maanen, J. (1979). *Qualitative Methodology*. Sage Publication, 520.

Yakut Çayır, M. ve Sarıtaş, M. T. (2017). "Computer Assisted Qualitative Data Analysis: A Descriptive Content Analysis (2011-2016)" *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, vol. 11,* Issue 2, 518-544.

URL-1: http://journals.openedition.org/factsreports/4750 Date of Access: 13.07. 2023

URL-2: https://mobilityexchange.mercer.com/Insights/quality-of-living-rankings Date of Access: 13.07. 2023

URL-3: https://www.eiu.com/n/campaigns/global-liveability-index Date of Access: 13.07. 2023

URL-4: https://livabilityindex.aarp.org/__Date of Access: 13.07. 2023

URL-5: https://livabilityindex.aarp.org/ Date of Access: 13.07. 2023

URL-6: https://www.ted.com/talks?page=1&sort=oldest&topics%5B%5D=urban+planning Date of Access: 13.07. 2023

Resume

Dr. Nur Yılmaz, graduated from Mersin University, Faculty of Architecture, Department of Architecture in 2012. In 2013, she started master studies at Çukurova University, Institute of Science, Department of Architecture. In 2014, he was appointed as a Research Assistant to Çukurova University, Faculty of Architecture, Department of Building Sciences, and completed her master's degree in 2016. She received his Ph.D. (2021) in Building Sciences in visual research methods and meaning in architecture from Çukurova University. She is currently a research assistant at Çukurova University, Faculty of Architecture, Department of Architecture since 2014.

Dr. Gamze Atay, graduated from Gazi University, Faculty of Engineering and Architecture, Department of Architecture in 2009. She received her master's and Ph.D. degrees in architecture from Çukurova University, Graduate School of Applied and Natural Sciences in 2015 and 2022, respectively. Her major research interests include architectural design, architectural education and qualitative research methods. She is currently research assistant at Çukurova University, Faculty of Architecture, Department of Architecture.

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Nature-based Solutions for climate-resilient cities: A proposal of a model for successful implementation

Didem Güneş Yılmaz*

Abstract

Nature-based Solutions (NbS) were introduced by the IUCN for the first time, but today have different definitions in the literature. NbS are deemed the key to urban sustainability and aim to enhance the built environment through ecological and environmental interventions to support the built environment for future extremes of climate change and related hazards. NbS include blue and green infrastructures, ecological engineering, ecosystem services and ecosystem-based adaptation. Various frameworks defined different key considerations and the literature suggests plenty of frameworks towards successful NbS applications. Current debates critique the extent to which innovative and adaptive the solutions are, whether they are implemented by considering social values and social equity, and the financial burden they often bring which strengthens the disparities between the world cities. Uncontrolled urbanization often causes cities to become an environmental problem. This paper conducts a literature review to lay out the current debates and to highlight the multidimensionality of NbS. It focuses on the potential of NbS in disaster risk reduction and so the paper draws a framework to successfully implement and provide improvements for NbS based on the theoretical ground. NbS are investments in the life quality of the residents and preventive tools in the risk management of cities. The paper attempted to frame the NbS clearer for scholars interested in the subject.

Keywords: nature-based solutions, resilient cities, urban sustainability, urban water, eco-sensitive city, climate change adaptation

1. Introduction

We are in an era under pressure from the environmental crisis induced by climate change. With the COVID-19 pandemic, all experienced how nature recovers its fresh air quality when all air pollutants (mainly cars and plants) are disrupted for a while. Our daily-life routine harms nature and this creates an environmental crisis in turn. The way we consume environmental resources and build our cities puts pressure on nature and narrow green spaces. A study by Mohommad and Pugacheva (2022) revealed that the pandemic made people realize the significance of a healthy nature and the need for green recovery since a study by Castellar et al. (2021) uncovered that nature is interpreted by people as a green factor and defined with the presence of vegetation. Lately, the approach to restoring and increase the quality and the number of green spaces and the classical perception of the water–urban ecosystem interaction in urban areas changed to Nature-based Solutions (NbS), which was first used by the International Union for Conservation of Nature (IUCN) in the early 2000s (Mell et al., 2022; OECD, 2020; Krauze & Wagner, 2019). NbS have

*Assist Prof. Dr., Bursa Technical University, Türkiye, didem.yilmaz@btu.edu.tr
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different definitions in the literature. Mell et al. (2022) defined NbS as a set of aid tools to cities in terms of preventing and reducing the biophysical environment problems including climate change effects, ecological losses, risk of flooding and air quality. Frantzeskaki et al. (2017) defined NbS as transition initiatives with solutions to restore nature, imitate nature and build upon nature to address place-specific environmental problems. OECD (2020) defined NbS as an umbrella concept for other environmental approaches including ecosystem-based adaptation (EbA), eco-disaster risk reduction (eco-DRR), green infrastructure (GI) and natural climate solutions (NCS). Depietri and McPhearson (2017) defined NbS as a combined 'hybrid' strategy that is based on ecosystem functions and engineering implementations in urban areas. NbS studies cover a wide range of research disciplines including ecosystem services and agriculture, eco-hydrology and climate change, wetlands, water quality, ecological engineering, green infrastructure and urban sustainability, remote sensing and geographical information systems (Bunclark & Hernandez, 2022).

Although most of the literature framed the vision of NbS within the ecological and biophysical environment, NbS also has strands contributing to the socio-economic values including the better spatial use of green spaces in cities and peripheries, decreasing crime numbers, increasing the well-being of residents and eventually rising the estate prices and contributing to the authority planning process in developing projects and policies (Mell et al., 2022). Simply, creating parks and green spaces can reduce urban floods, help to balance urban heat and provide recreational opportunities attracting communities and contribute to the human-nature relationship (OECD, 2020). Green walls, roof gardens and vegetated infiltration help to manage wastewater treatment and stormwater. This way, green infrastructure and imitation of green services are becoming part of the natural treatment process to reduce water pollution and surface run-off stormwater, particularly in Asian cities (Kooy et al., 2017). A well-planned recycling of greywater can decrease the demand for freshwater by up to 60 % and reduce the consumption of natural sources (Oral et al., 2020). Fuldauer et al. (2022) found that utility sectors covering electricity, transport and water infrastructure have a direct influence on 17% of SDG. Manufacturing, mining, and construction services influence 8% of SDG. Increasing the urban green space and enabling easy access to it enhances the livability of a city. For example, converting abandoned land into a community garden or other green-social forms enhances social cohesion and values disadvantaged urban areas. Restoring a polluted river passing by an urban area, which affects the neighbours negatively, can help to increase urban water quality as well as the value of nearby properties (ICLEI, 2017). NbS adoption can support balancing the pressing issues regarding poorly managed rapid urbanization, particularly in low and middle-income countries in Asia (Lechner et al., 2022). These examples point at how multi-dimensional NbS are and require a well-thought pathway to implement and to address the problems as mentioned above. This study conducts a literature review in line with that and aims to answer the questions as follows:

- What are the dimensions of NbS?
- What is the controversy between the positive and negative impacts of NbS?
- How possibly NbS contribute to disaster risk management considering climate change?
- How possible to address the issues through step-by-step process models?

2. Research Methods

To answer the research questions above, it is required to conduct a comprehensive examination of NbS research. Accordingly, a search on the ScienceDirect database with the keyword "nature-based solutions" was conducted. To understand NbS in the urban context, papers falling within the interest of hard science subjects including materials science, chemical engineering, biological sciences and so on were excluded from the literature review. Rather, papers discussing the NbS-related topics with the aim of framing the multi-dimensional features of NbS were mainly selected to include in the paper to better understand how differently NbS contribute to the environment and society. This inclusion strategy also helped to draw a model to achieve the standards defined by the literature review.

2.1. A review of the NbS framework

Global Standard of IUCN for NbS aims to ensure the NbS implementations are credible, tracked and measured for adaptive management. The standard consists of eight criteria which encompass societal challenges, design at scale, biodiversity net gain, economic feasibility, inclusive governance, balance trade-offs, adaptive management, mainstreaming and sustainability (IUCN, 2020). Depietri and McPhearson (2017) stressed a threefold integrated approach to NbS by establishing social-ecological interactions, ecological-technological interactions, and social-technological interactions. Voskamp et al. (2021) identified four key principles to implement and achieve successful NbS projects. They are institutional settings, availability of financial resources, level of expertise and know-how, and collaborative work for planning with governance.

Calliari et al. (2019) draw an adaptive management cycle for NbS which assesses the direct benefits vs. costs and co-benefits vs. costs of NbS implemented. They highlighted the explicit multi-stakeholder engagement, multi-functionality rather than single functioning, and targeting simultaneous delivery of economic, social and environmental benefits. The cycle they suggest includes a backcasting stage which means identifying a set of actions to realize the desired environmental situations. The actions should be reviewed and assessed before and after implementing. This requires several feedback loops at different stages to evaluate, to review and to adjust according to the potential needs and to avoid potential unintended consequences. Conti et al. (2021) also draw a feedback loop between healthy city outcomes and nature-based ecosystem endowment. A feedback loop is a self-reinforcing cycle according to their point of view. Davies and Lafortezza (2018) suggest a transitional path to the adoption of NbS and favor the balanced use of grey, green and hybrid infrastructure. The path begins with the education of existing and future infrastructure professionals. It continues with the reform of institutions and their cultures. The path considers the strategy of community-empowered place-making combined with 'ecosystem literacy' and, finally it develops a new approach to public and private sector procurement. Wickerberg et al. (2021) draw a framework that is shaped around a list of 'how' questions towards a promising NbS implementation, as follows:

- How the process will be?
- How are the NbS principles translated into local process?
- How the collaboration is initiated and organized?
- How to facilitate change by co-creation of knowledge?
- How to integrate NbS at the right scale?
- How to meet experimentation and formal planning processes as the implementation pathways?

Accordingly, as the review thus far emphasised, a framework for a successful NbS implementation entails five components as below:

- Social awareness and participatory process,
- Technical knowledge and expert consultation,
- Communication between stakeholders including the public and private sector and residents and (if there are) NGOs,
- Legal establishment (policies, laws, codes, and regulations),
- Post-implementation evaluation (likewise post-occupancy evaluation, end-user and long-term impact should be kept monitored routinely for a while).

2.2. A review of the controversies in NbS

The majority of NbS studies outline the positive impacts. Despite this fact, there are certain hesitations and barriers against the NbS adoptions. Mell et al. (2022) examined the barriers to successful NbS and they highlighted the factors regarding governance, finance, program and delivery. By focusing on the NbS implementations in Liverpool, UK, they defined eight indicators as below:

- Climate mitigation and adaptation,
- Water management,
- Green space management and air quality,
- Socio-cultural indicators,
- Participatory planning and governance,
- Social justice and social cohesion,
- Public health and well-being, and
- The potential of economic opportunities and green jobs.

Moreno et al. (2022) identified 23 barriers. Communication between stakeholders in terms of organizational barriers was highlighted by Croeser et al. (2021). They also underlined the importance of diagnosing the problems and obstacles specific to the local bodies in the way of delivering NbS implementations and taking actions against the persistence of the problems. The literature uncovers the controversy and disparity between the regions in terms of comparing the difference between their approach, perception and adoption of NbS. For example, Lechner et al. (2022) emphasized that the adoption of NbS remained more limited in Southeast Asia than in Europe. Different challenging conditions across the regions affect the decision and possibility of NbS adoption. The overarching reasons include the scale and area of polluted water, land and air, the pressure of rapid population in urban settlements, more complex hydro-meteorological event patterns and rapid deforestation which threatens the water, soil and air quality of the environment and the quality of residents' life. Lechner et al. (2022), thus, identified the challenges in five groups encountered in Southeast Asia against the adoption of NbS as below:

- Characteristics of urbanization
- Biophysical environmental and climatic context;
- Environmental risks and challenges for restoration;
- Human nature relationships and conflicts; and
- Policy and governance context.

Another argument between the South and North, the East and West appears from the epistemological approach. Mabon et al. (2022) argue that from the understanding of NbS, an epistemic injustice emerges. They underlined the exclusion vs. the dominance as embodying testimonial injustice (when someone or group's knowledge is viewed as less significant) and hermeneutical injustice (when someone or group's experience is viewed as less significant to what dominant is).

3. Multiple dimensions of Nature-based Solutions

The literature review sufficiently points out four dimensions that need to be considered holistically: social, economic, environmental and policy perspectives. The problems and NbS to be adopted address one of them or more than one (i.e. socio-economic, socio-environmental etc.).

3.1. Social perspective

In terms of acting solid, wide public support is crucial "towards implementing climate mitigation policies and achieving decarbonization" (Mohommad & Pugacheva, 2022). NbS are not only engineering and design-based interventions but also require social inclusion as NbS often target to strengthen the social-ecological settings (Frantzeskaki et al., 2017). A certain level of 'green knowledge' of residents is necessary to conduct a participatory process (Voskamp et al., 2021), but at the same time, social disinterest in the environmental problems is a handicap as well (Moreno et al., 2022). A study (Nóblega-Carriquiry et al., 2022) surveyed the social perspective of the residents of the NbS in the Tordera delta in Spain and concluded that understanding nature had two standpoints. For some, it was only good to maintain the original and to help re-naturalization of the delta area, whereas for some it would be good to adapt nature to socio-economic opportunities for the locals. For the latter, a further analysis uncovered the perception of nature and human activities. For some, nature was under stress of unsustainable economic activities by

the locals, and for some their socio-economic activities in the delta area were suffering from frequent floods, which needed to be prevented.

Raymond et al. (2017) underlined that NBS should develop synergy between ecosystem services and the manmade environment. Kabisch et al. (2022) highlighted that NbS should be driven by mutual learning and should bring sustainable transitions in cities. However, 'lack of public awareness and support' is one of the barriers listed by Sarabi et al. (2020). Frantzeskaki (2019) emphasized that NbS needs to fit into the urban mosaic and aesthetically appealing to residents to have them appreciated and cared for. A participatory approach is a key to socially acceptable urban design. Raymond et al. (2017) stated ensuring citizen involvement in governance and monitoring is one of the success keys to effective NbS. To say, NbS helps to improve the sense of place and the feeling of belonging to a place among the residents as long as it is developed taking into account the local communities (Alva, 2022).

The majority of NbS research concerns environmental urban context, but contrary, only a little shed some light on land use concerns (Hanson et al., 2020). For a just NbS, intentionally developed urban land use and accessibility of resources should be targetted to eliminate the drivers of socio-economic inequalities. The clearest inequalities are seen in race and income classes. Capital circulation ignores disadvantaged groups including minorities and low-income residents. In simple terms, greening NbS projects should address this contestation and bring solutions to achieve environmental justice (Cousins, 2021). However, greening projects often reward capitalist values and welcome higher-income groups, mostly replacing lower-income groups. Social justice, in/equalities and affordability are among the least focused and evaluated in the studies reviewed by Hanson et al. (2020). Pathak et al. (2022) also emphasized the equity implications in the design and application of NbS among their seven key principles to address when planning NbS. Overlapping with these arguments, 'property ownership complexities' and 'space constraints' are among the barriers listed by Sarabi et al. (2020).

3.2. Economic perspective

NbS projects hitherto are realized mostly by local or national authorities and sponsored with public finances. To say, private investors are not very much into involving the NbS implementations as they deem it less marketable and high risk with low reward (profits) in turn. Hence, authorities with limited access to financial sources encounter major barriers to sponsoring the realization of NbS projects (OECD, 2020). Thinking of how developing business models for NbS is more than necessary to establish partnerships between the private sector and local authorities to form an investment pool (Frantzeskaki et al., 2020). In May 2021, the European Commission (EC) shared a document to highlight the potential NbS holds for the environment and climate change mitigation. Alva (2022) criticized this EC document as having been written from a strong financial perspective to charm companies and investors, who were also responsible for causing the climate change crisis.

Green infrastructure for flood risk reduction is a well-known NbS component. However, similar to the argument above, it is lately deemed as neoliberal urban governance. To give an example, it was very arguable when the city council of Houston, USA, proposed a plan to relocate 400 low-income households and to rehabilitate the area as floodable green space for the city. This raised dispute because the climate change discourse was forcefully used to evict mostly black and brown low-income residents out to the peripheries of the city. In this way, creating green infrastructure as one of NbS components intentionally or unintentionally contributes to the socio-economic disparities as wealthier groups can afford to pay for valuable estates benefitting green areas, whereas disadvantaged groups cannot afford and are eventually excluded (Shi, 2020). This shows how social and economic perspectives are bound together. In their assessment guide for NbS implementations, Raymond et al. (2017) placed a monitoring phase to evaluate the outcomes and uncover the barriers to achieving the long-term goals. It is evident that the financial contribution of NbS should consider different spatial and temporal intervals to fully understand the socio-economic benefits.

It would be wrong to assess NbS projects solely based on the financial scheme. This would diminish their rationale as the costs would go head-to-head with traditional engineering solutions. One must see NbS as living solutions as their effectiveness is mostly measured by the environmental capacity empowerment to respond to climate change pressure on the environment (Calliari et al., 2019). O'Leary et al. (2023) emphasized that NbS can lead to a sustainable blue economy by improving marine and coastal ecosystem services. Bockarjova et al. (2022) researched to reveal the dimension of the value transfer between the social benefits and the financial investment into NbS. They estimated that 85 NbS interventions in 13 EU countries delivered an aggregate social value of US$ 800 million per year to residents. Per hectare of urban space, these NBS deliver an average of US$ 96,285 worth of yearly benefits to residents (median US$ 48,981). They estimated that in 65% of the 60 NbS projects they reviewed, the added value to residents surpassed the total financial cost. The NbS projects they reviewed have the financial load varied between $110.000 and $1.75 billion, with a separately estimated maintenance cost ranging from $1 million to 14.7 million per year.

3.3. Environmental perspective

Urban development has been viewed from an economic perspective without considering to what extent natural resources have been harmfully consumed. Particularly, water management and waste management in cities are problematic. For urban areas, no arguably water is the main factor with its accessibility and serviceability to direct urbanization (Krauze and Wagner, 2019). The management applications were mostly developed in the early 1960s and by then engineers and authorities were only aiming at a single purpose for projects, i.e. for the sake of urban infrastructure, without considering environmental destruction and degradation (Matthews and Cruz, 2022). In North America, approaches considering the low impact on the environment were first adopted in the 1990s and the movement was named Low Impact Development (Alemaw et al., 2020). Drinking water supply and sanitation were mostly provided through grey infrastructure. Unlike the earlier viewpoint, stormwater and wastewater are no longer seen as disposable and harmful. As the perception of sustainability increase and become widespread, they are seen as the most valuable and 'cheap' resource to recycle. Considering many Asian cities and suburbs with high populations and with lacking grid infrastructure systems, this approach helps to secure and protect the continuity of water sources (Kooy et al., 2020). Moving from the low-impact development to NbS provided an ecological transition to mitigate urban water challenges and to transform conventional cities to water sensitive cities. Improving the efficiency of water use techniques and reducing the freshwater demand through recycling, filtrations and better land use planning can solve the primary water-related problems in cities. A holistic approach considering environmental, economic, social, technical and political aspects is called Integrated Urban Water Management, which takes one step further than conventional urban water management (Oral et al., 2020).

Depietri and McPhearson (2017) emphasize that grey infrastructure is only a prevention system and is insufficient which requires a huge amount of investment and a continuous budget to maintain, which can structurally fail in extreme cases. Krauze and Wagner (2019) emphasized that NbS may include a novel grey structure, but this approach should remain as auxiliary to the development of blue-green infrastructure. They suggest the 'mimicking nature' approach for the development of NbS to recover the urban ecosystem. Moreno et al. (2022) indicated that more cost-benefit analyses must be studied to reveal green infrastructure versus grey infrastructure solutions, particularly in coastal risk management. NbS, whether green or grey or hybrid, requires investment not only in the construction phase but also in monitoring and maintenance. NbS are a sign of the reorientation from grey infrastructure to green infrastructure (Matthews and Cruz, 2022), in this regard.

Frantzeskaki et al. (2017) pointed out the transformative effect of NbS on urban sustainability in terms of enhancing the conditions of balance, resilience and socio-environmental relations without damaging or exceeding the capacity of the surrounding ecosystem. The scale of NbS is also critical to replicate the implementation in the same city or another one. Each NbS project needs

localization for the application, even for green roofs, green walls, and green courtyards (Frantzeskaki, 2019). Kabisch et al. (2022) emphasized the local context among their five key NbS challenges. Sowińska-Świerkosz and Garcia (2022) draw a SMART approach to NbS regarding this 'localisation' factor (Figure 1) considering specific, measurable, attainable, realistic and timely targets.

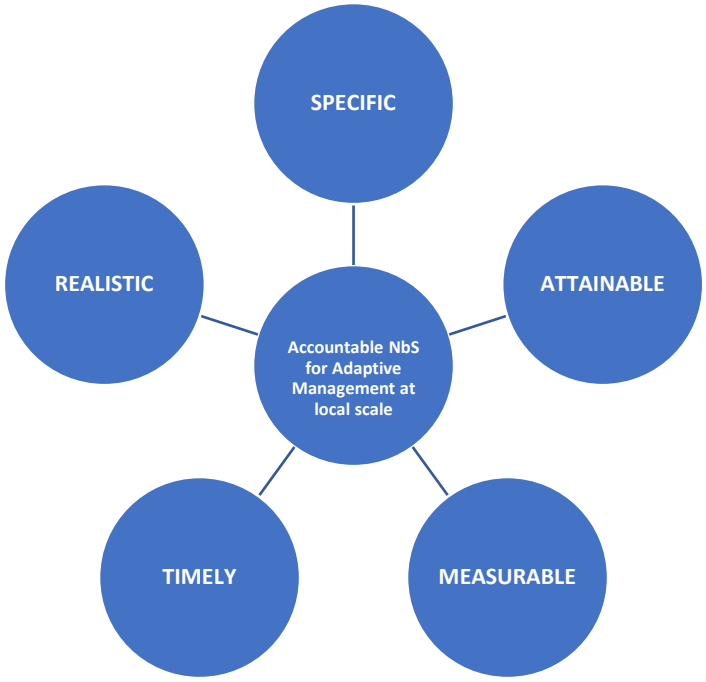

Figure 1 The elements of the SMART approach defined by Sowińska-Świerkosz and Garcia (2022).

Localization is significant for bringing solutions to specific problems. For example, Bahrain aims for mangrove transplantation to rehabilitate degraded coastal areas. Vietnam aims to manage sustainable forests and enhance carbon sequestration. Morocco aims to protect "its natural heritage, biodiversity, forestry and fishery resources (Seddon et al., 2020). IUCN (2020) stated that NbS help to stabilise global warming to below 2 degrees by 2030 and could provide cost-effective mitigation against the adverse impacts of climate change on biodiversity. Climate change's effect on the rapid extinction of biodiversity can be reduced and slowed down by well-considered NbS projects, as Pathak et al. (2022) pointed out as one of their seven key principles for NbS. Climate change can reveal how harmful we use natural sources. The Marmara Sea in Turkey suffered from the bio-chemical formation of mucilage as the Sea was used for the discharge of urban wastewater with no or low level of treatment. This affected the tourism and fishing industry in Istanbul (Tuğaç, 2023). Kabisch et al. (2022) highlight that NbS should ensure multiple benefits for human as well as non-human. Pineda-Pinto et al. (2022) argue that the environmental perspective is only human-centred. Biodiversity conservation and public health are the following concerns (Hanson et al., 2020) if multi-target NbS is attempted. Therefore, Pineda-Pinto et al. (2022) introduce the concept of ecologically just cities. This includes human focus and non-human nature focus, which underlines that non-human nature is symbiotically linked with human nature.

3.4. Policy perspective

Although NbS planning is a highly technical process including multiple expertise of engineers, architects, planners, landscape designers and other disciplines, the projects need to be framed within an appropriate policy environment as well. This should cover land-use regulation and zoning, permitting, safety and performance codes and standards, procurement policies, land rights and environmental protection regulation (OECD, 2020).

Institutional settings and the willingness of authorities are the key factors and at the same time barriers in the realization of NbS. Local officers often encounter difficulties in convincing politicians about how NbS are needed and its potential benefits for the area in hand (Voskamp et al., 2021). Sarabi et al. (2020) identified 'Lack of political will and long-term commitment' , 'Lack of sense of urgency among policymakers', and 'Lack of supportive policy and legal frameworks ' as three of the barriers to the NbS adoption. Regarding the multi-stakeholder nature of NbS, a collaborative approach is required between municipal staff and other urban actors, such as civil society, NGOs and residents (Frantzeskaki, 2019). Frantzeskaki et al. (2020) define 'policy need' as the bridge (a strategic solution) between the opportunity (the current status) and the objective (the desired status). Dumitru et al. (2020) suggest that providing systematic evidence from NbS case studies at a smaller scale can be useful for an in-depth understanding of the outcomes. This could guide better for an impact evaluation so that the policy-makers understand the influences over specific objectives.

NbS implementations are manmade interventions in the end and they are often limitedly applied to a degraded environment (Krauze and Wagner, 2019). An argument (Mell et al., 2022) is that the public reactions affect the NbS projects to invest by the local authorities since the more visible the project is, the more positive reactions would be gained from the public, which is linked to green and blue infrastructure, such as green walls, green parks and riverbed rehabilitation. Nóblega-Carriquiry et al. (2022) emphasize that local communities aspire for an NbS-based future, but a participatory process needs to be conducted to result in appropriate land use policies while achieving flood prevention and environmental protection.

It is also about the differences between the culture of collaboration and hierarchy in the European and the Asian systems that affect the adoption of NbS (Morita and Matsumoto, 2021). Although, the tertiary public administration directly influences 50% of SDG targets through the governance services it provides (Fuldauer et al., 2022), excessive imposing of the positive impacts of NbS to urban politicians and authorities may result in reduced inspiration and handicaps in catalyzing the change. The pressure on the urban resilience policy need may turn into marginal voices that are being disregarded (Shamsuddin, 2020). At this point, it is overlapping that 'functionality and performance uncertainties' and 'misalignments between short-term plans and long-term goals' are two barriers identified by Sarabi et al. (2020).

4. Nature-based Solutions for disaster risk management

As the literature review thus far elaborated how multi-dimensional NbS is and also is an addressing tool to combat the climate change effects in the natural and built environment, it is now more relatable to discover how NbS can be utilised for disaster risk management. High-density urban settlements with land use planning mostly covering housing are highly vulnerable to disasters. The risk of urban settlements keeps increasing with the intense pattern of land use and unplanned growth despite the climate change effects becoming more observable (Sagala et al., 2022). Sendai Framework for Disaster Risk Reduction, the 2030 Agenda for Sustainable Development Goals, the Paris Agreement and the New Urban Agenda by the United Nations are the international policies adopted for disaster risk reduction (DRR) and climate change adaptation (CCA). They point to the importance of NbS to achieve sustainable development. The policies abovementioned focus on the restoration and preservation of ecosystems (Da Silva et al., 2022). The New Urban Agenda was adopted on 20 October 2016 and was one of the earliest policies to refer to NbS and ecosystem-based solutions (The New Urban Agenda, 2017). Following this, The World Bank NbS Program was established in 2017.

