



ISSN:2822-4175

DEPARCH JOURNAL OF DESIGN  
PLANNING & AESTHETICS RESEARCH

VOL 2  
ISSUE 1  
SPRING 2023

# DEPARCH



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**DEPARCH**  
JOURNAL OF  
D E S I G N  
P L A N N I N G  
A E S T H E T I C S  
R E S E A R C H

**VOL.2 NO.1 - SPRING 2023**

ISSN:2822-4175

**Published by**

Rectorate of Selcuk University  
(e-journal)

**Printing by**

Selcuk University Press, November 2022  
Printed in Konya, Türkiye





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JOURNAL OF  
DESIGN  
PLANNING  
AESTHETICS  
RESEARCH

**VOL.2 NO.1 - SPRING 2023**

ISSN:2822-4175

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DESIGN  
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AESTHETICS  
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## Urban Public Streets in the Collective Memory: A Case Study of Uray Street in Mersin

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### Abstract

Streets are public spaces that serve as a vital component of a city's transportation network, not only for transportation purposes but also for the spaces they provide that hold significant value in the daily lives of individuals. These spaces are subject to social, societal, and economic transformations and changes, which can ultimately weaken or even cause the disappearance of urban memory over time. The collective memory of a city, which is closely linked to its physical structure and identity formation, entails the interpretation of physical environment signs and symbolic meanings within the social, historical, and psychological components of society. This study aims to investigate the shifting and transforming role of Uray Street, a significant street that has been part of Mersin's memory since its inception, as a port city located in the southern region of Turkey. To this end, oral history interviews were conducted with individuals from different age groups who have utilized Uray Street. Through these interviews, the changes and transformations that have taken place on Uray Street were obtained from the narrations, memories, and recollections of the interviewees within the context of their own life stories as urban dwellers with long-term connections to the area.

**Keywords:** Collective Memory, Oral History, Urban Space, Streets, Space Transformation.

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**Received:** 31.08.2022 - **Accepted:** 26.03.2023

Özdemir, E. E. (2023). Urban public streets in the collective memory: A case study of Uray Street in Mersin. DEPARCH Journal of Design Planning and Aesthetics Research, 2 (1), 1-14. <https://doi.org/10.55755/DepArch.2023.14>



## Kolektif Hafızada Kentsel Kamu Sokakları: Mersin Uray Caddesi Örneği

Elvan Elif Özdemir<sup>1</sup> 

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### Özet

Sokaklar, kentlerin ulaşım ağını oluşturan, sadece bir ulaşım aracı olarak değil, barındırdığı mekânlarla da bireylerin gündelik yaşamında önemli bir yere sahip olan kamusal alanlardır. Kentlerin önemli bir parçası olan kamusal alanlar da, yaşadığımız sosyal, toplumsal ve ekonomik dönüşüm ve değişimlerden etkilenmektedir. Bu durum kentsel belleğin sürekliliğinin zayıflamasına ve hatta zaman içinde yok olmasına neden olmaktadır. Kentlerin fiziksel yapısı ve kimliklerinin oluşumu ile güçlü bir bağı olan kolektif hafıza, fiziksel çevrenin işaret ve sembolik anlamlarının sosyal, tarihsel ve psikolojik bileşenlerle toplumun bilişsel yapısı içinde okunmasıdır. Bu çalışma, Türkiye'nin güneyinde bir liman kenti olan Mersinde, kentin ilk kuruluşundan bu yana önemli bir caddesi olan Uray Caddesi'nin kent belleğindeki değişen ve dönüşen konumunu araştırmaktadır. Bu amaçla Uray Caddesi'ni kullanan farklı yaş gruplarındaki bireylerle sözlü tarih görüşmeleri gerçekleştirilmiştir. Alanda bulunan uzun süreli bellek mekânlarının kullanıcıları ile sözlü tarih görüşmeleri yapılarak kentlilerin öz yaşam öyküsündeki, Uray caddesine ait anlatılar, anılar ve hatıralar üzerinden Uray caddesinde meydana gelen değişimler ve dönüşümler elde edilmiştir.