The most obvious impact of climate change is the volatile rainfall patterns that cities across the world are hit by in increasing numbers and most of which drainage systems fail against the frequent overloading and suffer from surface runoff water due to the large impervious areas (Oral et al., 2020). From the perspective of CCA, NbS are increasingly becoming the key tools. NbS suggest environmentally friendly implementations for water-related risks such as ecosystem degradation

(e.g. rapid decrease in groundwater), coastal storms, riverine floods, and urban floods on one hand, and on the other hand intensive and spreading droughts in different world geographies (OECD, 2020). To give an example, rehabilitated floodplains and wetlands are examples of NbS that can prevent floods by increasing water retention and can save communities and contribute to their well-being by adding recreational value to the surrounding area (OECD, 2020). Some countries are highly vulnerable to climate change and suffer hydro-meteorological disasters frequently. Turkey is one of them and climatically extreme events change year by year. In 2020 and 2021 water reservoirs supplying freshwater to cities including Istanbul and Bursa reached critique levels due to seasonal drought with no rainfall event. In the same years, few cities were hit by heavy rainfalls, which caused urban floods with deadly results (Tuğaç, 2023). In terms of urban water-food-energy cycle and security, NbS are still at the preliminary stage, but surely the implementations can help to balance evapotranspiration and by that, the seasonal rainfalls are kept in the normal spectrum rather than going extremes in between floods and droughts (Oral et al., 2020).

Re-naturalization of the urban environment in an era of environmental crisis is a promising roadmap to achieve urban resilience (Dumitru et al., 2020). Cities located in valleys, on hillsides or in coastal areas are better protected by planning with and for nature (ICLEI, 2017). However, Seddon et al. (2020) revealed that only 30 countries out of 104 provided measurable targets to realize NbS. In most cases, NbS are implemented to increase water quality and quantity in terms of environmental management and to reduce flood risk (OECD, 2020). Unlike blue and green infrastructures, which are protective and restore natural sources, grey infrastructure refers to building structures such as dams, dikes, channels and storm surge defences to reduce disaster risks (OECD, 2020).

Nehren et al. (2023) categorized the approaches towards NbS for DRR into five groups. The first one includes the ecosystem-based DRR approaches. These approaches target the CCA and mitigation, ecological restoration and sectoral restoration, such as soil bioengineering and climate adaptive agriculture. The second group attributes to landscape units and related hazards, such as mountainous and coastal areas as well as wetlands and drylands. Urban forests and landscapes are also part of this group's target. The third group targets the climate extremities and different climatic conditions, from tropical and subtropical climates to semiarid and dry climates. The fourth group includes the approaches for biophysical services and ecological services. The last group is formed to understand the measures and techniques in NbS for DRR. To explore the potential of NbS for DRR, Tyllianakis et al. (2022) analyzed countries depending on capability drivers and necessity drivers. They included the percentage of the forest area a country has, the percentage of GDP generated from agricultural, forestry and fishery activities, and the percentage of country area that is assigned as to be protected among the capability drivers. Necessity drivers include parameters to reveal the proneness to disasters, such as the average rate of CO_2 emission, the percentage of the population living in urban centres, the percentage of country land at the risk of inundation, and the average yearly economic cost of climate change impact.

Enhancing resilience only in one system may result in further negative impacts in other systems. Therefore, resilience and NbS need to be taken into account together from the wider window of urban planning (Bush & Doyon, 2019). Kabisch et al. (2022) underlined that NbS should be integrated and based upon a systems approach, rather than one system approach, and should appreciate long-term benefits. To see how NbS for DRR works, particularly for stormwater and urban water management, it is essential to create an objective resilience assessment framework, as one that Beceiro et al. (2022) provided. They draw a two-dimensional framework to assess the integration of NbS in the city and to assess the extent of the operation services of NbS. The latter dimension includes spatial planning (hazard and exposure planning, land use and NbS inclusion), service management (resources availability and adequacy, service management and planning), resilience-engaged service (reliable service, flexible service and scenarios relevant for disaster response), infrastructure safety and robustness, infrastructure preparedness, and infrastructure dependence and autonomy.

5. Potential model for development of Nature-based Solutions

Regarding the social, economic, environmental and policy perspectives as discussed and the capacity to improve the disaster risk management as highlighted in this paper, it is now more evident that the implementation of NbS requires a well-established roadmap prior to development. To fulfil the needs, to evaluate the NbS responses and to improve, if necessary, an inclusive framework should be utilised. While many researchers emphasized the issues related to NbS and developed various frameworks to improve the implementation process of NbS in the literature review, this paper also attempts to suggest a model to address the issues through a step-by-step process model. In this regard, a well-known strategy is emphasized, which is Plan-Do-Check-Act and is adopted in many disciplines from industrial engineering to business management and education (Loyd and Gholston, 2016). The plan stage includes all about the planning process, setting the project objectives and deliverables, defining who the stakeholders are, setting a timeline and clarifying the projects risks and constraints. The do stage simply implies the implementation. The check stage points at the review of the implementation to make sure whether the implementation is ongoing as planned. This stage is the critical one in the cycle because it helps to define the mistakes or unintentionally wrongly going components. It allows fixing the mistakes or improving the status with further actions within the plan. This is also the stage that is pointed out by many researchers as a feedback loop. The act stage is the last one on the cycle in which the decisions taken at the previous stage turns into the real act and adjustments made in the plan. Hence, the PDCA cycle is a tool for continuous improvement as the literature review articulates in this paper. In Japan, it has long been a risk management tool for disaster mitigation. Okada (2004) mentioned that the PDCA cycle can be useful for both pre-disaster and post-disaster stages. Yamada et al. (2011) utilized the PDCA cycle for community-based flood risk mitigation to ensure the participatory approaches (Figure 2).

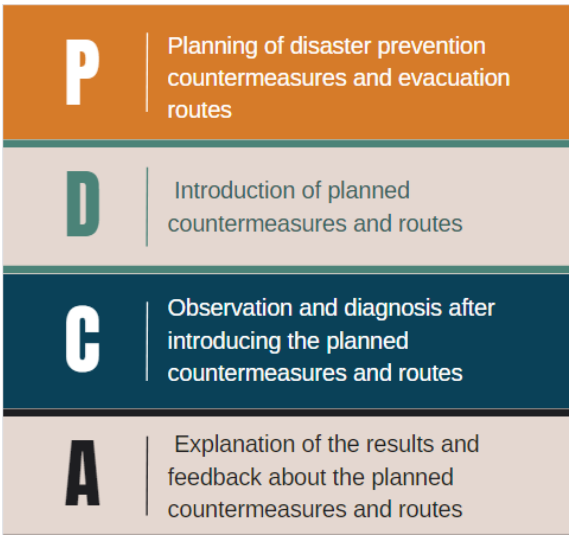

Figure 2 The PDCA cycle application for flood risk mitigation by Yamada et al. (2011).

Since the cycle has four stages, one can find it similar to another well-established approach, the disaster management cycle, which has Response, Recovery, Mitigation and Preparation. Unlike the conventional cycle, the matching of the stages can be interpreted as Mitigation/Plan, Recovery/Do, Response/Check and Preparation/Act. To define better, the plan stage concerns the questions of how to mitigate, the do stage concerns how well implemented for recovery, the check stage concerns how successful the response was, and the act stage concerns the lacking parts that cause failure in the preparation planning. Thinking from this angle, the two cycles match efficiently.

NbS require a serious amount of time and financial investment. The implementation of NbS is not an issue for countries with high GDPs but is a big concern for countries with considerably low GDPs. Because we are living in an information and technology era, technological developments

should be adopted and adjusted according to the needs for better planning and implementation. In this regard, a contemporary approach can be helpful, which is Digital Twin Construction (DTC). Sacks et al. (2020) provide a convincing argument for how DTC is applicable within the PDCA cycle and also the other way. They matched the Plan/Model, the Do/Build, the Check/Monitor and interpret, and the Act/Evaluate and improve. If NbS aim to bring solutions to the needs from a multi-dimensional approach for a better urban environment and urban system than the previous status, then the testing from a replicated model becomes more critical than ever. Digital modelling, digital monitoring and evaluating to improve the solutions surely save time and money not only from the side of the authorities but also for the urban residents, who are the taxpayers. Delgado and Oyedele (2021) also point out the benefits of DTC, how the conceptual planning turns into a model to process and test so more than one scenario can be seen with the estimated results. To give a preliminary example, Pillai et al. (2022) applied DTC modelling to simulate their NbS proposals and to find an optimal seagrass for the coastal zone of Emilia-Romagna, which area is vulnerable to coastal erosion and storm surges. While the DTC approach is at a rudimentary stage, it is for sure in future it will be more utilized by designers, investors and authorities.

6. Conclusion

For the past few decades, the discussion of the human impact on the environment has been circling the theme of 'sustainability'. Lately, the argument has changed to 'Nature-based Solutions'. This time the argument considers the natural environment as much as the built environment. Today, world populations and leaders are convinced by the fact that climate change affects our natural environment and more seriously, it threatens our built environment with the increasing frequency of disasters occurring. Accordingly, the sustainability approach moved from being human-centred to ecosystem-centred as the approach began to take into account more extensively the recovery and restoration of the natural environment than the question of how we build with less impact on nature. NbS have several successful examples around the world cities and the evaluations revealed promising outcomes. As the literature articulates the positive consequences of NbS interventions; it seems the most suitable approach to balance the human impact on the natural environment.

However, it should be emphasized that NbS are beyond simple infrastructure projects and cannot be diminished to the question of how to design green spaces randomly over a city without thinking more complex as this paper discussed the multi-dimensionality of NbS. None of the arguments (the principles of NbS and barriers to NbS) rose is less important than the others or vice versa. The implementations should not be viewed as a financial burden. In some cases, NbS can be considered a more cost-effective approach than building grey infrastructure. They are investments in the life quality of the residents and preventive tools in the risk management of cities. As the number of NbS implementations increases in the world, researchers need to evaluate and identify the outcomes objectively so that further examples will not repeat the same mistakes but will improve the replications.

The paper attempted to frame the NbS clearer for scholars interested in the subject. The literature review provided a comprehensive discussion regarding the issues in NbS approaches and implementations from different angles. It should be kept in mind that NbS implementations are not magical tools that result in the short term. Long-term visions should be targeted and post-implementation evaluations are necessary to understand how the human and non-human nature co-benefit from the interventions. It is recommended that future scholars to research on NbS case studies to reveal the impacts and outcomes based on the arguments provided in this paper.

References

Alemaw, B.F., Chaoka, T.R. and Tafesse, N.T. (2020) Modelling of Nature-Based Solutions (NBS) for Urban Water Management—Investment and Outscaling Implications at Basin and Regional Levels. *Journal of Water Resource and Protection, 12*, 853-883. https://doi.org/10.4236/jwarp.2020.1210050

Alva, A. (2022). *A critical perspective on the European Commission's publications 'Evaluating the impact of nature-based solutions*. Nature-Based Solutions. December 100027. https://doi.org/10.1016/j.nbsj.2022.100027

Beceiro, P., Brito, R. S., and Galvão, A. (2020). The Contribution of NBS to Urban Resilience in Stormwater Management and Control: A Framework with Stakeholder Validation. *Sustainability, 12*, 2537; 10.3390/su12062537

Bockarjova, M., Botzen, W.J.W., Bulkeley, H.A. et al. Estimating the social value of nature-based solutions in European cities. (2022). *Sci Rep 12*, 19833 https://doi.org/10.1038/s41598-022-23983-3

Bunclark, L., and Hernandez, I. M. (2022). *Scientifc Mapping of Research on Nature-based Solutions for Sustainable Water Management.* Water Resources Management (2022) 36:4499–4516. https://doi.org/10.1007/s11269-022-03242-w

Bush, J., and Doyon, A. (2019). Building urban resilience with nature-based solutions: How can urban planning contribute? *Cities. 95*. https://doi.org/10.1016/j.cities.2019.102483

Calliari, E., Staccione, A., and Mysiak, J. (2019). An assessment framework for climate-proof nature-based solutions. *Science of The Total Environment. Volume 656*, 15: 691-700. https://doi.org/10.1016/j.scitotenv.2018.11.341

Castellar, J. A. C., Popartan, L. A., and Pueyo-Ros, J. (2021). Nature-based solutions in the urban context: terminology, classification and scoring for urban challenges and ecosystem services. Science of the Total Environment. 779: 146237. https://doi.org/10.1016/j.scitotenv.2021.146237

Conti, M.E.; Battaglia, M.; Calabrese, M.; Simone, C. (2021). Fostering Sustainable Cities through Resilience Thinking: The Role of Nature-Based Solutions (NBSs): Lessons Learned from Two Italian Case Studies. *Sustainability, 13,* 12875. https:// doi.org/10.3390/su132212875

Croeser, T., Garrard, G.E., Thomas, F.M. et al. Diagnosing delivery capabilities on a large international nature-based solutions project. *NPJ Urban Sustain 1*, 32 (2021). https://doi.org/10.1038/s42949-021-00036-8

Cousins, J. J. (2021). Justice in nature-based solutions: Research and pathways. *Ecological Economics. Vol: 180*, https://doi.org/10.1016/j.ecolecon.2020.106874

Davies, C., and Lafortezzab, R. (2018). Transitional path to the adoption of nature-based solutions. *Land Use Policy. 80:* 406-409. https://doi.org/10.1016/j.landusepol.2018.09.020

De Silva, A.; Amaratunga, D.; Haigh, R. (2022), Green and Blue Infrastructure as Nature-Based Better Preparedness Solutions for Disaster Risk Reduction: Key Policy Aspects. *Sustainability 14*, 16155. https://doi.org/10.3390/ su142316155

Delgado, J. M. D. and Oyedele, L. (2021). Digital Twins for the built environment: learning from conceptual and process models in manufacturing. *Advanced Engineering Informatics. 49*, 101332. https://doi.org/10.1016/j.aei.2021.101332

Depietri, Y. and McPhearson, T. (2017). I*ntegrating the Grey, Green, and Blue in Cities: Nature-Based Solutions for Climate Change Adaptation and Risk Reduction*. In Naturebased Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice (Kabisch N, Korn H, Stadler J and Bonn A (eds)). Springer, Cham, Switzerland, pp: 91-109.

Dumitru, A., Frantzeskaki, N., and Collier, M. (2020). Identifying principles for the design of robust impact evaluation frameworks for nature-based solutions in cities. *Environmental Science and Policy, 112* (107-116). https://doi.org/10.1016/j.envsci.2020.05.024.

Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environmental Science and Policy. 93*:101-111. https://doi.org/10.1016/j.envsci.2018.12.033

Frantzeskaki N, Borgström S, Gorissen L, Egermann M and Ehnert F (2017) *Nature-based solutions accelerating urban sustainability transitions in cities: lessons from Dresden, Genk and Stockholm Cities*. In Naturebased Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice (Kabisch N, Korn H, Stadler J and Bonn A (eds)). Springer, Cham, Switzerland, pp. 65–88.

Frantzeskaki, N., Vandergert, P., Connop, S., and Schipper, K. (2020). Examining the policy needs for implementing nature-based solutions in cities: Findings from city-wide transdisciplinary experiences in Glasgow (UK), Genk (Belgium) and Poznan (Poland). *Land Use Policy, Volume 96*, 104688, https://doi.org/10.1016/j.landusepol.2020.104688

Fuldauer et al. (2022) *Targeting climate adaptation to safeguard and advance the Sustainable Development Goals*. Nature Communications, https://doi.org/10.1038/s41467-022-31202-w

Hanson, H. I., Wickenberg, B., and Olsson, J. A. (2020). Working on the boundaries—How do science use and interpret the naturebased solution concept? *Land Use Policy, 90*. https://doi.org/10.1016/j.landusepol.2019.104302

ICLEI – Local Governments for Sustainability (2017). *Nature-based solutions for sustainable urban development*. Briefing Sheet.

IUCN (2020). *Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS*. First edition. Gland, Switzerland: IUCN.

Kabisch et al. (2022). Principles for urban nature-based solutions. *Ambio 2022, 51:1388–1401 https://doi.org/10.1007/s13280-021*

Kooy, M., Furlong, K., Lamb, V. (2020). Nature Based Solutions for urban water management in Asian cities: integrating vulnerability into sustainable design. *International Development Planning Review, Volume 42,* Number 3, 381-390. DOI https://doi.org/10.3828/idpr.2019.17

Krauze, K. and Wagner, I. (2019). From classical water-ecosystem theories to nature-based solutions: Contextualizing nature-based solutions for sustainable city. *Science of the Total Environment*. 655: 697-706. https://doi.org/10.1016/j.scitotenv.2018.11.187

Lechner et al. (2022) Challenges and considerations of applying nature-based solutions in low- and middle-income countries in Southeast and East Asia. *Blue-Green Systems Vol. 2*:1 doi: 10.2166/bgs.2020.014

Loyd, N. and Gholston, S. (2016). Implementation of a Plan-Do-Check-Act Pedagogy in Industrial Engineering Education. *International Journal of Engineering Education Vol. 32*, No. 3(A), pp. 1260–1267.

Mabon, L., Barkved, L., Bruin, K., and Shih, W. (2022). Whose knowledge counts in nature-based solutions? Understanding epistemic justice for nature-based solutions through a multi-city comparison across Europe and Asia. Environmental *Science and Policy. 136*: 652-664. https://doi.org/10.1016/j.envsci.2022.07.025

Matthews, J. and Cruz, E O D. (2022). *Integrating Nature-Based Solutions for Climate Change Adaptation and Disaster Risk Management*. Asian Development Bank. Manila, Philippines. ISBN 978-92-9269-533-0

Mell I, Clement S and O'Sullivan F (2022) *Engineering nature-based solutions: examining the barriers to effective intervention.* Proceedings of the Institution of Civil Engineers – *Engineering Sustainability 175*(5): 236–247, https://doi.org/10.1680/jensu.21.00033

Mohommad, A. and Pugacheva, E. (2022). *Impact of COVID-19 on Attitudes to Climate Change and Support for Climate Policies*. International Monetary Fund Research Department.

Moreno, C.S.; Roman-Cuesta, R.M.; Canty, S.W.J.; Herrera, J.; Teutli, C.; Muñiz-Castillo, A.I.; McField, M.; Soto, M.; do Amaral, C.; Paton, S.; et al. Stakeholders' Perceptions of Nature-Based Solutions for Hurricane Risk Reduction Policies in the Mexican Caribbean. *Land 2022, 11,* 1701. https://doi.org/10.3390/ land11101701

Morita, K., & Matsumoto, K. (2021). Governance Challenges for Implementing Nature-Based Solutions in the Asian Region. Politics and Governance, 9(4), 102-113. https://doi.org/10.17645/pag.v9i4.4420

Nehren, U., Arce-Mojica, T., Barrett, A. C. (2023). Towards a typology of nature-based solutions for disaster risk reduction. *Nature-Based Solutions, Volume 3* December, 100057. https://doi.org/10.1016/j.nbsj.2023.100057

Nóblega-Carriquiry, A.; March, H.; Sauri, D. (2022) Community Acceptance of Nature-Based Solutions in the Delta of the Tordera River, Catalonia. *Land 11*, 579. https://doi.org/10.3390/ land11040579

OECD. (2020) *Nature-based solutions for adapting to water-related climate risks*. Policy Perspectives. OECD Environment Policy Paper No. 21.

Okada, N. (2004). Urban Diagnosis and Integrated Disaster Risk Management. *Journal of Natural Disaster Science, Volume 26*, Number 2, 49-54.

O'Leary, B., Fonseca, C. and Cornet, C. C. et al. (2023). Embracing Nature-based Solutions to promote resilient marine and coastal ecosystems. *Nature-Based Solutions. Volume 3*, December 2023, 100044, https://doi.org/10.1016/j.nbsj.2022.100044

Oral, H. V., Carvalho, P., Gajewska, M., and Ursino, N. (2020). A review of nature-based solutions for urban water management in European circular cities: a critical assessment based on case studies and literature. *Blue-Green Systems Vol 2* No 1, 112-136. doi: 10.2166/bgs.2020.932

Pathak, A.; Hilberg, L.E.; Hansen, L.J.; Stein, B.A. Key Considerations for the Use of Nature-Based Solutions in Climate Services and Adaptation. *Sustainability 2022, 14*, 16817. https://doi.org/10.3390/ su142416817

Pillai, U. P. A., Pinardi, N., Alessandri, J. et al. (2022). A Digital Twin modelling framework for the assessment of seagrass Nature Based Solutions against storm surges. *Science of the Total Environment. 847*, 157603. https://doi.org/10.1016/j.scitotenv.2022.157603

Pineda-Pinto, M., Frantzeskaki, N., and Nygaard, C. A. (2022). The potential of nature-based solutions to deliver ecologically just cities: Lessons for research and urban planning from a systematic literature review. *Royal Swedish Academy of Sciences, Ambio, 51*:167–182. https://doi.org/10.1007/s13280-021-01553-7

Raymond, C. M., Frantzeskaki, N., Kabisch, N., and Berry, P. (2017). A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environmental Science and Policy. 77*: 15-24. http://dx.doi.org/10.1016/j.envsci.2017.07.008

Sacks, R., Brilakis, I. and Pikas, E. (2020). *Construction with digital twin information systems*. Data-Centric Engineering (2020), 1: e14 doi:10.1017/dce.2020.16

Sagala, S., Murwindarti, A., Avila, B. A., Rosyidie, A. (2022). *Sustainable Urban Drainage System (SUDS) as Nature Based Solutions Approach for Flood Risk Management in High-Density Urban Settlement*. IOP Conference Series: Earth and Environmental Science, Earth and Environmental Science 986 doi:10.1088/1755-1315/986/1/012055

Sarabi, S., Han, Q., Romme, A. G., and Vries, B. (2020). Uptake and implementation of Nature-Based Solutions: An analysis of barriers using Interpretive Structural Modeling. *Journal of Environmental Management* 270. https://doi.org/10.1016/j.jenvman.2020.110749

Seddon N et al. (2020). Global recognition of the importance of nature-based solutions to the impacts of climate change. *Global Sustainability 3, e15*, 1–12. https://doi.org/10.1017/sus.2020.8

Shamsuddin, S. (2020). Resilience resistance: The challenges and implications of urban resilience implementation. *Cities. 103*: 102763. https://doi.org/10.1016/j.cities.2020.102763

Shi, L. (2020). Beyond food risk reduction: How can green infrastructure advance both social justice and regional impact? *Socio-Ecological Practice Research (2020) 2*:311–320. https://doi.org/10.1007/s42532-020-00065-0

Sowińska-Świerkosz, B. and Garcia, J. (2022). *What are Nature-based solutions (NBS)? Setting core ideas for concept clarification. Nature Based Solutions*. December 100009. https://doi.org/10.1016/j.nbsj.2022.100009

The New Urban Agenda. (2017) *the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Quito*, Ecuador. ISBN: 978-92-1-132731-1

Tuğaç, Ç. (2023) Evaluation of urban infrastructure policies in Turkey for climate resilience and adaptation, *Sustainable and Resilient Infrastructure, 8*:1, 190-202: 10.1080/23789689.2022.2138162

Tyllianakis, E., Martin-Ortega, J., and Banwart, S. A. (2022). An approach to assess the world's potential for disaster risk reduction through nature-based solutions*. Environmental Science and Policy. 136*: 599-608. https://doi.org/10.1016/j.envsci.2022.07.021

Voskamp, I.M.; de Luca, C.; Polo-Ballinas, M.B.; Hulsman, H.; Brolsma, R. Nature-Based Solutions Tools for Planning Urban Climate Adaptation: State of the Art. *Sustainability (2021), 13*, 6381. https:// doi.org/10.3390/su13116381

Yamada, F., Kakimoto, R., and Yamamoto, M. (2011). Implementation of community flood risk communication in Kumamoto, Japan. *Journal of Advanced Transportation J. Adv. Transp. 2011; 45*:117–128. 10.1002/atr.119

Wickenberg, B., McCormick, K., and Olsson, J. (2021). Advancing the implementation of nature-based solutions in cities: A review of frameworks. *Environmental Science & Policy. Vol: 125*, 44-53. https://doi.org/10.1016/j.envsci.2021.08.016

World Bank, 2021. *A Catalogue of Nature-based Solutions for Urban Resilience*. Washington, D.C. World Bank Group

Resume

Dr. Didem Güneş Yılmaz received her Ph.D. (2015) about post-disaster housing reconstruction, in Architecture from the Queen's University Belfast, UK. Since October 2015, she has been working at Bursa Technical University, in the Department of Architecture. She teaches courses regarding natural disasters, post-earthquake housing reconstruction and planning in the Department. Currently, her research interests include climate change adaptation, flood risk management, water sensitive urban design, smart city design and urban resilience. She also teaches for the Master Degree in Urban Design in the Faculty of Architecture and Design and supervises her postgraduate students. She is a member of various scientific and technical committees of several conferences.

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Swallowed by the urbanization: Spatial evolution of Adana Bağlarbaşı District

Aytaç Taşkın*
F. Duygu Saban**

Abstract

Vineyard (Turkish: bağ) culture is a common urban phenomenon in Çukurova region communities, which have strong ties with the land, due to the favorable climate and soil conditions. Adana's historic city center and some of the vineyard settlements to the north of this area lost their rural settlement characteristic and started to be built up as a result of Hermann Jansen's planning studies that started in the 1930s, and the city continued its development as planned towards the vineyard settlements (Turkish: bağlar) to the north. Although Gazipaşa, Ziyapaşa, and Namık Kemal Neighborhoods, which were examined within the scope of the study, were planned as a result of these planning studies, they were not built according to the plan. Thus, the implemented part of the Jansen Plan was defined by the railway line located to the south of these three neighborhoods. As a result, these three neighborhoods turned into an area where vineyards began on the periphery of the planned built-up areas and became known as Bağlarbaşı (starts of vineyard area). The aim of the study is to make a morphological analysis of the transformation of the three neighborhoods formed in the area where the vineyards, which previously had a rural settlement texture, disappeared as a result of the urbanization pressure that started in the 1950s, starting from 1950 to the present day, and to examine the process dynamics and to determine the general characteristics of the vineyard culture and houses in the study area. In the study area, morphological analyses were carried out by comparing aerial photographs from 1950, 1954, 1961, current maps from 1985 and 2019, zoning plans dated 1940, 1969 and current data. In addition, the transformation was documented with photographs from various archives and oral history research was utilized. Two vineyard houses in the area were surveyed to determine their spatial characteristics. The data obtained through the studies coincide with Marcel Poëte's assertion that "the memory of a city survives in the physical structure of that city". It has been determined that today's parcel boundaries, main roads, and streets, physical formations such as thresholds and reinforcements of the three neighborhoods bear traces of the period when the neighborhoods were vineyards and gardens. In the area, a small number of vineyard houses (cottages), which are in parallel with the typological characteristics of the traditional Turkish House, have survived to the present day, albeit in ruins.

Keywords: Adana vineyard houses, Bağlar, rural architectural heritage, urban morphology.

1. Introduction

The 20th century can be seen as a turning point as large number of people migrated from rural to urban areas, especially with the industrialization movements. As seen in many countries, rural-urban migration movements accelerated in Turkey, especially in the 20th century. Turkey had a

*(Corresponding Author) M.Sc. Architect and Civil Engineer, Çukurova University, Türkiye, taskinaytacc@gmail.com
** Prof. Dr. Çukurova University, Türkiye, duygufazilet@gmail.com
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***Abbreviations: AEFFG: Adana's old photographs Facebook group, HGM: General Directorate of Mapping, ABB: Adana Metropolitan Municipality*

relatively steady period until the 1950s in terms of domestic migration mobility, and after the 1950s, migration movements increased especially to larger cities (Akyıldız and Ertürk, 2021). In Anatolia, which has a rich character in terms of urban settlement types, in the early years of the Republic, settlements with rural architectural characteristics are frequently encountered in regions other than traditional residential settlements in historical city centers. In these years, Adana was also surrounded by a rural settlement pattern around its historic city center. This study focuses on the urban transformation of some of the rural settlements (Bağlarbaşı area) in Adana city center as a result of the internal migration movements that started in Turkey in the 1950s.

Adana, with its vast and fertile plains, favorable climatic conditions and water basins, has been the scene of settlement throughout history. Traces of many civilizations from the earliest human settlements to the Hittites and Ancient Rome can still be traced in the city today. The city continued to develop in its birthplace during the Ramazanoğulları Principality (Turkish: Ramazanoğulları Beyliği, 14th-16th centuries) and later during the Ottoman Empire rule. By the 20th century, as a result of population growth and the new needs of the time, urban problems emerged that needed to be solved. Adana Municipality, in the light of the ideals of creating a modern city by taking into account the political interests of the time, made an agreement with the German City Planner and Architect Hermann Jansen in 1932 (Saban, 2009). Jansen produced the plans of the modern city, which was aimed to be built together with the settlement areas that developed in the historical process, based on the existing map prepared in 1918 during the French occupation years (Yıldız, 2020). According to the last known version of the urban plan in 1940, the historic city center was largely preserved and expansion was envisaged to the north, east and west of the existing city (Figure 1).

Adana's historic city center and some of the rural settlements to the north of this area lost their rural character and started to be built up as a result of the planning activities, and the city continued to develop as planned towards the north (Figure 1). The neighborhoods of Gazipaşa, Ziyapaşa and Namık Kemal, which were examined in this article, were planned as a result of these planning activities, but were not built according to the plan (Figure 1, red marked area). Thus, the implemented part of the Jansen Plan was defined by the railway line on the southern border of these three neighborhoods. As a result, the three neighborhoods turned into an area of vineyards on the periphery of the planned built-up areas and the area became known as Bağlar/ Bağlarbaşı (English: vineyards/ start of vineyards), (Figure 2). After the 1930s, the Bağlar region, which had vineyard houses (cottages) in large plots of land, maintained its rural settlement character for about 25 more years.

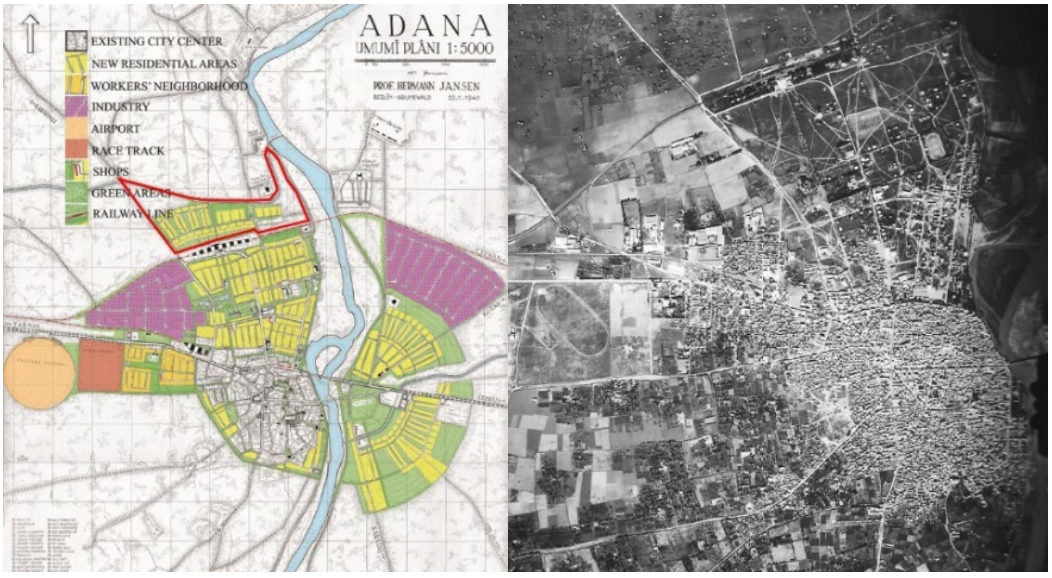


Figure 1 Study area on the urban zoning plan prepared by Hermann Jansen in 1940 (left), (Saban Ökesli, 2009:57) and aerial photograph dated 1940 (right), (HGM archive).

Figure 2 The current relationship between the historic city center of Adana, the built-up part according to the Jansen Plan and the study area (Bağlarbaşı area) of this article (produced by Aytaç Taşkın).

By 1950, the plan up to the railway line and the main lines of the road network were almost completed. After that, as in the rest of Türkiye, the process of rural-urban migration accelerated and the morphological structure of the cities underwent serious changes even within a few years. This can also be confirmed by population statistics. In the period following the proclamation of the Republic, the city of Adana gained importance with industrial and agricultural policies and the population growth rate increased with a forward momentum. According to the first census conducted in 1927, the population was 72,652 people and reached 76,473 people in 1935 with very little progress. The population growth rate was 51.48% between 1945-1955 and 54.1% between 1955-1960. Thus, the population reached 290,000 in 1960, 347,454 in 1970, 475,348 in 1975 and 574,515 in 1980. In 1985, the population growth rate reached a record high of 60.5% and increased by more than 200,000 people in five years, reaching 777,554 people (Sönmez, 2012). From 1985 to today, as of 2022, the population has tripled to 2,265,888 people.

It is known that the plan prepared by Hermann Jansen in 1940 was prepared to accommodate a maximum of 105,000 people (Saban, 2017). However, Adana, one of the most prominent cities in Anatolia with its agricultural and industrial development, filled the population capacity of the planned areas in a short period of 10 years in the 1950s. Thus, the city of Adana continued its urban growth in a distorted manner on the peripheries of the Jansen plan under intense migration pressure. It took 26 years for a new or additional plan to be prepared. This plan, commissioned by the Bank of Provinces (Turkish: İller Bankası) to Bülent Berksan and Melahat and Ali Topaloğlu in 1966, was approved in 1969. However, by 1970, the population had already reached approximately 350,000 people and certain parts of these plans could not be implemented even today. Again, in these years, there was an increase in density in the sections built within the framework of the Jansen Plan and the area was almost completely demolished and rebuilt.

The 1938 cadastral maps show that the cadastral boundaries of Cemalpaşa and Kurtuluş, two of the four neighborhoods (Reşatbey, Cemalpaşa, Çınarlı, Kurtuluş) planned within the scope of the Jansen Plan, move northward and cover all three neighborhoods in the study area. Again, when these maps are analyzed, it is seen that the parcel functions of the region are mostly vineyards, vineyard houses (cottages) or gardens. This is reflected in the titles of the cadastral sheets. Namık Kemal Neighborhood is named Kurtuluşbağlar (Kurtuluşvineyards) and Ziyapaşa Neighborhood is named Cemalpaşabağlar (Cemalpaşavineyards). Again, when the relevant cadastral maps are examined, it is seen that the vineyard settlements continue around the Jansen Plan by becoming

sparser. Names such as Döşemebağlar (Döşemevineyards), Zincirlibağlar (Zincirlivineyards), Karalarbucağıyolubağlar (Karalarbucağıyoluvineyards) continue to be used even today.

The vineyard culture in the three neighborhoods, on the other hand, remains vivid in the memories of people who are old enough and live or have lived in the region. According to the information obtained from the memoirs written by people who lived in the neighborhood, the vineyard settlements here are temporary places of residence where people come to cool off, especially in periods of hot weather. Various plants are grown here in large areas in preparation for winter. Fruit trees such as vineyards, figs, prickly pear, plums and seasonal vegetables were grown and made ready to be stored for a long time by various methods such as drying, pickling and salting. Molasses, tomato paste, pomegranate syrup and jam are also produced (Hız & Göçük, 2018; Gümüş, 2018; Çetin, 2018).

The aim of the study is to analyze the process dynamics and to determine the general characteristics of the vineyard culture and houses in the study area, by making a morphological analysis of the transformation process of Gazipaşa, Ziyapaşa and Namık Kemal Neighborhoods, which were formed in the area where the vineyards disappeared as a result of the urbanization pressure that started in the 1950s, while they had a rural settlement pattern in the north of the historical city center, starting from 1950.

2. Material and Methods

The materials of the study consist of aerial photographs from 1940, 1950, 1961, 1973, 1985, and current aerial photographs, as well as the as-built maps from 1965, 1985, 2007, and 2019, 1940, 1969, and current zoning plans, and photographs obtained from institutional and individual archives. The survey work carried out in the area is also among the tangible materials. In addition, the information obtained through field studies and oral history studies in the field constitute the materials from which user opinions are obtained. In addition to all these, architectural history, urban morphology studies, urban monographs, memoirs, and epistemological and methodological research on urban morphology are among the materials of the study.

While conducting morphological analyses of cities, conducting studies at the neighborhood scale is a very effective choice in terms of understanding the whole city. The city of Adana is composed of neighborhoods, each unique in its own way, with a deep-rooted agricultural and industrial history. The dynamics of each neighborhood can be quite different due to the regions they are associated with. Therefore, in order to obtain accurate and comprehensive data, many different methods and disciplines should be utilized.

The scope of the study is in the intersection of urban morphology and architectural history, as it is about examining the morphological change of neighborhoods and determining the transformation of vineyard houses (cottages). In this context, four different methods were applied to analyze the data obtained in the study area. The first of these is Lynch Analysis. With Lynch analysis, boundaries, roads, regions, reference points and nodal points were identified (Lynch, 1960). Secondly, morphological analyses were performed in three neighborhoods with the method developed by M. R. G. Conzen (1969). Morphological analyses were carried out by comparing the data of 1950, 1985 and 2019 in three periods, at intervals of approximately 35 years. In addition to these, survey studies were carried out in the neighborhoods and the typological characteristics of the vineyard houses were revealed. Finally, oral history research was verified and converted into data sets.

3. Findings and Discussion

3.1. Lynch Analysis

3.1.1. Borders – Roads

Gazipaşa, Ziyapaşa and Namık Kemal Neighborhoods in Seyhan District of Adana, which have been in the process of urbanization since the 1950s, were located on the outskirts of the city when they were first formed. The current borders of the neighborhoods are quite old. The south of the three neighborhoods is bordered by the Adana Mersin railway line. This border has not changed since 1911 when the new Adana train station was put into service (Şenyiğit, 2002). The eastern border of Ziyapaşa Neighborhood in the east of the area is the Seyhan River. While the border of Namık Kemal Neighborhood in the west of the area was the street known as Karaisalı Road, which is now called Mücahitler Street. Alparslan Türkeş Boulevard was opened to the west of the street as a result of the metro works that started in the 1990s, and the boulevard and the metro line became the western border of Namık Kemal Neighborhood. The irrigation canal, which is the northern boundary, is visible in the 1940 aerial photograph and the Jansen Plans, although the exact year of its construction cannot be determined. Therefore, the boundaries of the three neighborhoods were completely finalized in 1940 and there have been no major changes in these boundaries until today. Ahmet Remzi Yüreğir Street and Baraj Street, which form the boundaries between the neighborhoods, consist of the traces of the axes reaching to the historical city center as understood from the 1918 survey map. Today, Ahmet Remzi Yüreğir Street is interrupted by the railroad line, and 66035 Street was interrupted for many years for the same reason, but it was reunited with its historical axis with an underpass from Atatürk Street (Figure 3).

Figure 3 Lynch Analysis (produced by Aytaç Taşkın).

3.1.2. Reference Points

When old photographs of the neighborhoods are examined, it is seen that there have been dominant reference points in the region for many years. The regulator bridge to the east, the irrigation canals built afterwards, the new railway line created with the commissioning of the new station in 1911 and the Demirköprü (English: Iron Bridge), which forms the river crossing of this line, and the Darüleytam building, which was built as an Armenian orphanage in the early 1900s, later used as a teacher's school and today as Adana Science High School, are the oldest reference points of the region. In the following years, Lütfiye Kısacık Primary School, built in 1963 when Lütfiye Kısacık donated her vineyard parcel, Borsa High School, built in the late 60s, and Ziyapaşa Secondary

School, built in 1973, became important reference points. Bağlar Police Station, which is believed to have been built in the late 1960s, is one of the old reference points. Today, the Güzel Mosque, Nakkaşlar Mosque, Kaymakam Kalezade Mosque, Hoca Ahmet Yesevi Mosque, Zillidede Tomb and Makam Mosque can be added to these locations. Cemalpaşa Bridge, Özen Bridge and Kanalköprü also play an important role in people's experience of the city.

3.1.3. Nodes- Regions

The Bağlar District is rich in boundaries and reference points, and naturally has many nodal points. Beyond the nodes in the region, the region itself is one of the nodes of the city. In order to pass from the Jansen plan area to the north of the city, one has to pass through these nodes. As shown in Figure 3, the intersections of the boundary points in the region are all nodal points. The boundaries also clearly divide the neighborhoods into zones. Apart from these zones, the route with high density building stock can also be considered as a zone. Since the zoning works in the region have not been finalized for many years, the construction of new buildings is progressing point by point.

3.2. Visual History of the Region

When old aerial photographs and photographs are analyzed, it is seen that in the 1940s and 1950s, the irrigation canal located on the street known today as Kıyıboyu Street had a soil surface and double rows of eucalyptus trees were planted both to the north and south (Figure 4a). The 1950 aerial photograph shows that there are bridges known as Cemalpaşa Bridge and Kanalköprü at both ends of the area (where Karaisalı Road and Baraj Street intersect with the irrigation canal). Therefore, it is clear that these bridges were built before 1950. Figure 4a and Figure 4b show Cemalpaşa Bridge. In the 1960s, it is understood that the trees around the irrigation canal were cut down and the ground of the irrigation canal started to be covered with concrete (Figure 4b).

In the 1960s, Bağlar Police Station was built, named after the residential identity of the area. Figure 4b shows a photograph of the police station under construction. According to the memoirs of Zeki Gümüş (2018), the police station was established to eliminate public order problems in Bağlar area as a result of the increasing population.

When the 1973 aerial photographs are analyzed, it is seen that the Jansen Plan area is largely built up, with only two large parcels not yet built up. These two parcels are today the regional offices of the State Railways and the Postal Organization. A photograph taken from the location of these parcels is shown in Figure 4c. When the photograph is examined, it is noticed that the approximately 1.5-kilometer Bağlar area behind the station and the railway line is built up in a rural texture. Looking towards the horizon line, it is seen that the green texture continues intensely. According to Gümüş (2018), vineyard houses and vineyards continue from this region to the Taurus Mountains. Looking in the opposite direction from where the same photograph was taken, the difference in the quality of construction between the two regions is clearly visible (Figure 4d).

a. Eucalyptus trees on Kıyıboyu Avenue, 1950s.

b.The process of concreting the irrigation canal, construction of Cemalpaşa Bridge and Bağlar Police Station, 1960s.

c. View of the Bağlar area from the Kurtuluş neighborhood, 1970s.

d. Jansen Plan Area, 1975.

Figure 4 Photographs of the Bağlar area in the past (AEFFG Archive, Url 1).

By the 1980s, the rural settlement texture in the region had largely dissolved and building density increased. The cottages were completely destroyed in this period, unlicensed, unauthored shanty houses were built instead, and high-rise constructions started in places. In these years, the street texture has reached a state close to the present day.

When we come to the present day, it is seen that a holistic zoning plan implementation has not yet been put into effect in the region. It has been determined that the execution of most of the plan has been suspended by court decisions, and the zoning problem has not been solved for about 50 years. New constructions are progressing with point-by-point transformations, the urban transformation pressure and the 2.4 density plan pose a great threat to the low-density construction in the neighborhood, and it is seen that demolitions are carried out regionally. In all three neighborhoods, organically formed low-density streets, parcels with the remains of demolished houses, a few preserved vineyard parcels and high-density converted houses coexist.

3.3. Morphological Analyses

3.3.1. 1950

In 1950, when the morphological structure of the region is examined, a rural settlement texture consisting of vineyard houses located in large vineyard parcels is observed. The boundaries of the neighborhood formed in 1940 have not changed. The roads that crossed the railway line are Karaisalı Road and the roads known today as Baraj Avenue, which lead to the city center. Since Karaisalı Road has a weaker connection with the city center compared to Baraj Avenue, Ziyapaşa Neighborhood has more residential areas. The strong connection to the city center is thought to have led to an increase in building density (Figure 5, grid 7E).

In 1950, it was determined that the dominant structures in the region were gasworks (Hız ve Göçük, 2018: 20), (Figure 5, grid 4F), and railway workshops, and three bridges were connected to the regions to the north of the irrigation canal (Figure 5, grid C1, D6, D7). When the aerial photographs are examined, two dominant road traces running on the north-south axis in Ziyapaşa District are noticed (Figure 5, grid 7, 8). When the aerial photographs of various dates are examined, it is seen that the river bed has changed over the years, and probably after the dam regulator was opened, the banks of the river were filled with alluvium. Again, from the aerial photographs, it is thought that there is a swamp structure in the region and these roads act as canals from time to time and the water of the river flows from here. For these reasons, there was no construction in this area. Although the area here was built in the following years, it has been declared as a disaster risk area today and this situation has been going on for about 20 years.

It was observed that the irrigation canal, which forms the northern line of the region, had an earthen surface in 1950 and there were double rows of eucalyptus trees both to the north and south. In the 1960s, all the trees were cut down within the scope of the concreting works of the canal surface, and it was understood that vineyard settlements continued to the north of the three neighborhoods in 1950 in a more sparse manner.

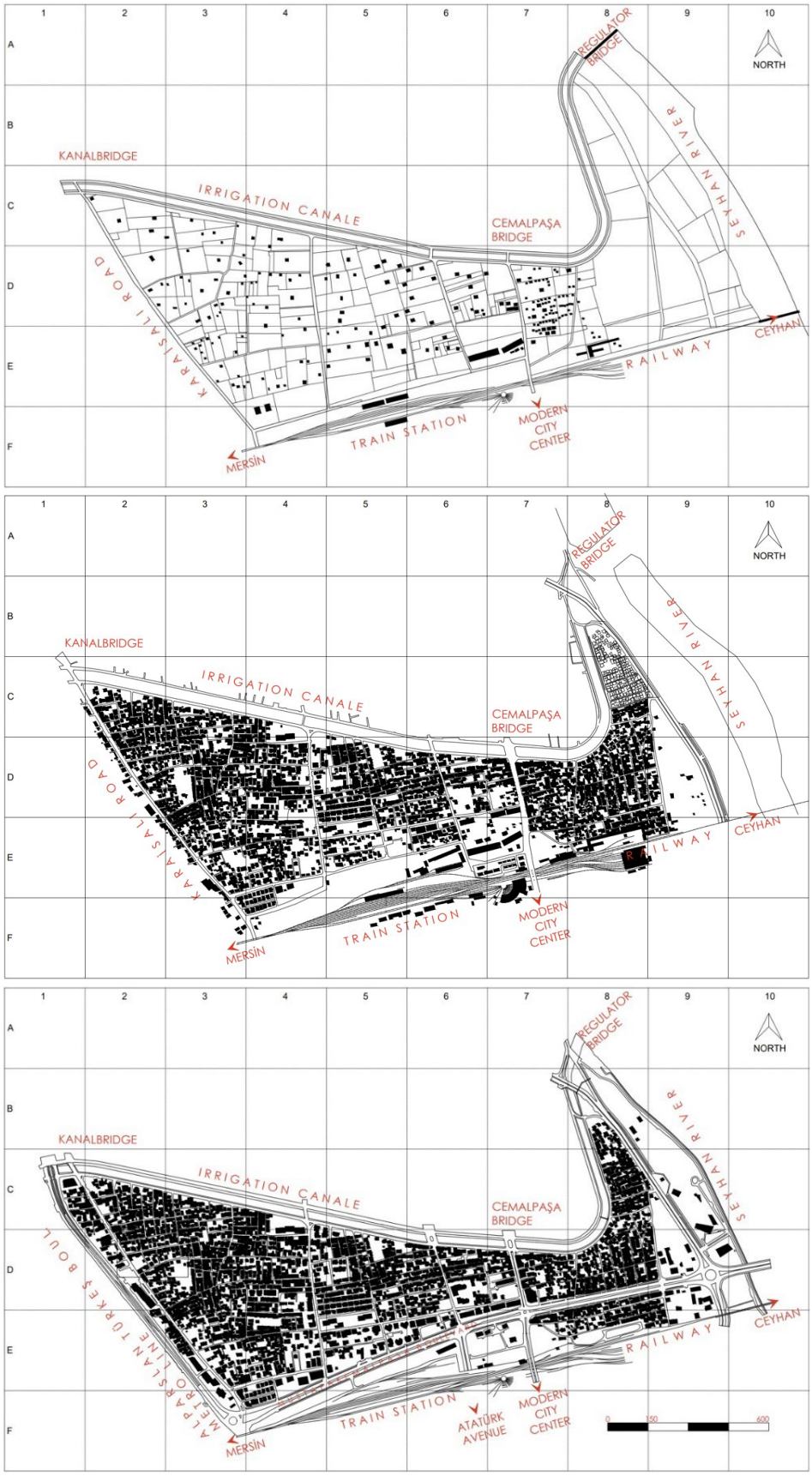


Figure 5 Comparison of parcel-street-building relationship of Bağlar region in 1950 (top), (produced by Aytaç Taşkın), 1985 (middle), (produced by Aytaç Taşkın and Akif Kemal Pekavcılar) and 2019 (bottom), (produced by Aytaç Taşkın).

3.3.2. 1985

As a result of the analysis of the region, it is understood that the Berksan-Topaloğlu plan, which was approved in 1969, was partially designed on the traces of vineyard parcels and existing construction (Figure 5). It is seen that the river shores were planned as recreational areas and the main roads forming the boundaries of the neighborhoods were largely preserved. However, it is understood that this plan has not been implemented to a great extent (Figure 6). The neighborhood was almost entirely developed organically and built-in free order. According to the oral history and literature research, it is seen that the residents of the region divided their vineyard parcels and sold them to their relatives since the 1950s, thus paving the way for construction. In 1985, when the rural settlement characteristic of the region completely disappeared, expropriations and demolitions started to be carried out to create Mustafa Kemal Paşa Boulevard, which can be read from the filled-empty diagram.

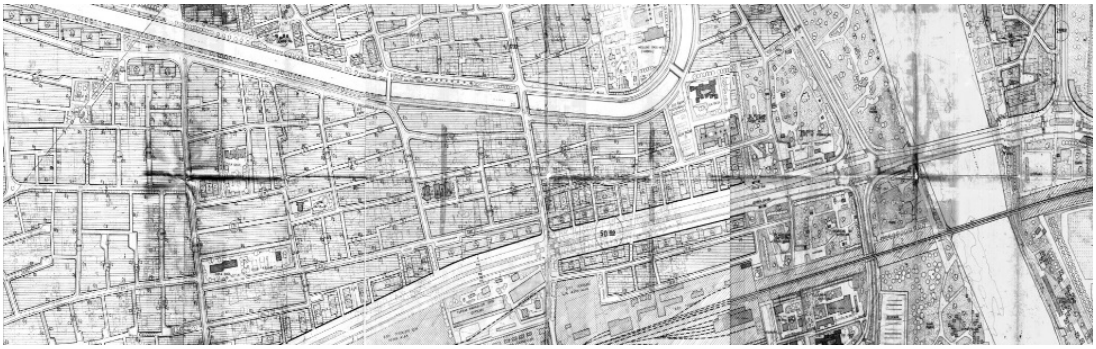


Figure 6 1/1000 application zoning plan of 1969 (Aytaç Taşkın archive)

3.3.3. 2019

The most recent existing maps of Adana City were prepared in 2019. In the light of these maps and the data obtained from the spatial address system, a parcel-street-building relationship diagram was created (Figure 5). In the second half of the 20th century, the city became a center of attraction with the development of agriculture-based industry, and due to the increase in the number of motor vehicles and population, new streets were opened. The building heights on these streets increased (Saban, 2017). Between 1985 and 2019, the creation of Mustafa Kemal Paşa and Alparslan Türkeş Boulevards in the region is one of the most significant changes in the urban fabric. New bridges were also built to cross the irrigation canal. The largest urban gap in the area is the Water and Sewerage Administration compound in the Ziyapaşa neighborhood, which was formerly the site of water wells and now belongs to the Metropolitan Municipality.

Adana has rapidly metropolitanized thanks to external factors such as its geographical location and regional transportation network, and internal potentials such as its existing trained workforce and capital structure. However, due to the excessive increase in residential areas and the inability of the main roads to adequately carry vehicle and pedestrian traffic, some green areas have been rapidly concretized and growth has continued. It can be said that this growth tends to expand rapidly instead of developing (Yıldırım, 2010). In the Bağlar region, the green texture has rapidly disappeared and the region has been completely built up. Between 1985 and 2019, it was determined that the building heights increased on Mücahitler Avenue, Alparslan Türkeş Boulevard, Mustafa Kemal Paşa Boulevard, Baraj Avenue, and Ahmet Remzi Yüreğir Avenue. Today, the buildings in the alleyways are being demolished one by one, and are waiting for the apartment buildings to be built in their place. In Namık Kemal and Ziyapaşa neighborhoods, a few vineyard plots have survived to the present day, preserving their characteristics. Apart from these, it can be said that the neighborhoods are completely built up, and green areas and social facilities are almost non-existent. The already insurmountable borders and thresholds of the region have been further strengthened and it has been completely enclosed by borders.

3.3.4. Parcel Analysis

When the neighborhoods in the Bağlar district are closely examined, it is much better understood how today's building islands, parcels, and streets were formed. Close plan analyses have been carried out in three neighborhoods and two areas in Namik Kemal Neighborhood are presented within the scope of the study. In Figure 7a, the parcel compared between 1950 and 2019 is approximately 20,000 square meters with a single vineyard house. In 2019, it is understood that it was divided into parcels of 400 square meters on average. There is a free order plan application within the parcels and they are not built according to any zoning plan. It is seen that some parcels have more than one building and streets have been created to provide access to the divided parcels. As a result, the traces of today's construction are shaped by the traces of the past.

a. 1950 (left) and 2019 (right)

b. 1950 (left) and 2019 (right)

Figure 7 Transformation of vineyard parcels in Namık Kemal Neighborhood (produced by Aytaç Taşkın)

The other parcels analyzed in Figure 7b cover a total area of 21000 square meters. It is seen that some of these parcels have been divided and sold, while some of them retain their root parcel characteristics. The vineyard parcel, which retains its root parcel characteristic, is very little built up today and preserves its garden. In the 2019 empty-fill diagram, the vineyard parcels are clearly visible. According to this diagram, it was determined that streets were created to reach the divided parcels and that the streets were cut and evolved into dead-end streets due to the protection of the root parcels. The formation of other dead-end streets in the region is very similar.

3.3.5. Parcel Functions and Sizes

In 1950, there were 292 parcels in total in the Bağlar region. Although the parcel sizes vary, the average is 4200 square meters. Although they are few in number, some of them are under 500 square meters and the majority are over 500 square meters. There are also parcels whose size reaches 40000 square meters. 115 of these parcels are vineyards and houses, vineyards or gardens, 52 are fields, 64 are land plots, 13 are masonry or courtyard houses, the functions of the rest could not be determined. These parcels started to be divided since the 1950s and were sold first to relatives and then to people who migrated (Hız ve Göçük, 2018). In cases where no new parcels were created by dividing, shares were sold and houses were built in large parcels without a zoning or license. Until today, only a few parcels from the division remained. In 2019, it was seen that the

number of parcels was more than 3000 and their size decreased to 100 square meters. In Figure 8, the condition of the parcels before and after the division is shown.