**Anahtar Kelimeler:** Kentsel Mekan, Kolektif Bellek, Sokaklar, Sözlü Tarih, Uray Dönüşümü.

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**Alınma Tarihi:** 31.08.2022 - **Kabul Tarihi:** 26.03.2023

## INTRODUCTION

Globalization, the result of rapid technological development since the 1990s, has revealed a broad and effective universal understanding of culture and space in architecture and urban design. This understanding of space is discussed and explained through the concepts of 'association', 'disidentification' and 'non-spatial' (Auge, 2017). Along with globalization, the increase in information and the movement of people affect space-time environment relations and create a new understanding of order. This new understanding of order focuses only on the biological needs of the individual and ignores difference, pushing into the background the meaning, identity, and culture that represent the individual. This situation has weakened the cultural differences of the city, and the urban space, which can provide a common history, a common present and a common world, and enrich the urban experience of citizens, is rapidly disappearing and shrinking. Streets have lost their place and importance as public parts of the city and have become appendages of the global economy. The public space of the city, which forms the common collective memory of the citizens, is rapidly disappearing and becoming monotonous, being replaced by spaces that we encounter everywhere in the world. On the other hand, these new spaces do not fit the fabric of the area in which they are located, rendering meaningless the connection that visitors form with the space.

Collective memory refers to a community's shared memories, experiences and history. It is a form of social memory that emerges from the collective experience of a group of people in relation to a space that shapes their identity, values and cultural practices. Public urban spaces are places where people can gather, interact and connect with their surroundings. They are the physical manifestation of the city's social and cultural life, reflecting its history, diversity and ambition. This study examines globalization-induced amnesia in the street, one of the city's public spaces. As one of the collective memories of the city, the street plays an important role in people's lives (Farahani et al., 2015). From childhood to adolescence to adulthood, people give different meanings to streets, and streets lose their meaning and functions, especially in the context of globalization. Mersin, located in the southern part of Turkey, is one of the cities with the greatest use of open public spaces due to its Mediterranean climate. This study focuses on the relationship between space and collective memory and uses Uray Street, located in the centre of the city and occupying an important place in the city's history, as an example to explore the impact of globalization on street memory.

Uray Street is one of Mersin's most important monuments with a long history. From the past to the present, it has been influenced by the different cultures it carries and has created its own unique memory. Cinemas, banks, bookstores, cafes, patisseries, restaurants and businesses are located on the street that connects the eastern and western edges of the city and runs parallel to the sea. As a commercial and entertainment district, it reflects economic, social and cultural life. But in the last 10 years, with rapid changes and transformations, it did not withstand globalization and lost its identity as a city centre. This study investigates which features of Uray Street have survived in the city's memory, which have been lost, and how these features of Uray Street have changed in modern memory.

*“Memories are built as a city is built”*  
Umberto Eco, 1986, 89

In today's rapidly changing world, collective memory has become very important for the sustainability of social life. Research on collective memory is becoming increasingly important to understand what is happening around us and to find new connections between the present and the future. Boyer (1993) explained this connection between past and future in terms of “place”. He believes that space flows in an individual's life, just like memory. The value of history – a collection of places – here called collective memory, helps to understand the meaning and individuality of places.

As Pierre Nora (2006) puts it: “Memory is life itself, created by an ever-present group. To this end, memory is open to the dialectic of remembering and forgetting, unaware of their constant changes, sensitive to various uses and sleight of hand, susceptible to prolonged uncertainty, sudden resurrection and constant development” (Nora, 2006, p.19) Halbwachs argues that collective memory includes both individual memory and personal memory, including all forms of memory, as individual memories are experienced within a social framework. He pointed out that although the memories that emerge are different, each individual memory has a view of the collective memory that changes with position in the group, and the place itself changes with the relationships established with other environments (Halbwachs, 2019, p.60). Connerton explains the importance of personal memory in the formation of collective memory as follows: *“no matter how personal the act of remembering is, it is in relation to the set of thoughts that many other people have”* (Connerton, 1999, p.60).