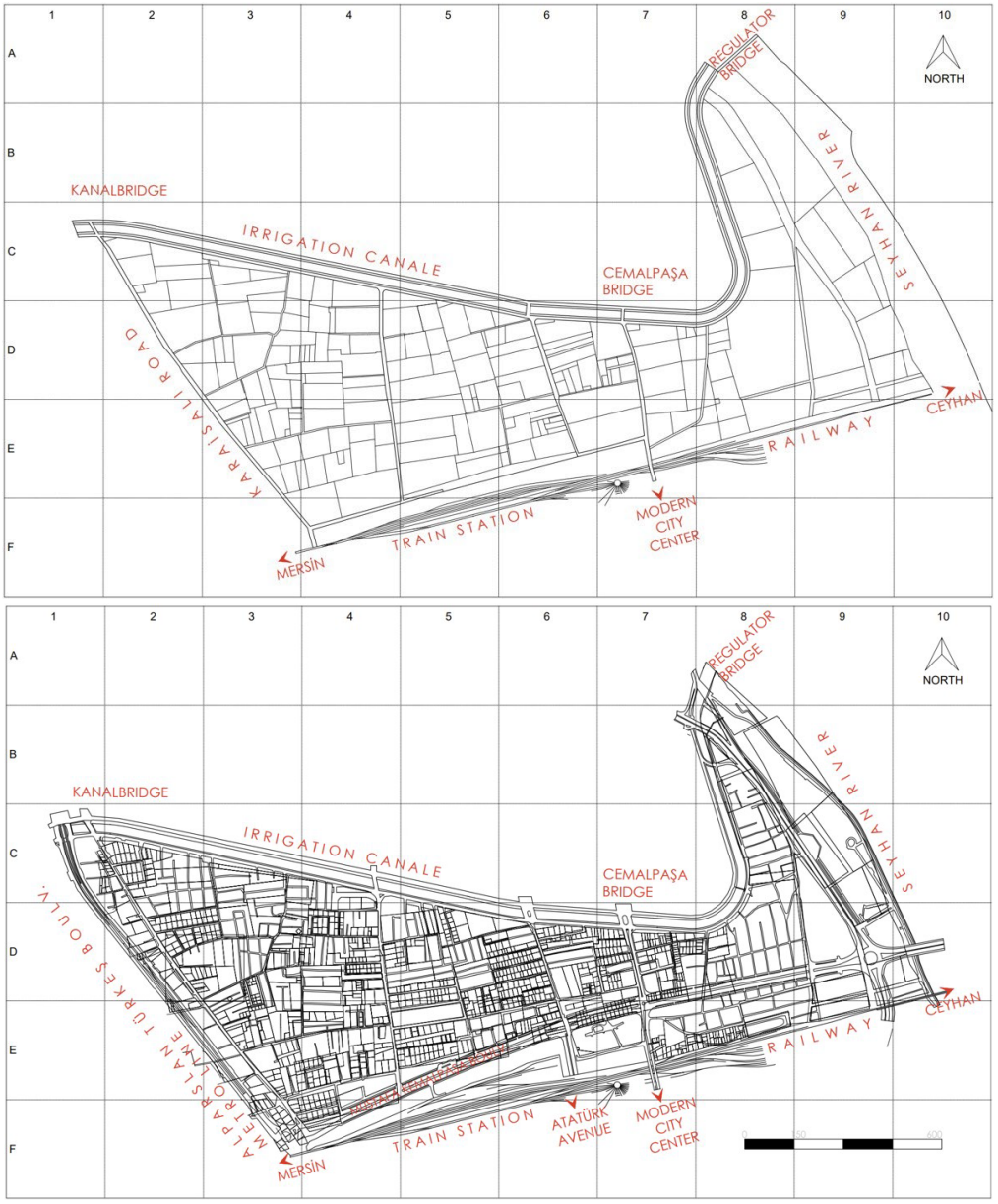


Figure 8 Comparison of parcel sizes of Bağlar region between 1950 (top) and 2019 (bottom) (Produced by Aytaç Taşkın).

3.3.6. Number of Storey Analysis

There are a total of 228 buildings in the Bağlar region as determined from aerial photographs taken in 1950. As a result of the oral history studies conducted in the neighborhood, it was determined that the majority of these buildings bear the typical characteristics of the cottages presented within the scope of the study. By 1985, there were 1413 1-storey buildings, 1393 2-storey buildings, 56 4-storey buildings and 41 5-storey buildings in the neighborhood. Buildings over five floors are very rare and the maximum number of buildings is 11 floors. When we come to the present day, it is determined that the number of buildings has increased in parallel with the increase in population. The number of single-storey buildings is 1017, the number of two-storey buildings is 1346, the number of three-storey buildings is 684, the number of four-storey buildings is 145, the number of 5-storey buildings is 37, there are 70 buildings between 6 and 10 floors and 28 buildings between 11 and 18 floors (Figure 9).

When Figure 9 is analyzed, it is seen that the majority of the houses are between one and three storeys. The most important element that draws attention as a result of this analysis is the locations

where high-density buildings are constructed. When the diagram of the number of storeys analysis in Figure 9 is analyzed, it is seen that five storeys and above are built on Mücahitler Street, Baraj Street, 66035 Street, the continuation of Atatürk Street, Mustafa Kemalpaşa Boulevard and its surroundings. These axes correspond to the threshold, border and nodal points of the neighborhood. In the Ziyapaşa neighborhood, the situation is different. Since the eastern side of this neighborhood, which is close to the river, was declared an urban transformation zone in the early 2000s, therefore there is no high-density construction on and around Kasım Gülek Boulevard.

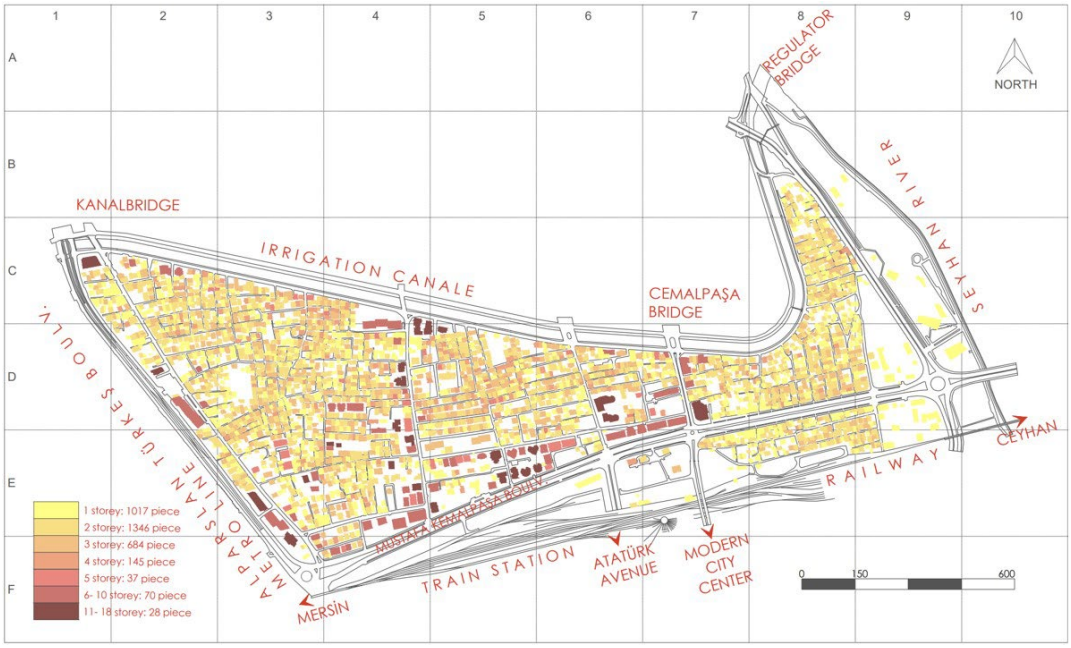
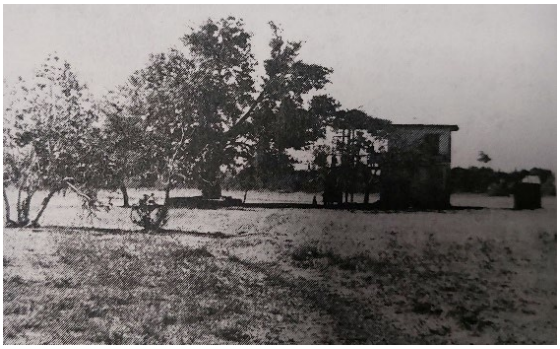


Figure 9 Analysis of the number of storeys of three neighborhoods as of 2019 (Produced by Aytaç Taşkın)

3.4. Vineyard Houses (Cottages)

In the Bağlar region, very few cottages have survived to the present day. As far as can be determined, traces of a few vineyard houses in the Namık Kemal Neighborhood and Gazipaşa Neighborhood can be read today. According to the oral history research conducted in the neighborhood, unlike other areas with rural settlement characteristics, the houses in this area were used as temporary residences. The cottages here are similar to the houses in the rural settlement texture in Yüreğir District, which Burcu Yıldız (2020) discussed in her master's thesis. As we move away from the city center, the number of cottages becomes fewer and the size of the vineyard plots increases. Figure 10a presents photographs of a vineyard house in the Namık Kemal Neighborhood in 1950 and a vineyard house identified in the same neighborhood today (Figure 10b). When the photographs of vineyard houses obtained from Mehmet Baltacı's photo archives are compared with the oral history data, they show an exact match. When these vineyard houses are examined, it is seen that these houses have their own water wells and pump systems. In addition, vineyard houses are generally oriented to the south and have open sofas. With these features, they are in harmony with the typological characteristics of the traditional Turkish house.

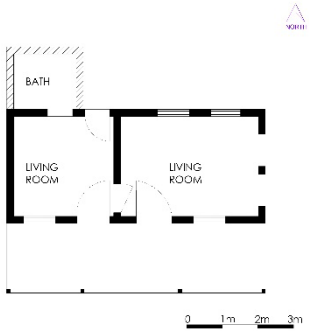
According to the examinations made in the study area, it was seen that the cottages that survived in Gazipaşa Neighborhood are mostly single-storey. Survey studies and interviews with the owners were conducted on one of these houses. Like the others, this house has two rooms around an open sofa and a hipped roof (Figure10c, 10d). It was found that a bathroom was added to the building later, the parcel of the building was preserved and an orange grove was created. This cottage is an example of a rare, preserved parcel and building combination in the region.



a. The Cottage of Pervin Olgun, 1950s (Hız and Göçük, 2018)

b. One of the last few remaining cottages in the Namık Kemal neighborhood, 2022 (Aytaç Taşkın Archive)

c. Cottage in Gazipaşa neighborhood, 2022 (Aytaç Taşkın Archive)



d. Cottage plan in Gazipasa neighborhood, 2022

Figure 10 Vineyard Houses in Gazipaşa and Namık Kemal Neighborhoods

4. Conclusions and Recommendations

In the light of the analysis conducted in the region, the change in the physical and human morphology of the neighborhoods can be clearly evaluated. The results obtained from the physical analysis can be listed as follows;

- The parcel boundaries of today's construction come from the boundaries of the vineyard parcels of the past.
- Although many zoning plan studies were prepared in the region, they were based on the organically developed texture. It has been determined that most of the plan studies could not be implemented and the zoning problems of the neighborhoods continue today.
- Almost all of the street texture, thresholds, boundaries, and zones in the region are traces of the rural texture of 1950.
- As Conzen (1969) and Oliviera (2016) have shown, street traces are the most difficult formations to change in cities. In the Bağlar area, the street formation and structuring of the area were almost completed until 1985, after which the demolition process started and the number of storeys started to increase in the area by demolishing low-density buildings while the streets remained constant. Today, the second demolition process has started and building heights continue to increase.
- While the average parcel size in the region was 4200 square meters in the 1950s, these parcels were divided to form the very small parcels of today.
- Today, the neighborhoods are under the pressure of rent and construction brought about by the 2.4-density zoning plan. In this situation, it is seen that the last traces of the neighborhood will disappear in the future.
- As a result of the surveys conducted in many areas of the neighborhood, it has been observed that the houses in the area have been demolished and are waiting for the completion of the

zoning works for rebuilding. This situation causes many parts of the neighborhood to be seen as ruins.

- The neighborhood has the appearance of a fringe belt first described by Conzen (1969). The area is squeezed between borders, and it has been determined that the borders have sharpened and strengthened over time, turning into obstacles that are difficult to overcome.
- The bed of the Seyhan River, one of the natural boundaries of the Ziyapaşa Neighborhood, has changed many times and this has created continuous changes in the morphology of the neighborhood.
- The rural settlement texture of the neighborhood and the vineyard culture have also disappeared. The last inhabitants, the witnesses of the period when the neighborhood consisted of vineyards, have either left the region or have reached the end of their lives. In this case, the lifestyle in the region is changing day by day and losing its local characteristics.
- In addition, a small number of vineyard houses in the study area have survived in ruins. These vineyard houses are in parallel with the typological characteristics of the traditional Turkish House.

The 3665 square meter parcel numbered 1469/ 97, located in Gazipaşa Neighborhood, is zoned as a green area since it continues to exist as an orange grove today. As a result of the oral history research and morphology studies conducted on this parcel, it was observed that it has existed as a vineyard since the 1940s. It is one of the two green areas envisaged for Gazipaşa Neighborhood together with a small park area of 980 square meters in 1469/ 29 parcel. Parcel 1469/ 97 is not open to the public as it belongs to a private owner. On the other hand, there is a vineyard house within the parcel in question, which preserves its original structure. Together with this vineyard house, it is the only vineyard in the region where the parcel and the vineyard house are preserved together. The vineyard house here is dilapidated (Figure 10c). It is recommended that this parcel be rehabilitated and opened to the public by making green area arrangements in a way to maintain the vineyard characteristic and that the vineyard house inside be preserved and restored. In addition, this area has the potential to be a recreation area where information about the vineyard history of the region is presented and products produced with viticulture methods are introduced.

Although the parcels of the two vineyard houses in Namik Kemal Neighborhood are not protected, both of them have the potential to be restored together with their surroundings and put back into use with zoning regulations. The areas where these vineyard houses are located are currently zoned for housing. However, they have a high potential to be used as public spaces with restoration and revitalization works.

Within the scope of this study, an evaluation was made on three neighborhoods in the region known as Bağlarbaşı. The study can be extended to include all the neighborhoods around the modern city center, known as the Jansen plan area, and the historic city center, as well as the region extending up to the Taurus Mountains. In addition, a more detailed study about the life and architectural features of the vineyard houses in the region can be compared with both the vineyard houses in Adana and the vineyard houses in other cities and their characteristics.

The data obtained from the studies are in line with Marcel Poëte's assertion that "the memory of a city survives in the physical structure of that city" (Bilsel, 2015: 61). The physical formations of the three neighborhoods, such as today's parcel boundaries, main roads and streets, thresholds, and reinforcements, bear the traces of the period when the neighborhoods were vineyards and gardens. It is thought that the data obtained in the study will be an important source for the planning studies to be carried out in the area, as well as bringing to light the values of the city's history that are about to be lost.

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References

Akyıldız, İ. E. ve Ertürk, E. (2021). Lee Kuramı Perspektifinden Kırdan Kente Göçün Mekaniği: Bursa Örneği. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 30* (2), 1-17.

Bilsel, C. (2015). *Kent Tarihi Araştırmalarında Mekânbilimsel Bir Yaklaşım: Batı'da ve Türkiye'de Kentsel Morfoloji Çalışmalarının Öncülleri*. Türkiye Kentsel Morfoloji Sempozyumu, Mersin, Türkiye.

Conzen, M. R. G. (1969). *Alnwick, Northumberland: a study in town-plan analysis*. Institute of British Geographers Publication.

Çetin, H. (2018). *Gazipaşa Mahallesi*. Heyamola Yayınları, İstanbul. 133 s.

Gümüş, Z. (2018). *Sümer Mahallesi*. Heyamola Yayınları, İstanbul.

Göçük, C. A. ve Hız, N. (2018). *Namık Kemal Mahallesi*. Heyamola Yayınları, İstanbul.

Lynch, K. (1960). *Kent İmgesi*. Çeviren: İrem Başaran, Türkiye İş Bankası Kültür Yayınları, İstanbul.

Oliveira, V. (2016). *Urban Morphology an Introduction to the Study of the Physical Form of Cities*. Springer International Publishing, Switzerland.

Saban Ökesli, F. D. (2009). Hermann Jansen's Planning Principles and His Urban Legacy in Adana, *METU JFA, 26*(2):45-67

Saban, F. D. (2017). *Geleneksel Adana Mahalleler, Sokaklar, Binalar* 1. Akademisyen Kitabevi, Ankara.

Sönmez, M. E. (2012). Adana Şehrinin Alansal Gelişimi ve Yakın Çevresinin Arazi Kullanımında Meydana Gelen Değişimler. *Türk Coğrafya Dergisi. 57*: 55-69, İstanbul.

Şenyiğit, Ö. (2002). *Adana-Mersin Demir Yolu Hattı Üzerindeki İstasyon Binalarının Tarihi ve Mimari Analizi*. Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Mimarlık Anabilim Dalı, Yayımlanmamış Yüksek Lisans Tezi. Adana.

Url 1: facebook.com/groups/495586090482780- *Adana'nın eski fotoğrafları* facebook grubu (AEFFG): (last access date: 05.01.2023)

Yıldırım, T. (2010). Çukurova- Adana'nın İmar Tarihi, Planlama Çalışmaları. *Güney Mimarlık Dergisi, (2):*30-39

Yıldız, B. (2020). *Adana İli, Yüreğir İlçesinin 1950-1986 Yılları Arasındaki Fiziksel Gelişimi*. Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Mimarlık Anabilim Dalı, Yayımlanmamış Yüksek Lisans Tezi. Adana. 401 s.

Resume

Aytaç Taşkın graduated from Çukurova University Department of Civil Engineering in 2013 and from the same University's Department of Architecture in 2014. In 2019, he received his M.Sc. degree from Çukurova University, Department of Architecture. He is still continuing his research as a Ph.D. student at the same University. After working in various architectural offices after graduation, he has been continuing his project practices in Adana Metropolitan Municipality, Urban Projects Department since 2016. His academic research interests focus on the theory of architecture and the history of urbanism.

Prof. Dr. Fazilet Duygu Saban is an architect graduated from Mimar Sinan Fine Arts University. She received her M.Sc. degree at Çukurova University and Ph.D. degree at University College London, Bartlett School of Planning. She is currently working at Çukurova University, Faculty of Architecture, Department of Architecture and her research areas focus on history of architecture, urban history, urban conservation and architectural heritage.

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Understanding the interplay of light, color, and interior design in healthcare spaces

Navid Khaleghimoghaddam*

Abstract

Healthcare facilities have evolved from strictly functional to therapeutic places, integrating spiritual and psychological components of health. Design issues must be given specific attention to establish a therapeutic atmosphere that promotes successful therapy and stress alleviation. Color and light have a tremendous influence on the human mind and body, according to extensive studies, making them critical aspects of healthcare facility design. This study's approach is to contribute to the construction of more effective therapeutic settings by investigating the effects of color and light on human wellness and providing design alternatives. So, it tries to provide a complete design paradigm that combines the strategic use of color and light in healthcare facility interior design. Because healthcare institutions play an important role in improving general well-being, this approach can help to create more effective healing settings. To provide the theoretical framework and collect data, this study uses a combination of library studies and descriptive research. The research initially investigates the notion of color and light, then explains their impact on physical and mental health disorders, as well as their use in therapeutic settings. The study concludes with the creation of a conceptual model and recommended design solutions for healthcare facilities.

Keywords: color, healing, healthcare spaces, interior design, light

1. Introduction

Hospitals, clinics, and health centers serve to treat patients and improve the health of the community. Therefore, the spatial and functional characteristics of health facilities as permanently accessible spaces need to be considered in their design. In most cases, such centers have been assessed from a functional point of view or in terms of health and pollution. However, factors such as user satisfaction, perception and visual aspects and their impact on patient behavior also need to be considered. The lack of attention to interior design, especially in therapeutic spaces, is striking for several reasons. Interior design plays a crucial role in the process of treatment and recovery of patients in health centers. The results show that healthcare environments influence people's physical and mental health, the treatment process and patients' recovery (Agom et al. 2022; Bernhardt et al. 2021; Elf et al. 2020; Huisman et al. 2012); Evidence on the healing role of hospitals also shows that environmental factors improve patient and staff performance through clinical practices (Lukasik et al. 2022; Brambilla et al. 2020; Konstantzos, 2020; Fadda, 2019; Laursen et al. 2014; Lipkin, 2012). light and color are considered environmental features that have been shown to have a positive impact on the health of hospital patients (Kakitsuba, 2020; Leccese et al. 2017; Kakitsuba, 2015; Hassan et al. 2020; Boubekri, 2014; Rikard, 2006). Studies have shown that the proper use of color in hospitals and healthcare environments promotes mental concentration and enhances feelings of relaxation. For instance, Lindahl et al. (2020) concluded that light and color in

*Assist Prof. Dr., Konya Food and Agriculture University, Türkiye, navid.khaleghi1363@gmail.com
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the physical care environment are perceived as psychologically supportive from the users' perspective. García-Rosales et al. (2018) emphasized the significant role of factors such as light and color in promoting well-being, establishing the visual relationship between outdoor and indoor spaces, orientation, and comfort in movements within hospitals, and rest for users. Mehrotra et al. (2015) have shown that in a multifunctional environment inhabited by a variety of people, such as the treatment rooms of a hospital, the design of the lighting system plays an important role in the comfort of patients, the critical visual requirements of hospital staff, and the comfort and visual needs of visitors.

In general, light plays a very important role in human visual activities and reduces depression, decreases fatigue, and improves alertness. Color and light have a natural power and effect that can affect the soul and spirit of man One of the most important aspects of creating a healing environment through architecture is the proper use of light and color. In this respect, the hospital is an architectural phenomenon in which color and light can be used as two factors influencing patients. It is expected that appropriate hospital interior design will help patients recover quickly and provide a better sense of space for patients and hospital staff. The present study aims to provide a conceptual framework for the interior design of hospitals and healing environments by reviewing previous research and carefully examining the properties of light and color and their effects on users and the perception of architectural space. In this respect, the study attempts to answer the following questions:

1. From what aspects can the biological effects of color and light be investigated in terms of accelerating patient recovery and their use in the interior design of healthcare environments?

2. What solutions can be offered using color and light for the interior design of healthcare facilities?

2. Research Methods

Current research is qualitative and application oriented. So, in accordance with the purposes of the study, to explain the interplay of light, color, and interior design in designing healthcare spaces, the descriptive-analytical research method was used. In this regard, three steps were taken. To delineate the theoretical framework of the study, the first step was to review the studies and theories (desk review) on the significance and impact of light and color in architectural design, especially in the interior design of healthcare spaces. Secondly, the results obtained were categorized based on the physical and spiritual properties of light and color. Then, using descriptive and analytical methods and evaluating the effects of these properties on users, architectural design approaches were proposed. In this step, Using the Delphi technique, an open-ended questionnaire was created based on the components derived from the literature review, and the author asked the appropriate questions in the form of an interview with three separate groups of experts (Table 1). The first group consisted of five architects and seven interior designers from design firms. The second group consisted of four doctors (intensivist: N=1, cardiologist: N=1, general practitioner: N=1, pediatrician: N=1) and four nurses from public and private institutions. The third group consisted of four psychologists, who are scientists concerned with the psychological effects of the environment on humans.

Table 1 The statistical population of study.

Participant	N	Gender		Education
		Women	Men	
Architect	5	3	2	Ph.D.
Interior Designer	7	4	3	5 Masters & 2 Ph.D.
intensivist	1	-	1	Doctorate
cardiologist	1	-	1	Doctorate
general practitioner	1	1	-	Doctorate
pediatrician	1	1	-	Doctorate
Nurse	4	2	2	Bachelor
Psychologist	4	2	2	Ph.D.

Generally, several steps were done to check the validity and reliability of the data. One was to examine the studies conducted by previous researchers to code the data and the conceptual model of the research is the result of examining and analyzing the results obtained from their studies. It is worth noting that the selection of participants is one of the most important components of Delphi technique. This is because the basis of this method will be the expert opinions of the participants. There is no clear rule for a sufficient number of samples, and their number varies depending on the situation. Often, the number of participants is less than fifty, and more than fifteen to twenty is sufficient (Hasson & Keeney, 2011). For this purpose, the results were shared with twenty-four experts in related fields. In this way, the researcher could be sure that the results obtained from the theoretical basis would be confirmed by the experts. At the last step, after the systematic collection of data, the conceptual framework of the study was presented in the form of a comprehensive model, and it was proposed to use light and color aspects in the interior design of therapeutic spaces.

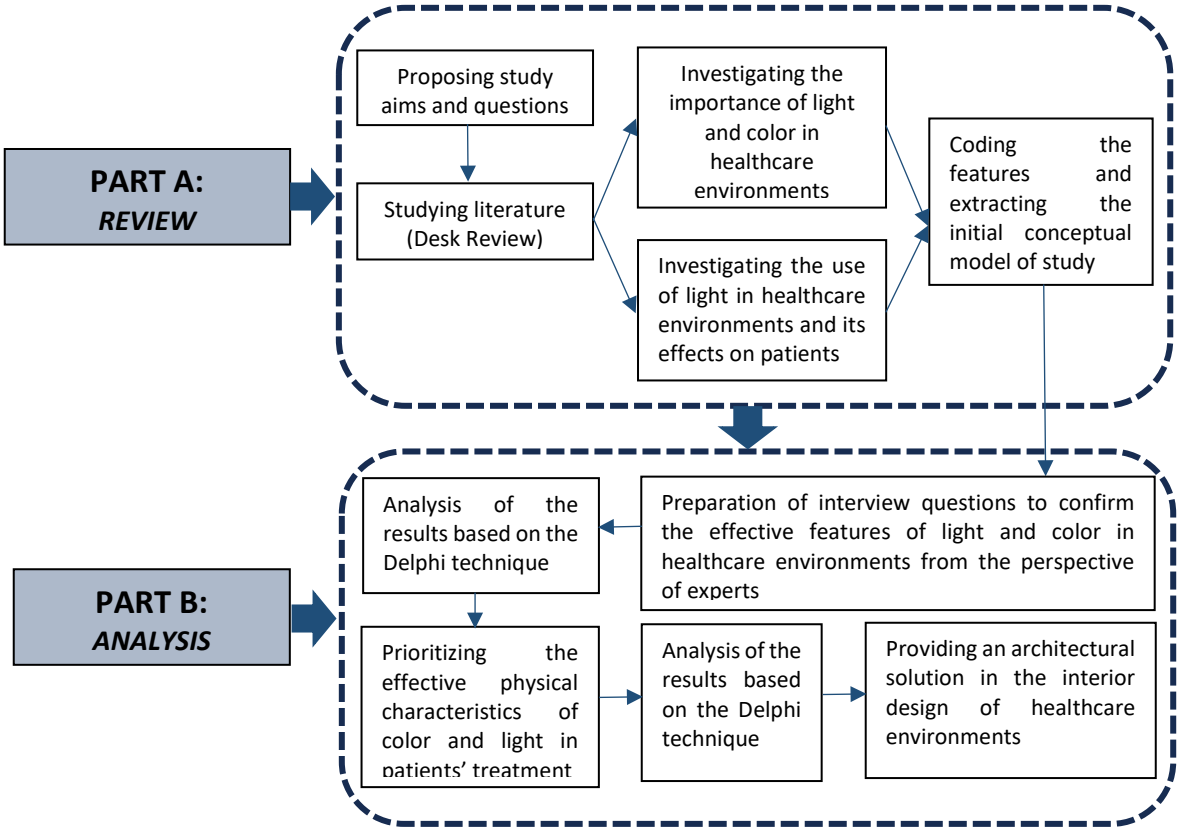

Diagram 1 Research's conducting process (Author).

3. Theoretical Framework

3.1. The importance of light in healthcare environments

Light is one of the most important and significant environmental factors. Research has shown that light influences hormonal rhythms, the balance of metabolism and the control of bodily functions (Barati and Barati, 2005). The psychological and behavioral system of man has evolved over time, and all these changes have been influenced by sunlight, to which the light-sensitive and light-regulated organs have adapted (Chen et al. 2022; Tomassoni et al. 2015; So & Leung, 2011). In this context, light therapy (heliotherapy) involves exposure to daylight or specific wavelengths of light, using lasers, light emitting diodes, fluorescent lamps, dichronic lamps or very bright lamps, full spectrum light, controlled by various devices. As a rule, the light is prescribed for a certain period of time and at a certain time of day. On the other hand, daylighting is a process that goes

beyond creating suitable conditions for seeing objects. This process has special emotional qualities that can affect people's mood. In the healthcare centers the presence of light in any room is necessary, and this important factor creates motivation for the recovery of patients (Rahmanian & Mahmoudi, 2020). Hospitals have many negative effects on the recovery process of patients who are hospitalized for long periods of time. For this reason, the hospital environment should be designed for patients so that they suffer less from tension and anxiety and their mental and physical needs can be easily met. Research has shown that when designing rooms, incorporating light at a standard angle, and using wide windows accelerates recovery and increases patient and staff relaxation. Just as a house is warmed and enlivened by light, a hospital space should, as far as possible, evoke the same feeling in patients. Daylight in the hospital not only meets the biological needs, vitamin D, regulates sleep and rest, but also enlivens the hospital environment, and patients are less afraid of the hospital environment with appropriate lighting (Veitch & McColl, 2001).

Figure 1 Examples of using light in healthcare environments (www.renadesign.com).

3.2. The use of light in healthcare environments and its effects on patients

The hospital's lighting system includes the provision of general lighting for all departments, including examination, injection, specialty care, and patient rooms. For this reason, the optimal visual requirements for patients and even for physicians and staff should be considered in the lighting design of the various hospital spaces. The fundamental goal of any health care system is to create the appropriate environment to restore patients to health. These systems include hospitals, special care centers for the mentally ill, surgery centers, clinics, and medical clinics. A comfortable view must be provided for patients and their companions, doctors and other hospital staff, and uniformity of light sources and lighting is also important (Parsons, 2000). Natural light is optimally supplied in health centers at different times of the year and, in addition to energy efficiency, has a significant impact on strengthening circadian rhythms and the healing process. Architects can promote healing and inner peace by using natural lighting effects. To create favorable conditions in the hospital, one should take advantage of the various properties of daylight. Sunlight not only has positive effects on the soul and spirit but is also considered a sign of hope and recovery for patients who have been in the hospital for a long time. In addition, there is the disinfecting effect of sunlight, especially in environments polluted by people. On the other hand, without natural light, the rooms look too gloomy and heavy. Sunlight is an abundant source of natural light and illuminates architectural forms. Even if the sunlight is intense, the quality of light directly or indirectly affects the patient. The energy of the sunlight entering space hits the surfaces inside the space and creates light and shadow, animating the space and separating the shapes inside the space. Since the intensity and direction of sunlight is almost known, its visual effect on the surface, shapes and space of the room can be controlled and predicted by the size, location, and direction of the windows (Dianat et al. 2013; Alzubaidi & Soori, 2012).

The dimensions of a window play a role in determining the amount of light in a room. The size of the wall or ceiling opening depends not only on the light, but also on other factors such as the materials, the wall or ceiling structure, the need to create a private space, ventilation, the degree of seclusion and the effect of the openings to the outside. Thus, in determining the amount of light in a room, the position and direction of a window are more important than its dimensions. The direction of an opening can be determined to receive direct sunlight at a particular time of day. The harmful effects of direct sunlight, such as excessive heat gain, can be controlled by installing a canopy or creating shade from tree foliage or nearby buildings. The direction of an opening can be adjusted to face away from direct sunlight and instead take advantage of indirect light from the surrounding area, as its light remains constant even on cloudy days and attenuates the intensity of direct sunlight. Adjusting the amount of light in the space also has a significant effect. It can also be mentioned that the use of floor-to-ceiling windows, which direct natural light inside, and proper lighting at night lead to tranquility and a sense of belonging in the space. It is true that light is one of the most important things in designing a therapeutic space, but it will not have a positive effect if it is not controlled appropriately (Rahmanian & Mahmoudi, 2020; Thuesen et al. 2011).

3.3. The importance of color in healthcare environments

The role of color in people's lives has always been so great that it has never been considered an unknown and foreign word. In some ancient cultures, including the Egyptians, Chinese and Greeks, color was used for treatment. Colorists believe that the imbalance in the body indicates the lack of one or more colors, which can be compensated by using the desired colors. Goldstein believes that color has a direct influence on behavior and all organisms in the human body. Color can affect a person's soul and spirit. According to psychologists, people who strengthen their sense of color have better control over their emotions and can create better harmony between body and mind (Malkin, 2002). The proper use of colors in medical centers not only lifts the mood and creates a cheerful atmosphere but can also be effective in the treatment of various diseases through the effect on the body and soul of patients. Research shows that colors directly influence human behavior. For example, the color scheme of walls, clothing and fabrics in treatment rooms affects how patients respond to treatment. Hospital architects and interior designers believe that the use of appropriate methods in design makes patients feel safe and confident, which is crucial in accelerating the improvement of their physical and mental condition (McGee & Park, 2020; Süzer & Olguntürk, 2018; Yang & Zhang, 2012). The effect of color in the hospital environment is so important that it can even reduce the fear of illness and the duration of treatment in patients.

Color can have a major impact on how people perceive and respond to the environment and can also improve the quality of the environment for patients, staff, and families, as well as patient recovery rates. Research has shown that color, like light, can improve recovery rates by 10% (Rahmanian & Mahmoudi, 2020). The use of colors in the operating room and patient preparation room for surgery is very important, and the recovery room should give the patient a sense of confidence and hope. The use of colors in the hallways and at the entrance of the hospital makes the space legible and heart-warming and gives the staff and patients a sense of freshness and vitality. The use of color in hospital interior design can help customers find their way around. Researchers have found that the tension caused by losing your way leads to increased blood pressure, headaches, and increased pressure from tension. Colors should be chosen so that signs are legible. And color design should consider people who suffer from color blindness. The chosen color should not overshadow the visual environment, and on the other hand, the contrast on the panels is very important. The presence of contrasts between colors does not simply mean the contrast between them, but rather the study of the relationships and comparison between them (Rismanchi et al. 2021).

Figure 2 Examples of using color in healthcare environments (www.renadesign.com).

3.4. The use of color in healthcare environments and its effects on patients

When designing a color for a hospital, it is very important to consider all patterns and types of color sources. One of the most important elements of a healing environment is colors, so each color has a certain effect on a person's body, psyche and social state depending on its properties. Positive results for patients are achieved when natural light, natural elements and cheerful colors are considered in the design of hospital rooms and various departments (Dalke et ai. 2004). The patient's environment should provide a sense of security of medical care along with physical and emotional relaxation. Achieving this balance is not an easy goal, as the variety of color schemes depends on the length of stay and the nature of the illness. Patient groups have special needs, and the quality of colors provides a better environment for them. For example, red color increases heart rate, blood pressure and respiratory rate. Therefore, it is not recommended to use this color in the delivery room (Kulivand & Kazemi, 2012), and the color gray is also not appropriate in the pediatric and maternity ward, where people expect a cheerful environment. Soft and bright red and yellow colors are more associated with childhood, and it is better to use these colors in the pediatric department (Malkin, 2002).

Mentally ill people have a special emotional experience. Spaces surrounded by certain dense colors are threatening for people with mental problems. Colors should cause these spaces to be perceived bright and open as much as possible (Dalke et al., 2004). The use of dense colors increases the incidence of schizophrenia. The sight of orange and red colors is unbearable for this group of patients. It should also be noted that excessive use of green and blue colors, which are known for their calming effect, can cause depression in this case (Rahmanian & Mahmoudi, 2020). Although designing with neutral and soft colors can be demotivating for patients who are hospitalized for long periods of time, using these colors for environments that require peace and quiet reduces stress. Soft green, gray and walnut colors are suitable for patient rooms. The color contrast between the floor and the walls and other surfaces makes the environment more suitable for people with visual problems (Birren, 2005). The influence of the properties and effects of some key colors on the human mind and spirit is discussed as follows:

- *Red:* The red color symbolizes life. In psychology, the red color stands for self-confidence. For this reason, this color is used in the treatment of anxiety. This color intensifies emotions and creates excitement and strength. It is the most suitable color for the treatment of anemia and blood diseases and can be used in the treatment of bronchitis, rheumatism, and tuberculosis. Also, this color can be useful in the treatment of colds and infections of the lungs (Muadi, 2000).

- *Blue:* Blue is the color of relaxation and helps relieve symptoms of insomnia and reduce nervous agitation. The blue color symbolizes the fight against infectious diseases and is used to solve problems caused by sore throat, measles, mumps, inflammation, cramps, and headaches. The blue

color calms the nervous system and drives away obsession. People suffering from insomnia are recommended to stay in environments where the blue color is used more often. It is worth mentioning that excessive use of blue color causes depression and fatigue (Rismanchi et al. 2021).

- *Yellow:* Psychologists recommend yellow to treat depression. The yellow color awakens in people a spirit of vitality and strengthens the will to live. Energetic and nervous people should not be exposed to this color too much. Yellow helps with constipation, boosts self-confidence, stimulates digestion, and improves thinking (Rahmanian & Mahmoudi, 2020).

- *Green:* Green represents peace and hope. This color is considered the best color for stress disorders and mental disorders, it has a calming effect and drives away fatigue and increases tolerance. The green color leads to a feeling of friendship, hope, peace, and faith. This color has a positive effect on thinking and creativity. Green promotes digestion and maintains inner peace and is also useful for people suffering from insomnia.

- *Orange:* Orange is also called anti-fatigue color. It is one of the colors that make people happy and is recommended by psychologists for the treatment of depression. This promotes social feelings. Orange preserves energy increases appetite, helps absorb calcium, supports healing and maintains the body health. The orange color strengthens the function of the lungs, spleen and pancreas and is recommended for the treatment of asthma and bronchitis and for cleansing the intestines. On the other hand, irradiating the overworked muscles of the body with orange light increases the blood pressure in this area and gives new energy to these muscles so that they can return to their natural state and the body eliminates the order of muscle pain (Rismanchi et al. 2021).

- *Purple:* The purple color awakens emotions. It is useful to relieve addiction and migraine symptoms and improves the function of the nervous, lymphatic, and cardiovascular systems and maintains potassium balance. Purple is considered the color of spirituality, dignity, and honor. From a spiritual point of view, it is very effective in reducing hatred and anger. Of course, excessive use of this color causes depression, longing, and spiritual discomfort (Rahmanian & Mahmoudi, 2020).

- *Neutral:* Neutral colors and colors combined with gray are known to have a relaxing and anxiety-relieving effect. Therefore, these colors should not be overused in hospitals, as they reduce visual stimulation and make the environment boring, which can lead to depression. Neutral colors are appropriate for short-term stays, but for long-term stays, using these types of colors will cause patients to become bored. Neutral colors are not used for patients with Alzheimer's disease because they cause anxiety and confusion in patients (Muadi, 2000). The following diagram presents an overview of the main concepts mentioned in the research theory framework section:

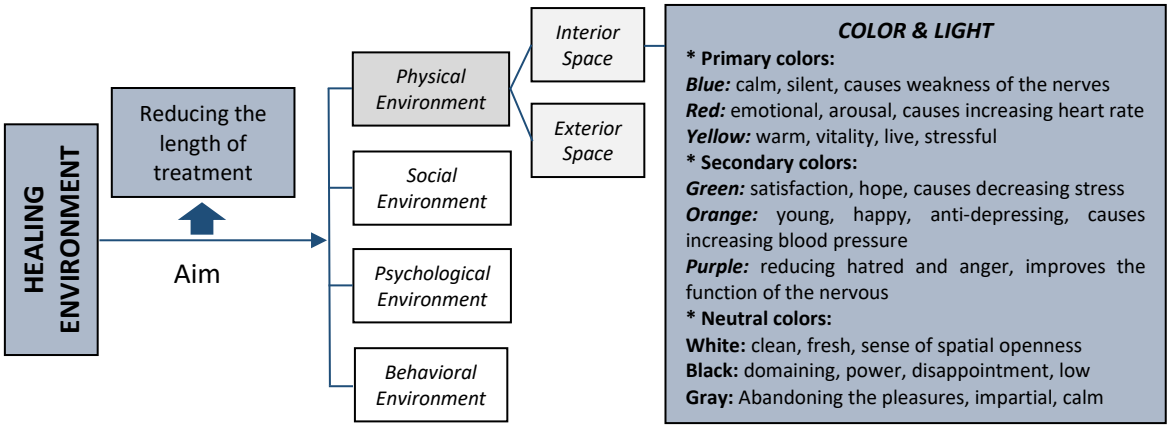

Diagram 2 Research's conducting process (Author).

4. Results and Discussion

The general aim of the research was to study the effect of the quality components of light and color in the interior spaces of healthcare environments. Since the patient's stay in the hospital can be associated with a lot of anxiety, a suitable interior design that uses the effect of elements such as light and color can create a friendly, calm, stress-free and healing environment for patients. Now that the positive and negative effects of light on the human body and spirit have been studied, we can point out the sensitivity of this subject and the effect of light on the health of the patient's body and soul. However, it should be mentioned that the intensity of light in open and closed environments of the hospital, and the use of natural and artificial light should be controlled so that it does not have side effects on patients. By categorizing the cases studied in terms of the effects of light on the user and the architectural space, the following table attempts to provide a design approach for strengthening the interior design of healthcare environments:

Table 2 The properties and effects of the light on physical and mental states and provision of a design approach.

Properties	Physically		Spiritually	
	Advantage	**Disadvantage**	**Advantage**	**Disadvantage**
* Melatonin secretion * Body rhythm regulation * Increased activity * Appetite * Positive feeling to the environment	*Vitamin D supply * Pain relief *Rickets *Germicide * Blood pressure regulation *Pulse adjustment *Pain control *Hair growth *Improvement of blood circulation *Improvement of sinus disorder	*Fatigue *Irritations & sensitivities *Eye fatigue *Insomnia *cardiovascular diseases *Stomach, intestinal disorders *Wrinkling of the skin *Malignant skin tumor	*Invigorating *Exciting *Create hope *Positive Energy *Life giving *Increase job efficiency *Reduction of hospitalization time and pain *Increasing the positive feeling to the hospital environment	*Loneliness *Worry *Depression *Lack of motivation *Emergence of emotional and social problems *Confused
Design Approach	*The use of wide and large windows in the design to create bright interior spaces, transfer a lot of natural light inside to provide relaxation and thermal comfort, and as a result improve the patients *The possibility of outdoor lighting through the design of the terrace or open space *Light intensity control through the installation of awnings and the use of glass equipped with sensors *Creating transparency and visual clarity in the environment through the design of transparent walls and wide corridors *Designing natural and artificial lighting for different hospital spaces according to optimal vision needs for patients and even doctors and staff *Creating light and shadow designs to separate the shapes inside the space and create dynamics by balancing the light intensity by considering the size, location, and direction of the windows. *Using intelligent artificial lighting system *Using trees to control light intensity *Not using fluorescent lights to reduce the patient's fear and anxiety			

What is understood from reviewing the studies conducted on color and investigating its impacts on people's sense of well-being is that in a healthcare environment the factor of color design is of vital importance in creating a pleasant, ambient environment. Color can have an impact on patients' perceptions and responses to the hospital environment and it also affects patient recovery rates, improving the quality and overall experience of patients, staff, and visitors. In addition, reviewing studies on the use of color in healthcare environments showed that there are some demonstrable, replicable, behavioral, and perceptual effects from color that justified their use in certain ways for design. Although using various colors can have an unbelievable effect on appearance, the spatial perception of a hospital, and boost morale and raise interest, color must be observed or investigated in context to avoid generalizations about color perception and mood affects. Negligent, careless or no use of color design can have an impact on users' perception and sense of space and well-being. Hence, by categorizing the cases studied in terms of the effects of color on the patients and the architectural space, the following table propose a design approach for strengthening the appropriate use of colors in interior design of healthcare environments:

Table 3 The properties and effects of the color on physical and mental states and provision of a design approach.

Effect		Physically		Spiritually	
Color	**Properties**	**Advantage**	**Disadvantage**	**Advantage**	**Disadvantage**
Red	*Increasing blood pressure *Increasing heart rate *Energy producer *Irritating	*Anemia *Gripe *Infection *Sterility *Bronchitis *Rheumatism	*High blood pressure *Nervous mood *High fever *Obesity	*Overcome fear *Depression treatment *Increase life expectancy & self-confidence	*Nervus system *Mental disorders *Psychological problems
Blue	*Decreasing blood pressure *Balancing heart rate *Peaceful *Calmness *Cooling	*Reduction of nervous excitement *Increase the strength of the body's defenses *Asthma treatment *Smallpox & thyroid treatment	*Not good for grip *Not good for digestive system *Eye pain	*Peace *Calmness *Healing *Honesty *Stress buster	*Not good for anxiety *Feeling cold
Yellow	*Create a spirit of vitality *Concentration enhancer *Stimulation nervous and muscles	*Paralyzed *Rheumatism and arthritis *Sluggish liver *Pancreas and stomach and constipation	*Nervous mood *Obesity *Hyperthyroidism and eyes	*Depression *Boredom *Lack of concentration	*Mental disorders *Tendency to isolationism
Green	*Alive, hope, faith *Promising *Sedative *Increasing tolerability *Feelings of friendship	*Infection *Insomnia *The pain *Body weakness *Heart problems *Restores muscle cells & bones	*Blood pressure *Breathing down *Low heart rate *Malignant glands	*Stress and mental disorders *Fatigue and low endurance	*Depression
Orange	*Increasing blood pressure & heart rate *Antispasmodic *Stimulating and energizing *Appetizer	*Kidney stones & gall bladder *Gripe *Bronchitis *Malignant glands constipation *Lung disease	*High blood pressure *Imbalance and disharmony in the nervous system	*Depression *Boredom *Isolation	*Nervous system *Tension *Stress *Insomnia
Purple	*Heart calmer *Blood purifier *Sadness *Elimination of toxins	*Spleen and bladder *Diseases *Rickets *Back pain *Sciatica *Epilepsy *Pneumonia and weak immune system	*Nervous system disorder	*Mental disorders such as schizophrenia and insanity *Hate *Anger *Fear	*Depression *Sadness
Neutral	*Calming eyes & nerves *Low visual stimulation-boring	*Nervus tense *High blood pressure	*Nervous system disorder	*Tension *Psychopathy *Stress	*Boredom *Depression
Design Approach		*Neutral palettes with soft natural tones work best for patient rooms and can have a hand in calming patients and their family members faced with the stress of having an ill loved one, according to the study. Avoid using palettes with strongly contrasting colors in these spaces, as they are known to cause strain for occupants. *Brightly lit rooms with stronger color palettes can help staff's needing a quick break to stay fresh and lively. Darker, subtler break rooms with softer lighting are preferred by many workers looking to rest for longer periods of time. *Red is believed to be energizing and encourage alertness: It's recommended for patients with dementia, who need brain stimulus. It's great for memory care services in senior homes. *Blue, green, and purple, especially in cool muted hues, can be very calming. They're great for hospital rooms, wards, waiting areas, and wellness centers like spas.			

5. Conclusion

The results of the research show that, depending on the needs of the patients in the healthcare environments, it is necessary to transform the hospital environment into a cheerful and relaxing environment, with the appropriate colors and light and beautification factors suitable for that space. Besides lighting and visibility, the light factor is one of the most effective environmental factors for the quality of treatment and the working environment. Natural light, or daylight, has a psychological effect on patients. Daylight has a positive effect on the healing process of psychological and physical diseases and accelerates it. Light has a direct influence on the activity of the inner parts of the brain. Rooms without natural light appear oppressive and heavy. Therefore,

lighting conditions should be considered more carefully when designing patient rooms in therapeutic environments. For example, the use of natural light, the creation of openings and windows, and the use of artificial light improve spatial perception, color recognition, reduce fatigue, elevate mood, and accelerate the patient's recovery process. The use of bright, appealing, warm colors and the design of rooms with a variety of colors provide a sense of cleanliness and openness, creating a pleasant environment and a better understanding of the space.

Color and light also have a great influence on human life and can be effective in bringing balance to various parts of the body and in curing many physical and mental problems of patients. Therefore, it is necessary to provide the opportunity for adequate daylight to enter these enclosed spaces to improve the biological quality and increase the level of health. The evaluation of the case studies shows the importance of light and its undeniable role in speeding up the recovery of patients. Moreover, the results indicate that the use of colors and the consideration of aesthetic and environmental aspects can be very effective in improving patients. Therefore, the results of the current study can be used as a generalizable conceptual framework for hospital and health center design. Based on this model, part of the general framework of interior design can be explained in terms of the use of light and color factors in a healing environment. On this basis, and to address the second question of study, three physical, perceptual, and social aspects can be considered (Diagram 3). The design of light and color can have a significant impact on these components, ultimately leading to patient recovery and improved staff efficiency. Such a model can be considered a suitable approach for the study and interior design of healthcare environments:

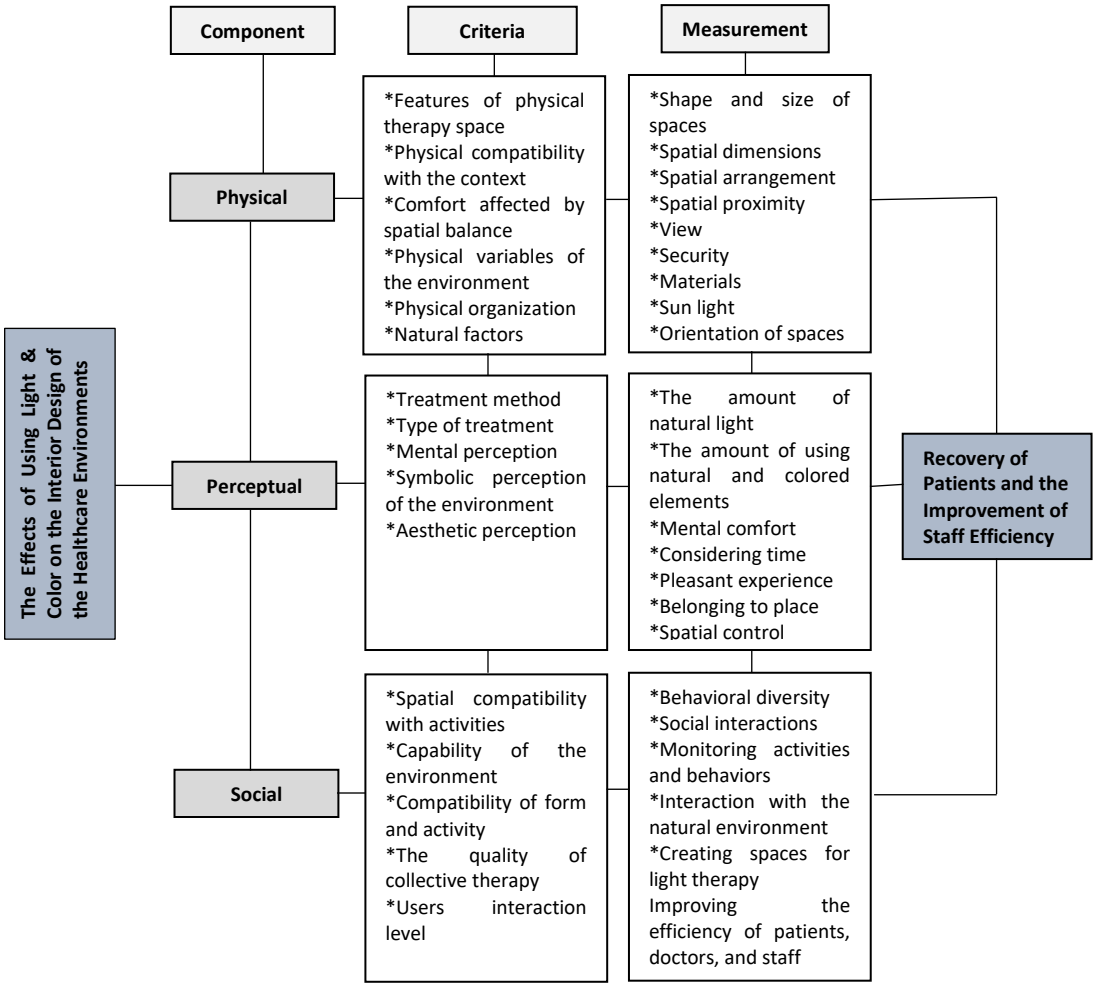

Diagram 3 A conceptual model, representing the effects of using light and color on interior design components.

References

Agom, D.A., Sixsmith, J., Ominyi. J., Onyeka, T.C., & Agom, J.C. (2022). Placing Care: The Impact of the Physical Environment on Experience of Providing and Utilizing Palliative Care. Journal of Nursing Research, 30(5), 1-11. https://doi.org/10.1097/jnr.0000000000000508

Al-Bqour, N., Rababeh, S., & Al-Rabady, R. (2022). The Psychological Supportive Design Features in Hospitals: Case of a Public Jordanian Hospital in Amman. *HERD: Health Environments Research & Design Journal, 15*(1), 173-188. https://doi.org/10.1177/19375867211029560

Alzubaidi, S., & Soori, P.K. (2012). Energy Efficient Lighting System Design for Hospitals Diagnostic and Treatment Room—A Case Study. *Journal of Light & Visual Environment, 36*, 23-31. https://doi.org/10.2150/jlve.36.23

Barati, H., & Barati, A. (2005). The Relationship between the Five Major Personality Factors with Stress and Job Performance in Employees of an Industrial Company. *Second National Biennial Congress of Industrial and Organizational Psychology of Iran*, Tehran.

Birren, F. (2005). Color Psychology and Color Therapy. New Hyde Park: University Books, Inc.

Boubekri, M., Cheung, I.N., Reid, K.J., Wang, C.H., Zee, P.C. (2014). Impact of windows and daylight exposure on overall health and sleep quality of office workers: a case-control pilot study. *Journal of Clinical Sleep Med*icine, *10*(6), 603-611. https://doi.org/10.5664/jcsm.3780

Brambilla, A., Morganti, A., Lindahl, G., Riva, A., & Capolongo, S. (2020). Complex Projects Assessment. The Impact of Built Environment on Healthcare Staff Wellbeing, Computational Science and Its Applications – ICCSA 2020: 20th International Conference, Cagliari, Italy, Proceedings, Part V, 345-354. https://doi.org/10.1007/978-3-030-58814-4_24

Bernhardt, J., Lipson-Smith, R., Davis, A., White, M., Zeeman, H., Pitt, N., Shannon, M., Crotty, M., Churilov, L., & Elf, M. (2021). Why hospital design matters: A narrative review of built environments research relevant to stroke care. *International Journal of Stroke, 17*(4), 370-377. https://doi.org/10.1177/17474930211042485

Chen, R., Tsai, M.C., & Yaw-Shyan, T. (2022). Effect of Color Temperature and Illuminance on Psychology, Physiology, and Productivity: An Experimental Study. *Energies*, *15*(12), 1-23. https://doi.org/10.3390/en15124477

Dalke, H., Littlefair, P.J., Estates, N.H.S., & Loe, D. (2004). Lighting and Color for Hospital - Design, a Report on an NHS Estates Funded Research Project, London South Bank University, London.

Dianat, I., Sedghi, A., Bagherzade, J., Jafarabadi, M.A., & Stedmon, A.W. (2013). Objective and subjective assessments of lighting in a hospital setting: implications for health, safety and performance. *Ergonomics, 56(10),* 1535 - 1545. https://doi.org/10.1080/00140139.2013.820845

Elf, M., Anåker, A., Marcheschi, E., Sigurjónsson, A., & Ulrich, R.S. (2020). *NursingOpen, 7*(3), 895-899. https://doi.org/10.1002/nop2.452

Fadda, J. (2019). Quality of Healthcare: A Review of Impact pf the Hospital Physical Environment on Improving Quality of Care. In: Sayigh, A. (eds) Sustainable Building for a Cleaner Environment. Innovative Renewable Energy. Springer, Cham. 217-253. https://doi.org/10.1007/978-3-319-94595-8-20

García-Rosales, G., Navarro, P.C., Sánchez, M.D., & Perea, E.C. (2018). Wayfinding Systems and Color to Increase Well-Being in Healthcare Facilities Spaces. *Graphic Imprints*, 1399–1410. https://doi.org/10.1007/978-3-319-93749-6_116

Hassan, M.A., Malik, A.S., Fofi, D., Karasfi, B., & Meriaudeau, F. (2020). Towards health monitoring using remote heart rate measurement using digital camera: A feasibility study. *Measurement, 149*, 1-11. https://doi.org/10.1016/j.measurement.2019.07.032

Hasson, F., & Keeney, S. (2011). Enhancing rigour in the Delphi technique research. *Technological Forecasting & Social Change, 78*(9), 1695-1704. https://doi.org/10.1016/j.techfore.2011.04.005

Huisman, E.R.C.M., Morales, E., van Hoof, J., & Kort, H.S.M. (2012). Healing environment: A review of the impact of physical environmental factors on users. *Building and Environment, 58,* 70-80. https://doi.org/10.1016/j.buildenv.2012.06.016

Kakitsuba, N. (2015). Comfortable indoor lighting conditions evaluated from psychological and physiological responses. *LEUKOS: The Journal of the Illuminating Engineering Society of North America*, *12*(3), 163-172. https://doi.org/10.1080/15502724.2015.1061945

Kakitsuba, N. (2020). Comfortable indoor lighting conditions for LED lights evaluated from psychological and physiological responses. *Applied Ergonomics*, *82*, 1-7. https://doi.org 10.1016/j.apergo.2019.102941

Konstantzos, I., Sadeghi, S.A., Kim, M., Xiong, J., & Tzempelikos, A. (2020). The effect of lighting environment on task performance in buildings—A review. Energy and Buildings, 226, 110394. https://doi.org/10.1016/j.enbuild.2020.110394

Kulivand, M.H., & Kazemi, H. (2012). Lighting and Color in the Design of the Hospital, Mirmaya, Tehran.

Laursen, J., Danielsen, A., & Rosenberg, J. (2014). Effects of environmental design on patient outcome: a systematic review. *HERD:* Health Environments Research & Design Journal *7*(4), 108-19. https://doi.org/10.1177/193758671400700410

Leccese, F., Montagnani, C., Iaia, S., Rocca, M., & Salvadori, G. (2017). Quality of Lighting in Hospital Environments: A Wide Survey Through in Situ Measurements. *Journal of Light & Visual Environment, 40*, 52-65. https://doi.org/10.2150/JLVE.IEIJ150000568

Lindahl, J., Thulesius, H., Rask, M., Wijk, H., Edvardsson, D., & Elmqvist, C. (2020). Assessing the Supportiveness of Healthcare Environments' Light and Color: Development and Validation of the Light and Color Questionnaire (LCQ). *Herd, 14(2)*, 130 - 144. https://doi.org/10.1177/1937586720975209

Lindahl, J., Thulesius, H., Rask, M., Wijk, H., Edvardsson, D., & Elmqvist, C. (2020). Assessing the Supportiveness of Healthcare Environments' Light and Color: Development and Validation of the Light and Color Questionnaire (LCQ). *HERD:* Health Environments Research & Design Journal, *14(2)*, 130-144. https://doi.org/10.1177/1937586720975209

Lipkin, N.K. (2012). The Environmental Impact of Health Care. *Journal of infusion nursing, 35*(3), 181-185. https://doi.org/10.1097/NAN.0b013e31824d289f

Lukasik, M., & Porebska, A., (2022). Responsiveness and Adaptability of Healthcare Facilities in Emergency Scenarios: COVID-19 Experience. *International Journal of Environmental Research and Public Health, 19*(2), 675-693. https://doi.org/10.3390/ijerph19020675

Malkin, J. (2002). Medical and Dental Space Planning: A Comprehensive Guide to Design, Equipment and Procedure, John Wiley and Sons Inc., New York.

McGee, B., & Park, N.K. (2022). Colour, Light, and Materiality: Biophilic Interior Design Presence in Research and Practice. *Interiority*, *5*(1), 27-52. https://doi.org/10.7454/in.v5i1.189

Mehrotra, S., Basukala, S., & Devarakonda, S. (2015). Effective Lighting Design Standards Impacting Patient Care: A Systems Approach. *Journal of Biosciences and Medicines, 3*(11), 54-61. http://doi.org/ 10.4236/jbm.2015.311006

Muadi, M.A. (2000). Application of Color in Ergonomics, Superior Sense, Tehran.

Parsons, K.C. (2000). Environmental Ergonomics: A Review of Principles, Methods and Models Environmental Ergonomics: A Review of Principles, Methods and Models. *Applied Ergonomics, 31*(6), 581-94. https://doi. org/10.1016/S0003-6870(00)00044-2

Rahmanian, S., & Mahmoudi, M. (2020). Study of the Effect of Light and Color on the Medical Interior Design; Case Study: Shahid Rahimi and Shohada-ye Ashayer Hospitals, Khorramabad City, Iran. *Armanshahr Architecture & Urban Development*, *13*(31), 67-78. https://doi.org/10.22034/aaud.2020.113259

Rikard, K., Seifeddin, B., Thorbjorn, L., Mikellides, B., & Tonello, G. (2006). The impact of light and colour on psychological mood: a cross-cultural study of indoor work environments, *Ergonomics, 49*(14), 1496-1507. https://doi.org/10.1080/00140130600858142

Rismanchi, M., Ebrahimi, K., & Badri Asl, S. (2021). Investigating The Effect of Hospital Interior Architecture In Terms Of Environmental Psychology On The Recovery Of Coronary Patients, *3rd National Conference on Knowledge-Based Urban Development and Architecture*, Azad University of Tehran, Iran, 1-12.

So, A.T.P., & Leung, L. M. (2011). Indoor lighting design incorporating human psychology. *Architectural Science Review, 41*(3), 113–124. https://doi.org/10.1080/00038628.1998.9697420

Süzer, Ö.K., & Olguntürk, N. (2018). The aid of colour on visuospatial navigation of elderly people in a virtual polyclinic environment. *Color Research & Application*, 43: 872-884. https://doi.org/10.1002/col.22272

Thuesen, N., Stidsen, L.M., Kirkegaard, P.H., Harder, H., & Suenson, V. (2011). Optimizing lighting design for hospital wards by defining user zones. *WIT Transactions on the Built Environment, 121*, 199-209. https://doi.org/10.2495/LIGHT110171

Tomassoni, R., Galetta, G., & Treglia, E. (2015). Psychology of Light: How Light Influences the Health and Psyche. *Psychology, 6*(10), 1216-1222. https://doi.org/10.4236/psych.2015.610119

Veitch, J.A., & McColl S.L. (2001). A critical examination of perceptual and cognitive effects attributed to full-spectrum fluorescent lighting. *Ergonomics, 44*(3), 255-279. https://doi.org/10.1080/00140130121241

Yang, Z., & Zhang, G.Q. (2012). Artistic Environment in Hospital Design. *Applied Mechanics and Materials, 174-177*, 3031-3036. https://doi.org/10.4028/www.scientific.net/AMM.174-177.3031

Resume

Navid Khaleghimoghaddam holds a doctorate in architecture. He works as an assistant professor at the Department of Interior Architecture at Konya Food and Agriculture University. In general, he works on key topics in architecture and neuroscience with psychological and physiological approaches, such as the study of the brain's perceptual mechanism and emotional behavior, spaces of worship and healing, neuroarchitecture, cognitive psychology, environmental psychology, and architectural education.

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An approach for the material selection and use in industrial-energy facilities

Ürün Biçer*
Rana Ayça Derviş**

Abstract

The place and characteristics of architectural structures in the developing production, industry and energy fields are important at the point of architecture being a versatile and interdisciplinary practice. Industrial-energy facilities are buildings that are mostly established in areas outside the city and designed to be protected against environmental factors, where energy and industrial activities are carried out. Since it is a production-oriented system, it includes many different operational processes. These buildings are used for a wide range of purposes such as manufacturing, storage, and distribution. The design of an industrial building plays an important role in determining the productivity, efficiency and safety of the facility. In this view, material selection has been evaluated as a critical factor in architectural design of industrial-energy facilities. It affects the environmental sustainability, structural performance, and aesthetic appeal of the built environment. The materials used in the construction of an industrial building should also be carefully selected. These buildings experience heavy wear and tear, and therefore need to be durable and long-lasting. Steel and concrete are popular materials because of their strength and durability, while also being flexible in accommodating the changing needs of the business. This paper presents a scientific approach to material selection that considers sustainability, performance, and aesthetics criteria. Studies on the structure and other characteristics of industrial-energy facilities, which constitute the main problematic of the study, has been examined, and it has been aimed to reveal the theory and knowledge at the point of the experience of the authors. In this context, the aim of the study is to reveal the architectural features, commonly used materials and material selection criteria of industrial-energy facilities by determining them through theoretical knowledge, analysis, observation and professional experience.

Keywords: building construction & materials, criteria of industrial facilities, design of industrial facilities, industrial & energy buildings, selection of materials for industrial facilities.

1. Introduction

The 20th century corresponds to a process in which radical changes and innovations take place in terms of cultural, economic and social aspects. the emergence of mechanical production facilities with water and steam energy at the end of the 18th century, the introduction of mass production based on division of labor and electrical energy in the 20th century, and the beginning of automation in the 1970s and the use of electronic and information technologies in manufacturing took a different path. Today, it is known that technology is essential and smart building and automation systems are used in industrial buildings and non-industrial buildings. Accordingly, when

*(Corresponding Author), Assist. Prof. Dr., İstanbul Beykent University, Türkiye, urunbicer@beykent.edu.tr
**M. Sc. Architect, Independent Researcher, Türkiye, aycadervis@gmail.com
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industrial buildings are considered in terms of their relationship with architectural features, it develops together with both the systems and requirements brought by technology and the specifications of the facilities.

Industrial buildings which should be designed with a major focus on efficiency, functionality and safety to also contribute in productivity and performance, play a crucial role in the manufacturing, storage, and distribution of goods. In this sense, the design of industrial building is a complex process that requires a multidisciplinary approach in which the design team must primarily consider various factors, including the nature of the industry, the workflow, the equipment, and the materials used. Various studies have revealed the need of workflow, layout, and equipment placement for optimal production persistency. Safety is also an essential consideration, as there are risks associated with equipment operation and the storage of raw materials and finished goods. Material selection, fire suppression systems, and ventilation have also been studied for improved safety in industrial buildings. Previous research has shown that appropriate industrial building design is critical for cost efficiency and profitability. In this framework, this paper presents a scientific approach to industrial building design that considers workflow, safety, materials, and occupants' needs.

In this context, a scientific approach has been taken to industrial building design. The authors have collaborated with the industry experts, analyzed the workflow, and identified the critical areas of the facility. The authors have also considered the pros and cons of different materials and equipment configurations for optimal performance and safety. Depending on their theoretical knowledge and the experience in the field, the authors have been proposed a scientific approach on the material selection and use in industrial-energy facilities.

Qualitative data collection methods have been used in the study. In qualitative research, three types of information are generally collected. Environmental information, process-related information and perceptions are related to the social, psychological, cultural and physical characteristics of the research (Yıldırım, 1999). In the study, the architectural structures in the industrial area and energy facilities will be revealed and determined with a broad approach, together with the holistic exterior, interior building features and usage areas, digital resources, and applied sample production images. The study will progress architectural building designs in energy facilities within the qualitative data collection method analysis. Data collection was prepared in the light of the information obtained in the document review. Within the scope of literature research, documents and documents related to the problem area, city and university libraries, document scanning, article, thesis, etc. written sources were used. All the data obtained in the document scanning process are described in the appropriate order. Based on existing documents and observations, it has been tried to clarify what the structures of architectural buildings are and which materials are preferred in energy facilities, along with the reasons.

To summarize, the aim of the study is to create and conduct a research of a wide range of information about the building structures and properties, material types in the energy facilities as a part of industrial buildings and the main concern of the study is to form a theory on the use of materials in industrial-energy facilities.

2. Industrial Facilities

Industrial facilities are called as enterprises where production is made as a whole, and there are activities in many areas depending on the regional-environmental-use. Industrial facility areas; transformer maintenance centers, chemistry, process pipelines, energy, agriculture, iron-steel, mining, machinery and parts are the areas where production takes place. Köksal (2005) defines industrial buildings as “factories that manufacture with machinery, structures built from materials produced by industrial production, and side settlements (workers' residences, warehouses, shops) that support industrial production”.

Industrial Spaces features designs derived from the need of various industries to provide efficient, safe and workable spaces for both operations and administration, while at the same time complying with rigorous industry standards and incorporating the latest technology. The setting of the industry itself also influences such space, whether it be on an industrial estate, on the city fringe, in a rural precinct, or an inner urban area (Images Publishing Group, 2006).

One of the most important factors to consider while designing an industrial building is the workflow. The placement of equipment and machinery within the facility should create a seamless flow that is easy to navigate. This is achieved through careful planning and collaboration between the different departments involved. The layout of an industrial building should be such that it can accommodate large machines and equipment. The building should have a column-free space, high ceilings, and open floor plans to allow maximum flexibility in operations, movement and storage. Additionally, the building should be designed to accommodate natural light and proper ventilation to promote a healthy work environment. Another critical aspect of industrial building design is safety. The structure, as well as the equipment and machinery, should be sturdy enough to withstand the weight and force of heavy loads. The building should also have sufficient ventilation and fire suppression systems to minimize risk and prevent catastrophic events. Proper lighting and signage are also essential to ensure employee safety within the facility.

Energy facilities (Figure 1) operating in the field of energy, which is among the most critical problems and needs of Turkey, along with the increasing amount of use, the establishment of facilities and the search for systematic and new solutions in this context have started to gain importance. In this context, it is necessary to correctly determine the criteria during the installation phase of industry-energy facilities. Proper design qualities considering different facility characteristics such as crane dimensions inside the buildings, machinery parks, administrative management buildings etc., clarification of the areas of need with the selection of right team and the right planning process, evaluation of costs, dimensions and types of structures and fire and explosion resistance characteristics are crucial for the establishment of industrial-energy facilities. The criteria and issues during the installation phase are shaped and differentiated according to the country, geography and local procedures where the building will be implemented.

Figure 1 Monterrey Power Plant, Mexico (https://www.sodemsen.org.tr/)

2.1. Types of Industrial-Energy Facilities

The most important criterion to be considered in architectural structures in industry-energy facilities is to prepare and implement the construction design and application of reinforced concrete and steel works, taking into account the country codes. The main structures described as energy facilities and their features are given below. Energy facilities are generally divided into two as Industrial Buildings and Non-Industrial Buildings.

Industrial buildings are designed for the sectors such as furniture, food, clothing, power plants, electricity in general and turbine buildings, transformer buildings, water tanks, chemical buildings, workshops, shelters, etc. can be defined as *industrial buildings*. These buildings usually consist of steel structures. *Non-industrial buildings* are primarily administrative buildings, maintenance buildings, warehouses, security buildings, laboratory and auxiliary buildings and generally consist of reinforced concrete structures. Apart from these structures, perimeter walls, environmental lighting, landscaping works, walking and vehicle roads are also added in the facility. While preparing the cost method, it should be calculated correctly in accordance with the local procedures (license, project approvals etc.) in the country where the project will take place.

In the design of industrial energy facilities, the important points and the main factors to be taken into account are the foundation loads. Constant load, foundations, floors, roofs, ceilings, partitions, stairs, railings, pavements, etc. It is defined as the weight of all permanent structures including the own weight of structures and superstructures. The weight of equipment and piping is permanently related to HVAC ducts, machinery load, crane load, instrumentation, switchgear, air ducts, electrical duct/armatures, cables, insulation, fire resistance and structural components. When calculating the constant load, the product load of the equipment and pipes is considered as empty. The gravity weight of the ground cover is considered as dead load. The installation dead load is the weight of the equipment plus the weight of the foundation at the time of installation. Foundation weight is the combined weight of foundation, plinth and overburden soil.

2.2. Installation Stages of Industrial-Energy Facilities

The establishment of industry-energy facilities (Figure 2) starts with the preparation of technical specifications and documents in line with the construction methods and employer demands. Time, quality standards, planning, accurate cost analysis, equipment purchasing processes, process and piping line studies, infrastructure requirements and finally plant commissioning and operating processes and specific methods are determined. In addition to this scope, factors such as capital, raw materials, labor and transportation should be considered.

While creating the preparation phase methods of the building, the analysis of the facility and the process of supporting the correct planning, cost method and specification requirements play an important role. Technical specification for site rating; Technical specification for architectural and main construction works and selection of materials; Architectural finish works technical specification; Technical specification for structural steel; Technical specification for precast boundary walls and doors; Technical specification for roads; Technical specification for underground piping and surface drainage; Technical specification for landscape works are among the criteria for the installation stage of the industrial-energy facilities.

Figure 2 An Example of an Energy Facility (https://proente.com)

3. Materials Preferred in Industrial-Energy Facilities

Industrial-energy facilities are divided into industrial buildings and auxiliary buildings. Industrial buildings are made of steel structures and auxiliary buildings are generally made of reinforced concrete. In this context, first of all, the calculations of the ground surveys should be made, and then the roof, facade, flooring and finishing materials of the buildings should be determined.

In general, according to Maleque and Salit (2013), the materials selection plays an important role in the manufacturing process of product especially for the new product. It will not just involve with the selection of suitable materials because the design of the product should also satisfy the technical, safety and legal requirements. In the design, materials and process selection steps, materials and/or relevant engineer should aware of the effects of the materials used and the process involved in the environment. It is not advisable and acceptable that raw materials are simply consumed in making engineering materials which are then used and discarded. In response to these demands, it is highly recommended to use materials those are recyclable and biodegradable in order to make sure that they will help to minimize the production of waste (Maleque & Salit, 2013).

Considering the region where the projects are located, technical specifications and procedures change depending on the conditions of the country. For example, if the facility is located in a region by the sea, the material to be selected is expected to be resistant to corrosion, and the selections should proceed according to the performance expected from the material, based on wind load, standardization, heat resistance, acoustic calculation values and other calculations. Determining the selections on a project basis, rather than advancing with a single right in material selection, brings out the right results.

Industrial buildings where production takes place continuously; They are complex facilities where electricity, flame sources and machinery and equipment that may cause fire due to overload are actively used (Kızılboğa, 2022). In this sense, material selection has a critical role in design and construction of industrial-energy facilities. Building materials are updated at the point of technological developments depending on the process required by today. The architects and engineers of the project should analyze all these situations and turn to the selection of appropriate and correct materials.

The parameters which should be reviewed while making material selections in industrial facilities are, Physical characteristics of the project; Concept determination with 3D visuals during the design phase; Geographical conditions in the region where the project is located; The relationship of the project with the structures in the region and the environment; Technical specifications requested by the employer; Cost; Supply Process; Technical Evaluation Processes of Material Companies; Logistics; Lifetime and Coordination processes with all disciplines.

As Whittleton and Wood (2003) mentioned, the majority of industrial building superstructures are framed in structural steel, although a small percentage are in precast concrete. Steel is used primarily for its large strength-to-weight ratio, enabling it to span large distances economically. Steelwork is easily modified, which provides for a degree of adaptability not always available from concrete structures. Ground slab and foundations are invariably reinforced concrete, though some ground bearing slabs are constructed with no reinforcement. Industrial buildings for containment of toxic of other processes may require construction primarily from reinforced concrete (Whittleton & Wood, 2003). The most preferred construction building material in Industrial-Energy facilities is steel construction. It is among the most important materials of the construction industry. The reasons for the preference of steel construction in these facilities are summarized below.

- It is long lasting.
- As it provides flexibility, it is resistant to wind and earthquake in natural disasters. At the same time, thanks to flexibility, steels can be placed according to the desired design.

- They are light structures. It consists of small foundations. It has half the weight of the reinforced concrete structure.
- Since the calculations and design are prepared in computer programs before assembly, the margin of error in production and steel connection points is minimized.
- It is easy to install and saves man-hours.
- Although the steel raw material is expensive, it is more cost-effective than the reinforced concrete structure, considering the assembly and service life of the structure.
- It provides sustainability. It is a material that supports 100% recycling. The steel material, which is scrap after completing its life, is evaluated for use in remanufactured structures.

3.1. The Role of "Floor" and the Selection of Materials

The flooring materials to be selected in industry-energy facilities must be specially produced, comply with quality standards, have been tested according to the type of material, and have certificates. The floors in these facilities must be resistant to impacts, heavy vehicles and crashes. It must have long-term resistance performance, adapt to weather conditions and expansion depending on humidity, and must be resistant to acid and water. It is desired that materials with harmful properties such as acid do not damage the floor coverings.

In this context, *anti-acid tile floor coverings* are used as an alternative (Figure 3). In the technical specifications of industrial plant projects, it is stated that floor coverings should be hygienic, antibacterial, acid-resistant and non-slip. Non-slip, anti-acid tile ceramic floor coverings do not require maintenance and accordingly effects the reasons for preference. The most important features of the anti-acid tile material are; Its surface is matte, it is not affected by chemical acids, it has high resistance to heavy equipment materials, it is antibacterial and easy to clean, it does not change in color tones depending on time. It provides resistance to high heat transfer differences.

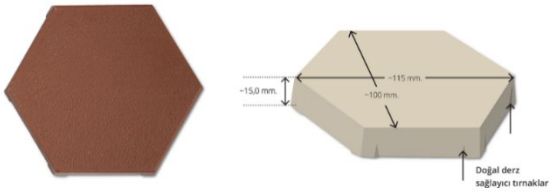

Figure 3 Sample Anti Acid Tile Floor Covering (https://vibroser.com/tr).

Epoxy flooring (Figure 4, Figure 5, Figure 6) is at the beginning of chemical floor coatings. Smooth surface, glossy surface, orange peel surface, parting sandy surface can be obtained. It is very resistant to physical impacts. It is applied on reinforced concrete surfaces. A homogeneous and continuous surface is obtained. In the application of epoxy flooring coatings, floor preparation is very important for a smooth surface. Structural defects, cracks and pits in the reinforced concrete floor are corrected using repair mortars. The most important features of epoxy flooring coatings are listed as; Resistant to acids, chemicals and water; It is resistant to impact and friction; It is hygienic. It prevents the formation of bacteria; It is long lasting; Allows decorative use, supports this with color transitions.

Figure 4 Sample Floor Epoxy Application (Author Archive).

Figure 5 Example Wall and Floor Epoxy Application (Author Archive).

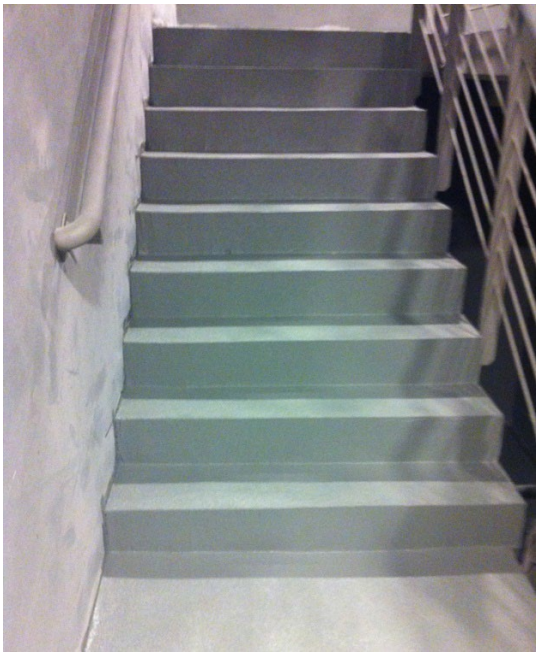

Figure 6 Example Fire Stair and Landing Epoxy Application (Parting sand surface epoxy) (Author Archive).

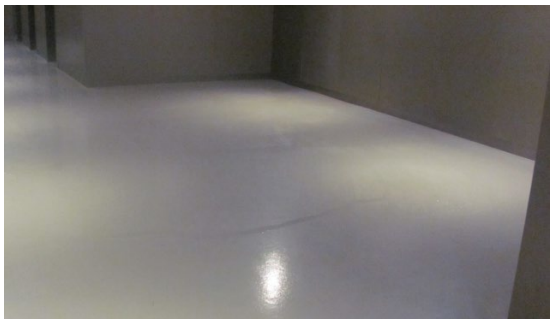

Figure 7 Sample Epoxy Application (Parting sand surface epoxy) (Author Archive).

Depending on the limestone contained in the concrete itself, the concrete causes dusting with the emergence of the materials from the concrete cavities, pores, capillary cracks, and vomiting. *Dust-free paint* (Figure 8, Figure 9) does not contain solvents and is two-component. It is a liquid, colorless primer paint application that protects reinforced concrete against moisture. It prevents the leak of oil, water, acid etc. to the concrete. One of the important reasons for preference of this material, which is applied on reinforced concrete wall and floor surfaces, is that it is economical. After the dust-free paint application of the reinforced concrete, it takes on a bright, polished appearance. It creates an antibacterial field. Due to the low material thickness, corrugations on the reinforced concrete surface indicate roughness.

Figure 8 Sample Dust-Free Paint on Reinforced Concrete Flooring (http://www.epoksizeminkaplamalari.com).

Figure 9 Sample Dust-Free Paint on Reinforced Concrete Flooring (https://www.tozumazzemin.net).

3.2. The Role of "Façade" and the Selection of Materials

In the construction of industrial-energy facilities, buildings are divided into steel structures and reinforced concrete structures. In reinforced concrete structures, the external wall material is usually pumice, brick or gas concrete, and plaster and paint are applied on it. In some cases, composite facade cladding on reinforced concrete structure is also used in administrative buildings where the facility has visual importance. In steel structures, it is progressed with sandwich panel coating application. An example of the industrial facility project, which was manufactured with all these facade cladding, is given below (Figure 10).

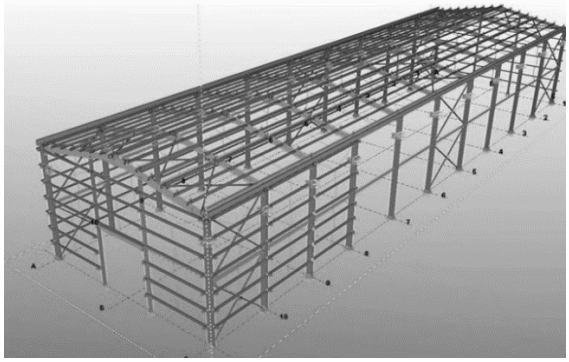

Figure 10 Sample 3D Modeled Steel Structure Project (http://www.mtfprokon.com/contents/hizmetlerimiz/250)

The designs of steel construction structures are made with the case design method in accordance with the region to be applied. They are generally light but robust, long-lasting, wide-opening structures that provide assembly and de-assembly at varying heights. Load calculations and force values are specially designed according to the project. In steel construction structures, the maximum deflection values under constant load and live load are determined for crane bridges

or any element or material exposed to working load and do not exceed the determined values. Structural steel for major structural frames, including building frames, crane beams, stair towers and pipe racks, must be manufactured in accordance with recognized approved standards, according to material quality code and grade. It is important that other applications, including platforms, walkways and various complementary steel framing, are produced in accordance with quality codes and standards.

Sandwich panels (Figure 11) are preferred for the facade and roof coverings of steel construction structures. Sandwich panels consist of inner and outer metal sheet, and their contents are separated as rockwool and plastic foam (PUR-Poliüretan and PIR-Poliizosiyanurat). It is important to know the material in the sandwich panels very clearly and to proceed with the right material during the ordering phase. It is designed and produced for sound, heat, water and fire insulation. The rapidity of production and assembly has expanded its usage areas. Before the sandwich panel production, application projects must be prepared and the details of trapezoidal ridge, gutter skirts, wall-roof junction, drip, outer corner, inner corner, facade panel, window and coping must be shown in the project.

Figure 11 Sample Rockwool Filled Sandwich Panel (https://www.panelsan.com/tr/)

In reinforced concrete structures, *paint and plaster application* is preferred on the facades. Thickness and application method are used in accordance with the technical specifications of the facility. Due to the components in the plaster, it has fast adhesion to the surface and is resistant to moisture and mold. Spray plaster application method is generally preferred in large facilities.

After the plaster production on the exterior is set, paint production is started. Depending on the weather conditions of the region where the paint is manufactured, the most suitable paint option should be evaluated. Exterior paints are distinguished as smooth and grainy. Flat exterior paints; It is divided into two as silicone-based and acrylic-based.

It can be preferred as plain or grainy exterior paints. Flat exterior paints are divided into silicone-based and acrylic-based. Silicone-based exterior paints are resistant to mold and moisture thanks to their smooth, matte and permeable nature. Due to the strong components of acrylic exterior paints, they have a very high resistance to weather conditions, especially to sunlight. Thickness and application method should be used in accordance with the technical specifications of the facility.

3.3. The Role of "Exterior Doors and Windows" and the Selection of Materials

There are generally three types of door models on the facades of industrial buildings. These include steel doors with a fire resistance of at least 2 hours used by pedestrians, spiral doors used by large vehicles or cranes, and fence doors for transformer or equipment protection.

- *Rolling Doors;*

Folding shutter doors, also known as rolling shutters, are fire resistant and work manually for security purposes, with automatic closing at desired locations. Rolling shutters are often complemented by insulated door curtains and constructed from coil-formed galvanized steel laths that interlock where other access is required and to withstand specified wind pressure.

Wide access exterior doors come in vertical lift, insulated, weather sealed and wind locked, with components manufactured from galvanized steel and factory primed and field painted. Doors in high-traffic areas are motor-operated, with manual access capabilities and controls adjacent to the doors both inside and out. Models should be selected in accordance with the project, their color should be determined, and accessories should be clarified. In production projects, all information should be described completely and production should be started after the approval of the project architect.

- *Steel Doors;*

Figure 12 Fire Escape Door Installation Stage (Author Archive).

Fire resistant doors (Figure 12) are made of galvanized steel conforming to the fire resistance test methods and criteria of building construction elements or approved equivalent standards. High quality accessories (hinge locks, striker, handles, door stops, door leaf materials, ral code, panic bar set, door closers, under-door guillotine, wick, bolt latch, slide bar etc.) should be used on all doors, accessories including emergency escape facilities, should be complete, and stainless steel material is chosen for the hinges used.

- *Fence Doors;*

Fence gates are generally used as gates for equipment that should be outside the building structure, but also important to protect.

- *Ribbon Windows*

One of the reasons why the band window application on the façade is preferred is the fact that the industrial buildings are mostly made of steel structures due to the high building height. The details become clear in the application examples whose projects and implementations have been completed. Glass properties, thicknesses, profile properties should be defined in the production projects, and after the approval of the architect, production and assembly should be started.

4. Conclusion

Industrial building design is a critical factor in the success of the manufacturing, storage, and distribution of goods. A systematic methodology for design can enhance productivity, safety, and profitability. The design of an industrial building is a complex process that requires careful consideration of different factors. Besides, the design of the industrial building should take into account the needs of the occupants. Proper amenities such as restrooms, conference rooms, offices, and break areas must be included. The building should also be accessible to disabled persons, have a loading dock or a loading ramp for easy and safe loading and unloading of goods. The goal is to create a facility that is functional, efficient, and safe for its occupants. The building must be able to accommodate the changing needs of the business and be a place where employees can work efficiently and effectively.

From this point of view, material selection is a crucial aspect of architectural design that requires careful consideration of various sustainability, performance, and aesthetic criteria while considering the material's cost and availability. Material selection is a complex process that involves consideration of various factors, such as environmental and social sustainability, structural performance, and aesthetic appeal. Architects and designers must make careful decisions regarding the materials used in their designs to meet these criteria and ensure the safe and efficient performance of the built environment.

In this context, this scientific approach to material selection, will aid architects and designers in striking the right balance between these criteria, leading to high-performance, aesthetically pleasing, and sustainably built environments. A scientific approach to material selection aids architects and designers to identify and prioritize essential material properties to ensure that the selected material can meet sustainability, performance, and aesthetic criteria. Further, it also helps evaluate the environmental and social impacts of the materials, ultimately guiding environmentally friendly material selection decisions. Future research should continue to explore ways to improve industrial building design for optimal efficiency and safety, also, to explore alternative materials that meet these criteria for a better and more sustainable built environment.

This study demonstrates the importance of a scientific approach to industrial building design. The industry's unique needs must be considered, identify the critical areas, and optimize the workflow. Optimal material selection and equipment placement are also essential for safe and efficient building design.

Finally, it must be said that the presence of comfortable buildings that will allow the staff working in these facilities to stay at the facility whenever they want, increases both the efficiency of the facility and the motivation of the employees. The completeness of the specified substances throughout the entire time from the project stage to the operation process of industrial-energy facilities will ensure the production, workforce and success of the facility.

References

Images Publishing Group. (2006). *Industrial spaces: A Pictorial Review*, Volume 1. ISBN-13: 978-1876907631. Australia: Images Publishing Group.

Kızılboğa, G. (2022). *Endüstriyel Yapılarda Risk Analizi. Şantiye*, 392, 70-71. ISSN: 2717-8145. İstanbul: Ekosistem Medya.

Köksal, T. G. (2005). *İstanbul'daki Endüstri Mirası İçin Koruma ve Yeniden Kullanım Önerileri* (PhD thesis). İstanbul Teknik Üniversitesi, İstanbul.

Maleque, M.A. & Salit, M. S. (2013). *Materials Selection and Design. Singapore*: Springer. ISBN 978-981-4560-37-5.

Whittleton, D. & Wood, M.A. (2003). *Industrial Buildings*. D. A. Snow (Ed.). Plant Engineer's Reference Book. 2nd Edition, (s.3-25). ISBN: 978-0-7506-4452-5. UK: Butterworth-Heinemann.

Yıldırım, A. (1999). *Nitel Araştırma Yöntemlerinin Temel Özellikleri ve Eğitim Araştırmalarındaki Yeri ve Önemi*, Eğitim ve Bilim Dergisi, 23 (112), 7-17. ISSN: 1300-1337. Access Address (12.12.2019): http://eb.ted.org.tr/index.php/EB/article/view/5326/1485.

Resume

Ürün Biçer was born in 1979 in Adana. After graduating from Yıldız Technical University, Department of Architecture in 2001, she completed her master's and doctoral studies in the Department of Architecture of the same university. Between 2001-2011 she worked as a Research Assistant at Yıldız Technical University, Department of Architecture, Department of Building Elements and Materials. Ürün Biçer, who has undertaken administrative duties besides her academic studies since 2001, has many publications in different fields of the discipline of architecture such as building elements and materials, design, education and studio experiences. Ürün Biçer, who served as a member of the Board of Directors of the Chamber of Architects of TMMOB between 2012-2020, has been working as an Assistant Professor at the Department of Interior Architecture (TR) at Istanbul Beykent University since 2012 and continues to serve as the Vice Dean of the Faculty of Engineering and Architecture.

Rana Ayça Derviş recieved her bachelor degree in faculty of engineering and architecture from Beykent University (2004) and she received master of science degree (2023) about Architectural Materials of Industrial Buildings in the same university. In her 19 year of professional life, she worked in several companies and be part in building design and construction management side. Projects are mostly related in industrial and mixed used projects (office, residence and shopping malls). Currently Derviş is work at industrial building design company. As a principal architect her role is controlling detail engineering & design project and support architectural procurement packages. This is her first article.

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Evaluation of an alternative approach to increase productivity in architecture project studios through student projects

Melih Kurnalı*
Ceyhun Şekerci**

Abstract

Studio courses in architectural education are undoubtedly among the most important courses that prepare students for professional design life. A given project should be guided with the support of the instructors and should include a simulation of the process in professional business life. Despite this, research shows that there is a disconnect between academia and the professional process. In addition to the fact that the educational process tries to add a different understanding to the student, professional life cannot find the middle point with academic education due to the constant changes in regulations due to rent and similar reasons. In such an environment, giving meaning to projects with an idealistic understanding, offering a thematic experience and producing holistic buildings with identity increases the importance of alternative approaches in project studios in educational processes. Although it is not possible to prevent the emergence of identity-less and rent-oriented products in the market only through architectural education, approaches that will increase productivity in this education will also increase students' expectations from the profession. The conceptual approach, which is one of these alternatives, can be defined as creating a network of relationships based on a basic idea. This network of relationships allows the concept to be transformed into a concrete structure by distributing it to all project processes without moving away from the context and with an inclusive approach. In this study, first of all, the conceptual approach in design education will be emphasized and general definitions will be made, and Studio-2, Studio-3, and Studio-4 courses in Konya Technical University Faculty of Architecture and Design, Department of Architecture in 2021-2022 will be evaluated with a conceptual approach. With this approach, it has been concluded that the student's design perception and thinking technique can be developed by creating concept-based, original, and holistic, and focusing on the missing aspects of professional life in project courses.

Keywords: architectural education, conceptual thinking, design education, architecture and design.

1. Introduction

It is accepted that the systematization of architectural education and the transformation of architecture into a discipline that serves many purposes began with the 17th century based Ecolé des Beaux-Arts (Sadri & Zeybekoğlu Sadri, 2013; Gül et al., 2013). With the spread of similar academies, architectural education has transformed from a method based on the master-apprentice relationship to a formal education with certain boundaries, which is the basis of known design education. In addition to the technical infrastructure offered by formal and systematic education, the beginning of research on the need for a philosophical infrastructure to create a design language dates to the years when the Bauhaus school emerged.

*(Corresponding author), Asst. Prof. Dr. Konya Technical University, Türkiye, mkurnali@ktun.edu.tr
**Asst. Prof. Dr. Konya Technical University, Türkiye, csekerci@ktun.edu.tr

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Architectural education is a synthesis of verbal and quantitative disciplines that support the cultural, artistic, and technical development of the student. In parallel with the technical infrastructure, education should also develop the student in terms of art and aesthetics. Design can only be successful with the correct establishment of these two infrastructures. Since the design process in architecture cannot proceed systematically, the existence of a single approach model cannot be mentioned. Since the Ecolé des Beaux-Arts and Bauhaus, the infrastructure of the current educational techniques in architectural education, there are educational models in which various methods such as 'problem-based learning', 'experiential learning', and 'constructivist learning' of design have been adapted (Gül et al., 2013). Alternative education models have emerged and are emerging under these methods. Since these models can be shaped according to the relevant project, technology, etc., it is not correct to argue that there is only one correct model. Continuously developing technology and construction methods should be included in architectural education so that students are better prepared when they graduate. The focus of the study at this point is to provide the update with alternative methods to increase the productivity of students.

Today, the transformation of architecture into a commodity that is constantly changing hands, bought and sold, rapidly produced, consumed, and monetized requires architects to offer more creative, innovative, and extraordinary designs. This means updating the education system and freeing the student from an understanding that does not go beyond the limits of regulations and rules that are constantly changed according to the conditions of the age, and that is forced to behave according to the rule book. Creative thinking and designing are seen as the leading concept in the renewal of architectural education (Asasoğlu, Gür, & Erol, 2010).

In the field of design from the past to the present; how design activities are carried out, what kind of data they are based on, that is, the phenomenon they contain in the background are concepts. In the most general form, the infinite data given by nature inspires people to design. These data are processed in the mind in various ways, thus informing the designer how and with what to design. In other words, each new formation produced is developed based on another formation in nature, hence a concept (Bilir, 2013). Conceptualization is an approach with a high potential for mental production and exercise. On the other hand, the approaches that directly proceed to building design and emphasize spatial analysis seem to be far from the problem and challenge in the creation of new forms and form-function integrity.

The concept, on the other hand, should be able to provide the student with the ability to be open to new experiences, and different perspectives, and to be open to innovation enough to establish connections and relationships between unrelated things. In addition, they will be able to generate new knowledge and produce original designs (Bekdaş & Yıldız, 2018). The dynamic structure of design requires continuous research, learning, and change, and this makes it necessary to produce different approaches. The conceptual approach method brings these requirements to the field of design. The primary aim of this study is to present the purpose of the approach and its contribution to the field of design and architectural education. Thus, it is aimed to emphasize once again the potential that can offer endless possibilities for the acquisition of creativity in architectural education.

2. Purpose and Methodology

The study aims to evaluate the contribution of the conceptual approach, one of the approach methods in architecture studios, to architectural education through student project outputs. In this context, the project studies carried out with the students at Konya Technical University, Faculty of Architecture and Design, Department of Architecture are included. In this context, the concept and concept choices of the student works were evaluated and the processes of reflection on the project and the project finals were evaluated. The limitation of the study is defined within the scope of Studio II and Architectural Concepts course, Studio III and Studio IV courses, which are studio courses of KTÜN Architecture Department. In Studio II and Architectural Concepts course, "Weekend Residence", in the Studio III course, "Closed Housing (Site, Collective Housing)" and in

the Studio IV course, the advanced transformation of the Konfaş building in the area between Konya Technical and Selçuk University were studied. All projects were produced with the same conceptual approach, considering the educational stages of the students. The conceptual approach refers to a process of design.

3. What is the Conceptual Approach?

It is not possible to talk about a gradual transition in the architectural design process. In the design process, there is constant back feeding. Since the project must be holistic in these flashbacks, step-by-step progress, in other words, a systematic design process is not possible. The existence of concepts in design is dependent on the application of rules derived from simple to complex relationships. Design must start with a right or wrong decision. Just as we do not distinguish an object as an object or a symbol, we cannot think of design as independent of concept. In the research phase, the visual thinker tries to picture the image in the mind with a concept. He develops the image that appears in a not-very-clear form and prepares its representation. What we are talking about here is the development and presentation of a concept that can be considered very raw or primitive in the development stage. The design begins with a good or bad concept. Just as it is wrong to separate the content of an object into objects and symbols, it is equally unhealthy to think of design as separate from the concept. Because the elements that are active in the establishment of the design and complement the design are reduced (Kömürcüoglu Turan & Altaş, 2003). The expression of the concept in design language is possible with words and images. Image is defined by Cevizci (2011) as a mental picture or image that represents external objects and has certain visual similarities with them. It is traditionally accepted that images have a close relationship with thinking, and it is said that comprehending the meaning of a word consists of bringing the appropriate image associated with the word to the mind. The formation of an image in the mind can be a result of perception, or it can be through thinking about perception, evoking it, and establishing something in the mind (Bilir, 2O13). From this point of view, a concept can include an item associated with the mind, visual, and all kinds of similar manifestations. The concept associated with this manifestation finds itself as a word to express it verbally. With this verbal expression, the conceptual process does not end, but the most challenging part is overcome. Because the concept reached is an expression that directs the entire design process and contains the solutions to the problems to be encountered in design. In general terms, the concept exists both with its visible and formally expressed features and with its features that are expressed in one or many words and that create various meanings in the mind. However, if we need to consider the concept from a design perspective, we can also evaluate it from a functional perspective that can be expressed both verbally and formally. What is important in design, where learning and development take place through questioning concepts, is the necessity of applying a language that transforms the objectives in the form of abstract and conceptual definitions into design concepts. In this way, each designer reveals his/her concept and develops a unique method and strategy and completes the design process he/she has started in this way. The extent to which the main idea is reflected in the final product, the extent to which the concept is moved away from the concept with the problems in the process or the concept is developed, the extent to which the concept image is reflected in every part of the design from general to detail are the features that distinguish each designer from the other. The starting point of this concept can be said to be geography, climate, material, culture, economy, technology, and the spirit of the place, which are the basic factors of the act of architecture (Kuloğlu, 2014). The concept is a reduced ground for easy comprehensibility where all abstract and concrete parameters are presented on common ground. The reason for this is to make the design education process, which is quite different from the normal teaching style, understandable for the student. The concept is an important key for the student whose entire education life has progressed in a systematic infrastructure focused on the general rather than the individual. As a matter of fact, according to the study conducted by Kömürcüoğlu Turan and Altaş, students who started the design process with concepts were able to develop the design more easily and were more successful than those who did not start the design process with concepts (Kömürcüoğlu, 2003).

3.1. Education Process, Concept Formation, Concept and Selection Process

In design education, individual development, the richness of designers' thoughts and emotions, the diversity of their tendencies and needs, the quality of the values they develop, their jokes, analogies, and metaphors, in short, the way they live affect the process of concept creation and development. It can be said that people's lives are limited by the concepts they develop (Ülgen, 2004). Accordingly, design studies and the project design process are the most critical areas of personal research and development. In this context, design education should not be seen as a problem-solving-oriented education. It is necessary for the student to determine the needs by considering all the parameters of the given project and to define a design problem from them, conduct regular and systematic research of related examples, and evaluate the solutions (Acar, Acar, & Ünver, 2021).

The place of the concept stage in the design process is at the very beginning. The concept is formed when the first steps in the design process become visible and explainable. However, if we should consider the act of concept development in the design process as a separate process; the concept is the end of the concept development process and the beginning of the design process, as it is at the point where this process, which is mostly in the mind, begins to externalize and concretize for the first time. For this reason, it is undoubtedly the most important part of the design as it is both a result and a beginning. For the designer, the concept will now be a point of departure to be referred to at every stage of the process, it will become equivalent to knowledge, a theory, a method to be applied at every new problem encountered and at every different stage. For the viewer, the design product will be handled and interpreted through its concept under all circumstances, and the concept will be the reason and essence that enables the design to be defined and comprehended.

Although the process up to the moment of concept creation in design is stage that can sometimes be solved in a very short time, it is perhaps the point in the process where the most importance should be given to examination and research. Because no matter how fast the designer goes through these processes or to what extent he transfers them from his mind to the external environment, the concept is the point that forms the essence of the design product.

The designer is obliged to meticulously find and reconcile the concept or concepts that have the same logic and content as the problem to be solved. The concept is the stage where the conceptual thinking stage in the individual's mind begins to gradually externalize and the first idea for the purpose can be easily conveyed to the individual or the audience. With this feature, concept development helps to ensure that ideas can be applied in different ways over and over again in all kinds of problems that will arise during the design process. Creating a basic concept that considers all the data will accelerate the design process and ensure that the data researched will not be forgotten in the future. The design proposals created with the determined concept present us with the area where design is used as a research method on its own. The designs and the concept are revised with continuous feedback in the studio environment. In this process, the student could continuously improve his/her work through criticism, discussion, and evaluation of his/her own and other works (Acar, Acar, & Ünver, 2021). It is imperative to consider design education separately from the traditional method based on repetition. The traditional method mentioned here refers to the method based on rote learning before higher education. With the Conceptual Approach, traditional and other methods applied in architectural project studios are not ignored. The conceptual method derives and develops from these approaches. While the instructor guides in design education, each individual is expected to create his/her own design solution and overcome the problems on his/her own. The biggest guide in this process is the concept.

3.2. Analogy in Conceptual Approach

In the conceptual approach method, which is the subject of the study, analogy is not included. The analogy is considered useful as a support in establishing a relationship with different elements. In analogies, the concept, event, principle, or phenomenon that is usually planned to be learned is

called 'target' and the concept, event, principle, or phenomenon that is known in this process is called 'source'. To expand the concept of analogy and at the same time overcome conceptual difficulties, it is necessary to use analogical thinking skills in the process of bridging the source and target (Clement, 1987). According to Kant, analogy, which establishes a similarity between two different phenomena, increases and produces knowledge (Koca & Uluengin, 2014). The student was left free in the concept selection and design process but was kept away from the analogical approach. Any analogy cannot find a place in this school as it may be a repetition of an existing design or harm the healthy and original progress of the design process.

3.3. Concept Formation in Project Studios and Project Design in Concept Based Design Method

The concept development process starts with the research of the study area. The effects of important parameters such as the province and district of the study area, the climatic characteristics of the region, topography, prevailing wind direction, the relationship with daylight according to the seasons, and the social, cultural, and economic characteristics of the region where the design project will be implemented, population structure, demographic characteristics of the population are analysed. A list of needs is created according to the needs program of the building to be built and according to the users in the scenario. Following the list of needs including the actions to be performed in the space, a concept is created within the framework of user-region-structure headings. The concept should be inclusive of all these parameters. In such a way that the titles of the research conducted in the formation of the concept should guide and be derived as a result product of this approach. Another important factor in the concept process is that the concept should be chosen correctly and should be analysable both verbally and visually. Otherwise, a concept design that is detached from its context will not be sufficient to carry the project to the desired point. It is not correct to use parameters that are fundamental for space and structure in concept selection. For example, "sun" cannot be a concept. Because daylight is a necessity for all spaces except special-purpose spaces. The sun is a mandatory parameter that must be included in the design.

Determining the concept is the most valuable stage in the design process, as well as the most difficult and painful process for the designer. Each student individually determines a concept following their scenario and the design problem they have identified. Finding and developing the concept and the design to be made accordingly is entirely possible through personal effort, research, and design exercises. The validity of the concept must be tested by using it in design proposals and sketches. If the concept, which is tested with the criticisms given in the studio, discussions, and inferences from other studies, will respond to the function and function requirements of the design and direct the whole design, the concept is accepted, and the design projecting process of the design is started. Determining the concept is a stage that facilitates and originalism the project design process. The student shapes the whole project according to the concept. At this stage, the solution of all problems in the project process is solved with the inferences from the concept.

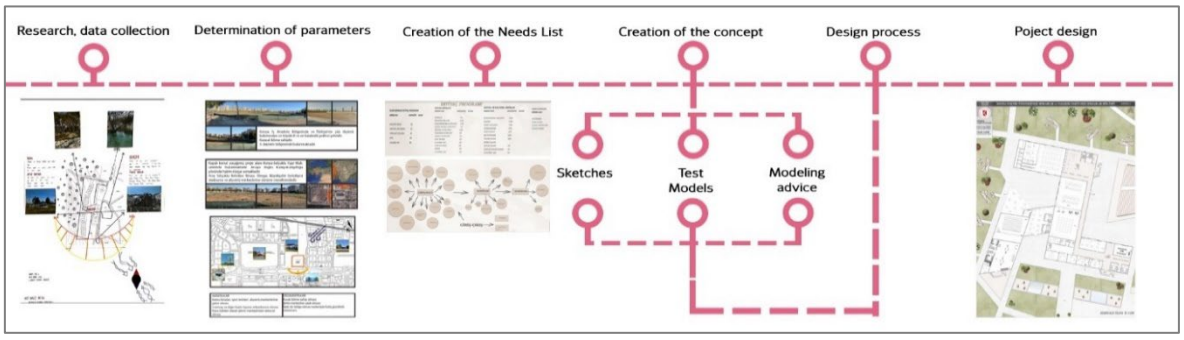

Figure 1 *Design Concept Relationship in the Project Process.*

The image above draws attention to the relationship between concept and design in the project process. While the concept is a design base put forward before the design process, it has all the

contents of the design process. The process of concept formation involves a continuous search like the design process. For this reason, it is in a cyclical relationship with the design process in constant feedback. To solve all kinds of problems and problems in the design, the return to concept and concept design is constantly connected. However, in this study, the process of determining the concept was investigated and student studies on the stages of sketching, test models (sketch models), and modelling proposals, which are equally and directly related to each other in this process, were presented. By presenting the concept proposals put forward in the student studies and the finalized projects, the contribution of the concept design process to the design and the project is revealed.

Enabling the aesthetic process in architectural education has been an active issue for many years. A student in the design process undergoes a similar production process as an artist and the nature of the problems he/she faces are architectural technical problems (Erzen, 1976). From this point of view, in activating the aesthetic process, the search for concepts is a guide for the student in the design process.

Studio-2, Studio-3, and Studio-4 courses in different semesters in 2021-2022 at Konya Technical University, Faculty of Architecture and Design, Department of Architecture were carried out with a process in which the conceptual approach was at the forefront compared to other studio courses. Students were not given any training on conceptual approaches in previous studios, and for the first time in these studios, students were expected to carry out the concept in an integrated manner with their projects from the first stage of design to the final stage. Due to the nature of architectural education and the differentiation of the functions and needs of each studio compared to the previous studio and the increase in expectations, the work given in the studios shaped the project design with the concepts determined by the students according to the parameters of the project subject. Before moving on to the prone topic, all students were asked to research the concept and concept of the words and were asked to make presentations with sheets related to their integration into the design process. During the study process, the conceptual design method described above was used and examples of projects developed in this context were presented. The limitations of the study are studio -2, studio 3, and studio 4 semesters. 4 studies from each semester were included in the evaluation (Table 1).

Table 1 *Topics of studio courses and concepts used in studies.*

Architecture Department			
Project Courses	**Studio- 2**	**Studio-3**	**Studio-4**
Project Topic	Weekend Residence	Closed Housing (Public Housing)	Forward transformation of the Konfaş structure and region
Concepts Reached in the Project Process	Combination Concept Intersection Concept Integration Concept Individualization Concept	Fracture Point Concept Diversity Concept Rupture Concept Demarcation Concept	Dynamism Concept Intersection Concept Stacking Concept Unity Concept

3.3.1. Studio-2 Weekend Residence

In the project, which includes the design of a two-story residence on the sloping lands on the slope of Kuğulu Park overlooking the lake in Konya Seydişehir district, the user profile and user preferences were carried out through the scenarios created by the students. How many people will live in the building, what they will use it for, and the specialized spaces were created according to these scenarios. Guidance was given through jury-style critiques and discussions and students were encouraged to create creative scenarios. They were supported to create concepts about the regional characteristics, climate, the purpose of the building, and the whole scenario.

Particular attention was paid to the character of the region and the character of the users in the scenario. The concept was obtained by making the abstract approach as concrete as possible and affecting the whole study.

Student Work-1 The Concept of Combination

The scenario of the project is a weekend residence and a place that unites the family, and the traditional foundations of the surrounding buildings with wood and stone materials all of these are processed with the concept of combination chosen with the logic of the combination of modern and traditional. In the project work, unity is emphasized not only with the material but also in the coming together of the structure. The ratio of fullness and emptiness is placed in a complementary manner in accordance with the concept and the sun shading elements added to the building also supports the concept of unity by complementing each other with their opposite placements (Figure 2).

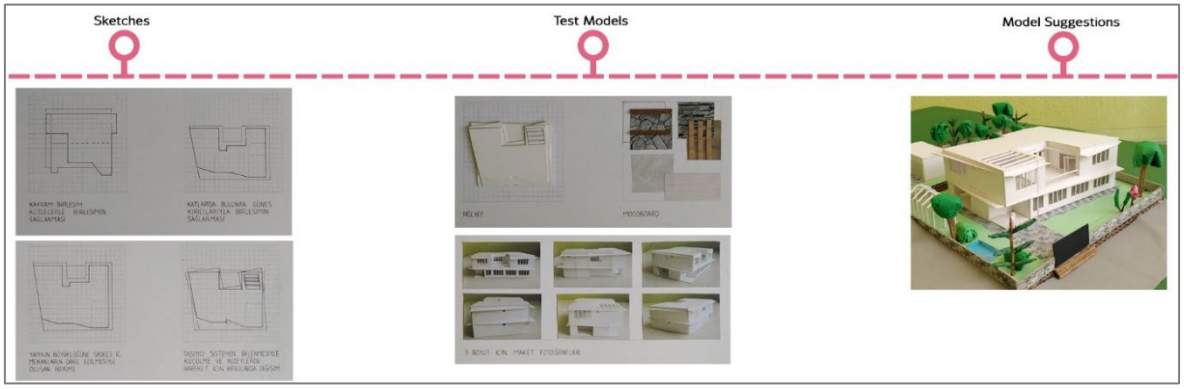

Figure 2 *Interpretation of the concept of combination*

Student Work-2 The Concept of Intersection

The concept was chosen because it is a common point where different purposes of use and families come together in the weekend residence has enabled the creation of a composition by bringing together intersecting parts in the process. While the intersecting parts come together, outdoor factors, such as the movement of the sun during the day, have created an opening in the building in this sense, enabling it to make the best use of the sun all day. The concept of intersection has influenced the whole space and at the same time, it has completely guided the design while emphasizing the concept with its direct effect on special-purpose areas (Figure 3).

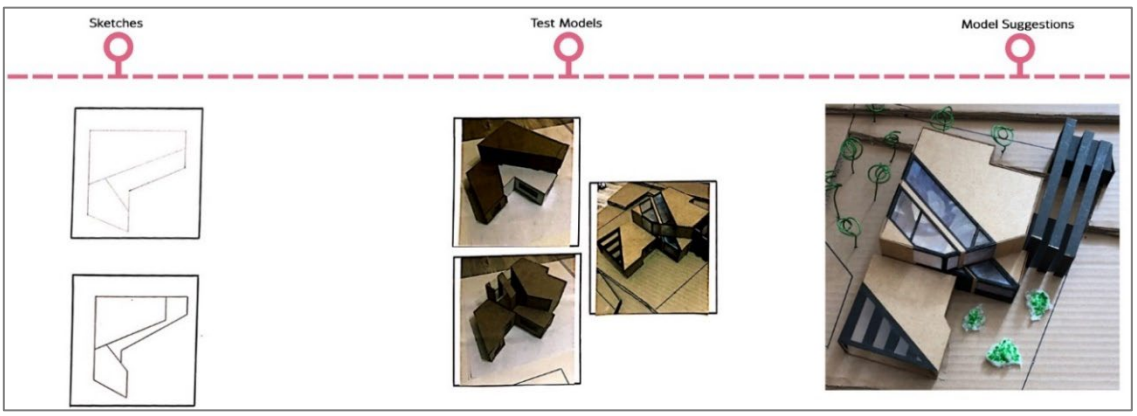

Figure 3 *Intersection concept*

Student Work-3 The Concept of Integration

In the building designed as a weekend residence, the designer evaluated the concept of integration as a concept for the study, based on the desire of the users to spend common time together depending on the scenario and the needs program, the integration of family members and the intertwining of the natural environment and the building, considering it as an inseparable whole. The designer has tried to integrate the concept of integration with the concern of creating common spaces by bringing together volumes with different functions and functions. The designer tried to reflect this concept in every stage of the building by integrating it with the concept of

adhering to the users' desire to live a life intertwined with the natural environment. Formally, he wanted to reinforce the concept of integrity by bringing different masses together. By continuing this approach in the whole design, he tried to reflect the conceptual process of the whole work to create common spaces (Figure 4).

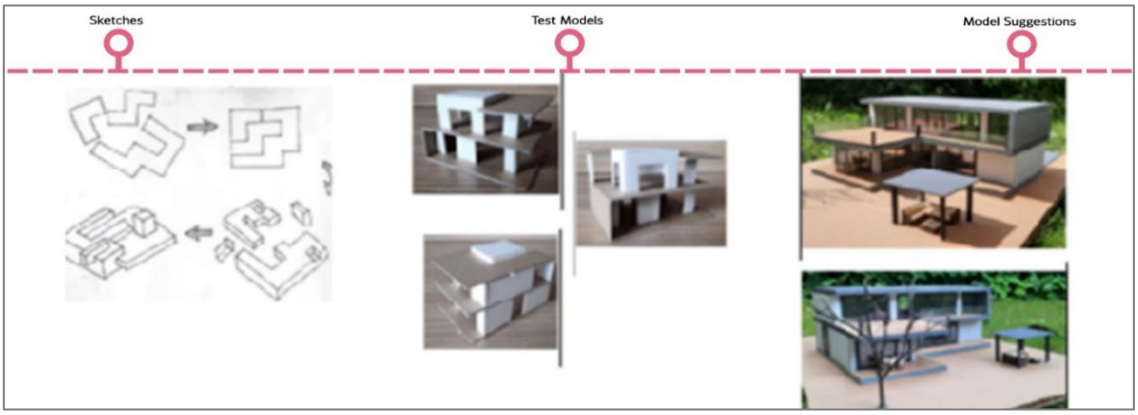

Figure 4 *Integration concept.*

Student Work-4 The Concept of Individualization

In the study, the designer has proceeded through the concept of individualization as a concept based on an approach where family members can face themselves, get away from the external environment, and isolate themselves. When we look at the whole work, we observe spaces where private volumes, hobby areas, and work areas come to the fore within the expectations of the users. To make each of the users feel special and to minimize the interaction with each other, a common space solution was not used. In the design of the building, the floors are solved for different users and each floor has a different story. To make this situation stronger, the mezzanine is positioned differently between the floors. The concept of individualization was tried to be used throughout the design (Figure 5).

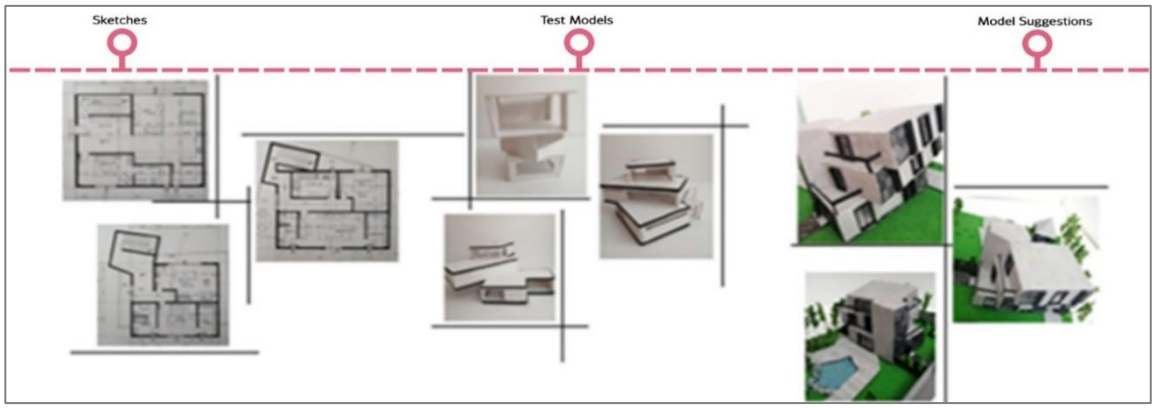

Figure 5 *Individualization concept.*

3.3.2. Studio-3 Closed Housing (Public Housing)

Within the 25.000 m² land area, the entrance, parking lot, common spaces, and landscaping of the site were also included in the project design in the closed housing project where the total construction area will be realized in a way to cover a minimum of 60 apartments (2+1, 3+1, 4+1). For this purpose, the flat land between Assoc. Dr. Halil Ürün Street and Türkerler Street next to Konya Ecdad Park were given to the students. The relationship of the area with the city was analysed and the buildings were asked to be placed by taking environmental factors into consideration. In addition, a corporate identity and logo study was requested for the building complex.

In the creation of the designs, the students were guided by continuous studio critiques, and the concept development and project development processes were continuously supported with

additional studies. In determining the concept, care was taken to ensure that the students consider environmental factors and do not break away from the urban context. However, the main goal was to understand the necessity of the concept in the creation of a design and project.

Student Work-4 The Concept of Fracture Point

The design, which started with a point and the lines that break that point, has also shaped this design. "In the design phase of the project, we first tried to find a solution to the problem of people getting bored with monotonous, flat structures and the routine lives shaped by those structures. We wanted to change people's lives, to create a breaking point in their lives. At this point, the breaking point became our main concept." As in the student's summary of the concept and the stages in the process of reaching the concept, the design is intended to get rid of the banality and monotony in the context. The planned aim is to offer users the opportunity to live in a space that liberates them from monotony and monotony when they enter the residential area. For this purpose, experiments were carried out with holistic geometric shapes formed by cutting and breaking many lines passing through a point, and finally, the intersection point of the blocks, which will also inspire the logo, was revealed (Figure 6).

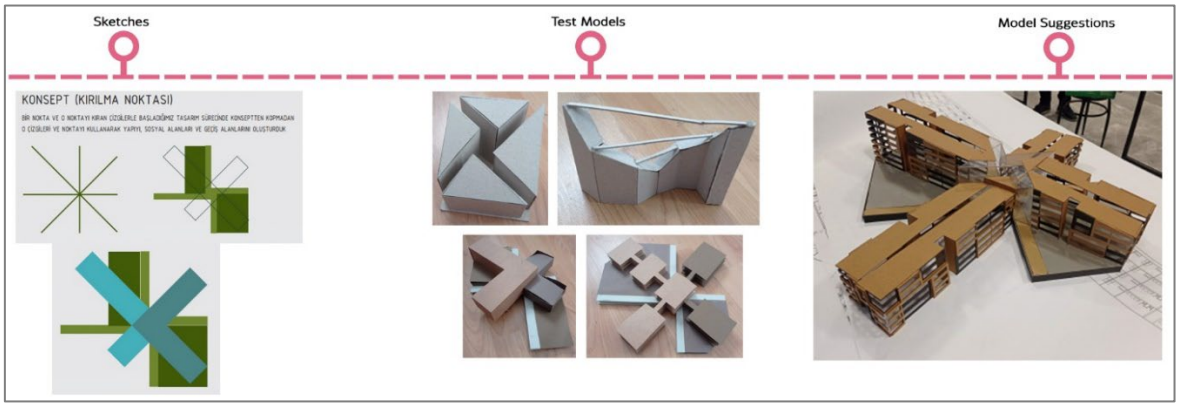

Figure 6 *Evaluation of the concept of Fracture Point in an enclosed dwelling.*

Student Work-2 The Concept of Diversity

The concept of diversity emerged from the diversity of the region and the users of the building, and geometric elements were used to reflect this in the building. "The concept of diversity has been addressed as the project seeks forms other than the similar building forms on the building island. Based on the concept of adding circular forms to quadrilateral forms of different sizes, both circular and quadrilateral forms were emphasized by utilizing the difference in tone, and diversity was provided within the integrity. In the project process, elongated quadrilateral forms were given volume by increasing their width, and an opening was left in the whole by following their axes." As stated by the student, the main problem of the work was to present diversity appropriately while ensuring integrity (Figure 7).

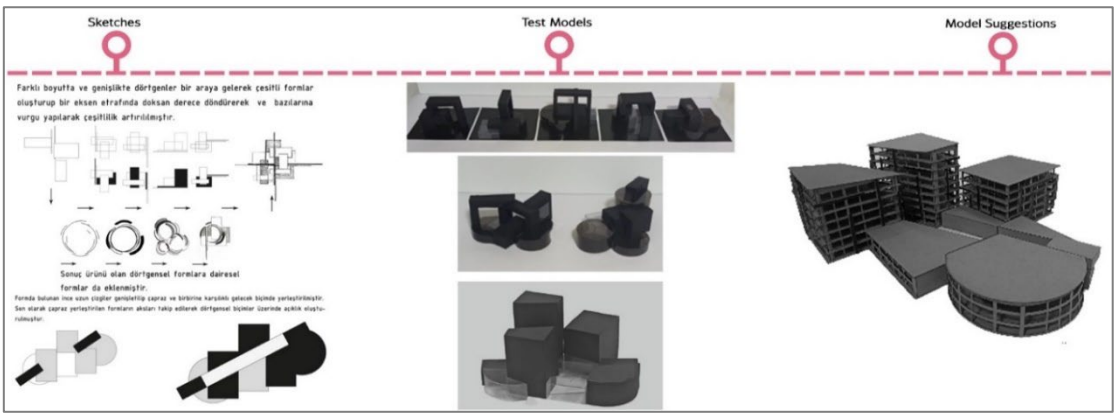

Figure 7 *Diversity Concept*

Student Work-3 The Concept of Rupture

In the design where the concept of rupture is used, the design has reached its final form by emphasizing the parts that are ripped from a whole and the repeated use of these parts. "The main concept of the design is rupture. For this reason, the L form was divided into three, and the break was emphasized with colour and floor difference. The building is broken vertically and again the break is emphasized in the facade design." As in the definition made by the student, the blocks are defined by being detached from the ground and each other. The concept of detachment similarly aims to offer individualized and private spaces within the site to break away from the heavy and tiring aspect of the city, which is sought in the residences of the age (Figure 8).

Figure 8 *Rupture Concept*

Student Work-4 The Concept of Demarcation

"At the beginning of the conceptual process of my project, I thought that "prejudices between people turn into borders" and decided that these borders should be eliminated. Thus, I chose my concept of "Unlimitedization"." The basis of the concept design was determined by the student in this way, and the idea that hard and sharp striped elements express boundaries and the idea of unboundarization was adopted with the idea that curvilinear forms exceed these boundaries. While black blocks express negative limitation, the curvilinear forms that cut them apart aim to reveal the richness of unlimitedization with their orange colours (Figure 9).

Figure 9 *Demarcation Concept*

4. Studio-4 Konfaş and Land

The project subject includes the design of a complex with a 1000 m² closed area, and a 10 thousand m² open area, including some or all the educational, social areas, library, laboratories, workshops, and management units. In this context, the design and production of the building complex of an organization working in parallel with public institutions to be called Konya Development Academy constitute the customized design problem area of the students. The Konya Development Academy is given the responsibility of public education, providing a source of new

knowledge and a working environment for students, Konya history research and promotion, design research, and all kinds of activities to be carried out in the name of becoming a sustainable city. In addition to these, students were asked to identify a field that their own development academy specializes in (e.g., ecological agriculture, etc.) and to design a design that includes spaces that focus on this field. Processing and designing the corporate identity and logo of the academy in this direction was also seen as one of the important outputs of the study. The site for the study was the Konfaş building and land between Konya Technical University and Selçuk University. One part of the building is used by Selçuk University and the other parts are idle. In this sense, students were given the freedom to partially use the building or completely reuse the land.

Student Work-1 The Concept of Dynamism

"Dynamism was chosen because youth and the young spirit are not static but always moving and the design area is located in an active area." The specialized theme of the academy is the active participation of disabled individuals, who are also included in the student population, in the society and the creation of an environment of cohesion are also seen as dynamic goals. During the research process with sketches for Dynamism, a two-dimensional drawing expressing a continuous and complex movement on a fixed line was accepted as the starting point and efforts were made to rationalize this form. The concept was used in all spaces from façade design to landscaping, showing the purpose and character of the space in all areas (Figure 10).

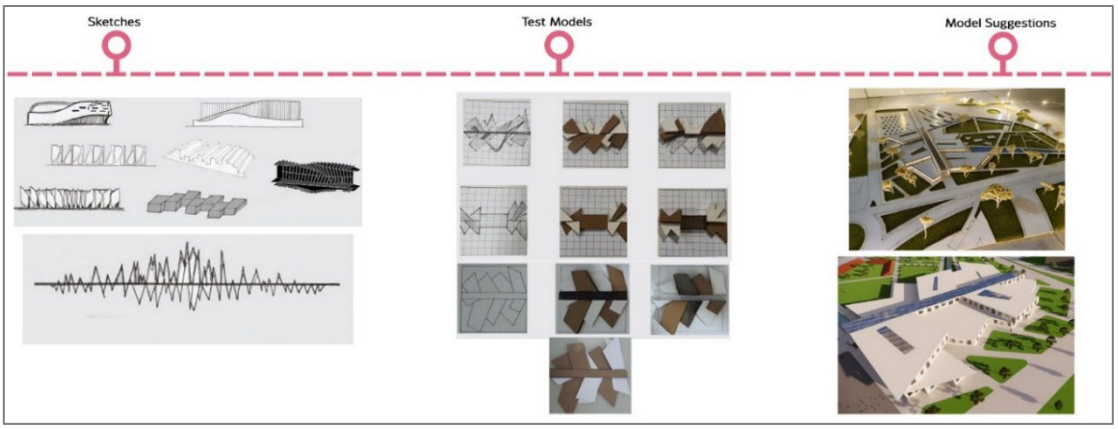

Figure 10 *Dynamism Concept*

Student Work-2 The Concept of İntersection

The reason for choosing the concept of intersection in this project is that the land between the two universities aims to provide a common working space for students studying in different disciplines. In the design, a center where common workshops and workspaces are offered to enable different fields to carry out multidisciplinary studies is designed. In the creation of the intersection, the axes leading to the location of the building were utilized, landscaping and access roads to the building were arranged in the areas where these axes intersect, and common special-purpose spaces were created in the areas where the design elements intersect with each other (Figure 11).

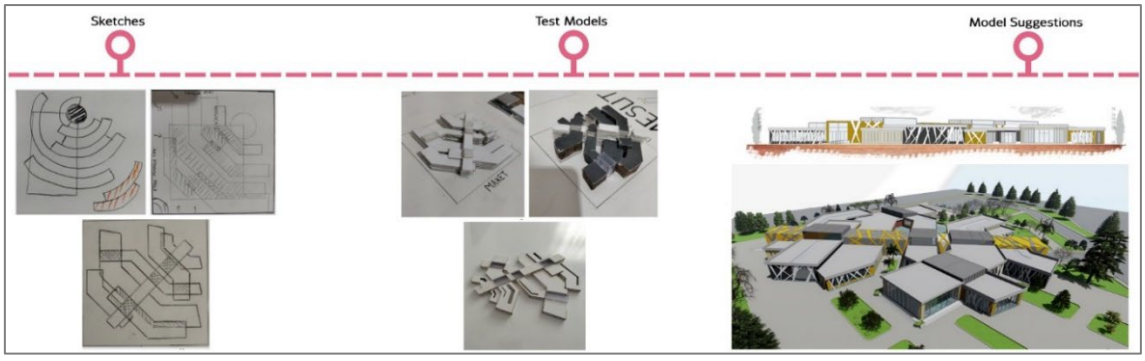

Figure 11 *İntersection Concept*

Student Work-3 The Concept of Stacking

The concept of stacking was chosen within the framework of emphasizing the continuous rise on a solid foundation by preserving the characteristics of the university region, which is constantly transforming and developing. The presentation of this aim, which is one of the goals of Konya Development Academy, was chosen with the concept of stacking, and the relationship between the concept-space-context character was established with the idea that the more orderly it rises from the foundation, the further it can go. The relationship between the parts of the space that complement each other but also present different characters can be seen in the final products (Figure12).

Figure 12 *Stacking Concept*

Student Work-4 The Concept of Unity

With the idea that there is a disconnect between generations in the region and the city, the concept of togetherness was chosen with the idea of a center that brings all users together. Focusing on the idea of bringing three generations together, 3 separate blocks representing each generation were brought together according to the needs program and space arrangement. Sometimes the spaces were integrated with each other, and sometimes new spaces were created for transition. In this way, the expression of supporting the bridging of the gaps between generations with bridges is also provided with space. In addition to the inability to establish a relationship between different generations, the concept design, which starts with the basic idea that society is a whole, draws attention to the idea of society by starting with the fragmentation of a whole in the first stage (Figure 13).

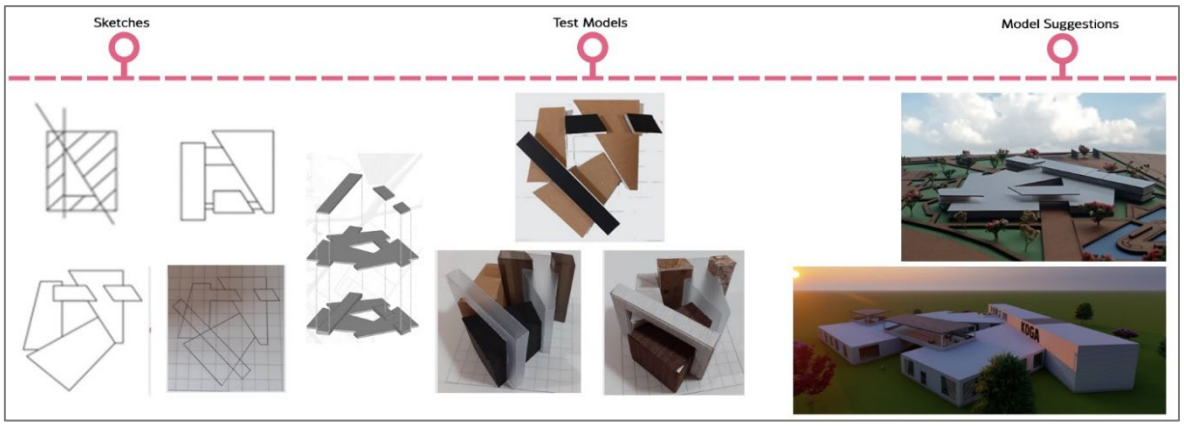

Figure 13 *Unity Concept*

All the student work on how and in what way the concept guides the work points to the fact that design is not simply about producing spaces that are closed on 4 sides. Design can be seen as

meaningful and successful when there is a strong idea behind it. In this sense, all student works focused on the aim of generating an idea.

5. Conclusion and Evaluation

In the current architecture and design environment, it is seen that the process of developing concepts and ideas in design is not given enough importance. It is a natural necessity to have an idea behind all the work done. An architecture that does not involve research and development and is disconnected from its context imposes products that can only provide basic requirements but no more than that. An architectural product that does not pay attention to the characteristics, traditions, culture, and needs of the city, but only fulfils its function, remains among other buildings, and becomes ordinary.

The discipline of architecture, which is at the common point of art and technique, is obliged to preserve this feature in the education process. The conceptual design offers an important method for maintaining this partnership. Design is a dynamic and cyclical process, constantly involving returns, revisions, and changes. Every good design should leave behind a broad artistic and technical background. This can only be achieved by belonging to the place where it is located and responding completely to the place and the need. It is the conceptual design method that makes this possible. Because the concept is only derived from the city, street, region, need, and environmental factors. The concept is everything that is necessary for that space. It is the imaginative reduction of the expression of necessities. It can be seen as a single word, but it is to reduce an intense meaning and expression to a keyword. The purpose of this reduction is to avoid confusion for the student and to facilitate the study and design process. The word, which is reduced to a single expression as a concept, must have a visual and semantic equivalent; it must have a two-dimensional and three-dimensional equivalent.

The conceptual design method supports creative thinking through continuous studio guidance and individual research content. Creative thinking and trial-and-error methods require constant mental exercises and design experimentation. Sketches, mass models, and the search for them support the formation of new ideas.

The conceptual design method, in which the process and the search in that process is an achievement for the student, offers new possibilities in the production of original ideas for design, as it requires intensive examination and research of other disciplines, the functions to be performed in the space, in other words, every fine detail. It has been proved by the student studies that a rich production environment that can work with different disciplines and incorporate concepts that are important and necessary for those disciplines, open to innovation, addable, improvable, dynamic but cyclically continuous feedback is realized with the conceptual design method.

In the studies, it was observed that aesthetic perception increased, and students adapted to the design by feeding aesthetic concerns in addition to function. In addition, the study evaluates the use of the conceptual approach in the design process of the projects carried out within the scope of Studio-2, Studio-3, and Studio-4 courses. The projects were tried to be read through the reflection of the selected concepts on the design process in two and three dimensions. In this context, it was observed that the effect of the conceptual approach was observed in the function, function, and form of the projects. In addition, it has been observed that students working in the studio - 4 studio courses give better results at the point of understanding and comprehension of the conceptual design approach.

References

Acar, A., Acar, Ş. S., & Ünver, E. (2021, 16 2). Mimarlık Bölümü Birinci Sınıf Öğrencilerinin Kendi Problem Çözme Becerilerine Dair Algılarının Dikkat ve Görsel-Mekânsal Becerileriyle İlişkisi Üzerine Bir Araştırma. *Megaron,* s. 212-222.

Asasoğlu, A., Gür, S. Ö., & Erol, S. Y. (2010, 18 11). Basic design dilemmas in architectural education. *Scientific Research and Essays*, s. 3538-3549.

Bekdaş, H. D., & Yıldız, S. (2018, 13 (2)). Tasarım ve Sanat Arakesitinde Kavramsal Düşünme: Enformel Eğitim Çalışmaları (2009–2015). *Megaron,* s. 324-333.

Bilir, S. (2o13. *Mekan Tasarımında Kavram Geliştirme Sürecine Analitik Bir Yaklaşım*, Yüksek Lisans Tezi. Hacettepe Üniversitesi Güzel Sanatlar Enstitüsü.

Cevizci, A. (2011). Felsefe Sözlüğü. İstanbul: Say Yayınları.

Clement, J. (1987). *"The Use of Analogies and Anchoring Intuitions to Remediate Misconceptions in Mechanics"*, (ERIC Document Reproduction Service No. ED 291 604).

Erzen, J. N. (1976). Eğitimin Estetik Süreç Olarak Yorumu ve Mimarlık Eğitimi. *ODTÜ Mimarlık Fakültesi Dergisi, 2*(2), 175–185. http://jfa.arch.metu.edu.tr/archive/0258-5316/1976/cilt02/sayi_2/175-185.pdf

Gül, L. F., Çağdaş, G., Çağlar, N., Gül, M., Sipahioğlu, I. R., Balaban, Ö. *"Türkiye'de Mimarlık Eğitimi ve Bilişim Teknolojileri"* Mimarlıkta Sayısal Tasarım Ulusal Sempozyumu, Sayısal Tasarım, Entropi, Yaratıcılık, ISBN:978---975---561---437---3. Haziran 2013, İTÜ.s:11---16.

Koca, S. K., & Uluengin, Ö. (2014, 152). How does concept transform into product? An appraisal of analogybased design practices in architecture education. *Procedia - Social and Behavioral Sciences,* s. 25 30.

Kömürcüoğlu Turan, N., Altaş, N. E. (2003). Tasarım sürecinde kavram. *İTÜ Dergisi, Mimarlık, Planlama, Tasarım.* s. 15-26.

Kuloğlu, N. (2014). *Mevcut Çevrede Tasarım: Stüdyo Deneyimleri. D. Ş. Gür içinde*, Mimari Güncellemeler (s. 125-139). Ankara: Nobel Akademik Yayıncılık.

Sadri, H. and Zeybekoğlu Sadri, S. (2013) "Özgürleştirici Mimarlık Eğitimi" (Turkish), Title in English: "Liberating Architectural Education", in the *Critical Pedagogy (Eleştirel Pedagoji) Journal, issue 28*, July 2013, PP: 60-66

Ülgen, G. (2004). *Kavram Geliştirme*. Ankara: Nobel Yayın Dağıtım.

Resume

Melih Kurnali is Assistant Professor at Interior Architecture pr., Konya Technical University. He is an interior architect and received his Ph. D. degree from Hacettepe University, Department of Interior Architecture and Environmental Design. He has focused her research mostly on micro architecture, cabins, limited spaces, interior architecture education and spatial sense.

Ceyhun Şekerci is an Assistant Professor Doctor at Konya Technical University, Department of Interior Architecture. His research continues in the field of social and human sciences, interior architecture education, parametric design, technology, virtual reality and in the field of disability.