Halbwachs explained the relationship between memory and objects, emphasizing that the shapes of the objects around us are significant. He said that the objects around us form a quiet and inactive community. He explains it further as follows: When Balzac describes a family residence, a miser's house, or Dickens describes a notary, all his house paintings allow us to intuit the people who lived in this social category. the frame belongs to It is not just a simple harmony and physical harmony between places and the appearance of people. Every object we encounter and the space it usually occupies reminds us of the shared existence of many people (Halbwachs, 2019, p.160).

Halbwachs describes this situation, he does it through objects, but also through cities. Halbwachs describes this situation, he does it through objects, but also through cities. When we talk about the change of the city, “The differentiation of the city is actually the diversity of its internal functions and social traditions, but as the group develops, the external appearance of the city changes more slowly. Local habits resist the forces that tend to change them, and this resistance makes us realize how much collective memory in groups like this support spatial images. (Halbwachs, 2019, p.165).

Nora (1989) defined the relationship between memory and space as a powerful connection that is always constructed and expressed depending on where it is located. Nora expresses the relationship between history and memory as “memory is about place and history is about events” (Nora, 1989, p.22) and emphasizes that “spaces of memory” are important for the construction of collective memories. It defines a “place of memory” as “any significant object which, through human will or the efforts of time, has (become) a symbolic element in the lasting heritage of any society”. (Nora, 1989). The material commemoration

area described by Nora includes works of art, sculpture, individual buildings and urban spaces. Examples of buildings he assigns as material memory include the Eiffel Tower and the National Museum of Antiquities. It is important for individuals to have a sense of belonging in order to create a sense of collective identity. In particular, this sense of belonging, which is created and felt in the public space, in a shared environment characterized by shared social life and architecture, contributes to the sustainable development of society and at the same time preserves the local area. According to Boyer (1993), the public sphere provides a framework for the construction of collective memory. Public spaces that provide venues for social events can reflect class differences and cultural clashes, and can be part of corporate culture or be more subversive. (Boyer, 1993).

*“A Public space is a place for everyone. It is a place in which you do not have to know anyone or do anything in particular, except be there. Public places serve an important role as the most easily accessible places to meet people and to take part in public life”* (Gehl, 1989, p.17).

In the urban design research literature, public space is an important phenomenon for cities and people. Several researchers and authors (Lynch, 1960; Jacobs, 1961; Habermas, 1989; Carr et al., 1992; Cullen, 1996; Gehl, 2001) have pointed out that public spaces play an important role in preserving, recognizing and understanding social and cultural aspects play an important role in the meaning of the city. On the other hand, Neils (2010) and Carmona (2010) promoted citizens' interest in public space design by emphasizing the complexity of public space.

Streets, which are the main components of the urban structure, are not only the areas that form the transportation network of the city, but also important urban public areas that meet the functional, social and leisure needs of individuals (Soltani et al., 2018). Jacobs (1961) explains the importance of streets in everyday life as follows: *“The streets and sidewalks, the main public spaces of the city, are the most vital organs of the city. Sidewalks, their frontier uses and users are active participants in the drama of civilization...”* (Jacobs, 1961, p.49). Many researchers and writers (Jacobs, 1961; Southworth & Ben Joseph, 1996; Vernez-Moudon, 1991) mention that streets constitute the majority of public spaces in urban areas and their importance in revitalization efforts. What is usually meant by street revitalization is the effort to make the streets alive by increasing the capacity to create and use more action (NMSC, 2019). Carmona et al., (2003) states that streets constitute *‘accessible public space’*. Researchers such as Rudofsky (1969), Lofland, (1998), on the other hand, emphasize that streets serve basic needs in cities and towns, such as survival, communication, and the importance of various political, religious, commercial, civic and social functions.

While Southworth and Ben-Joseph (1996) talk about the physical and social component of the street, Rapaport (1990) noted that *“streets are the more or less narrow, linear spaces lined between buildings found in settlements and used for circulation and, sometimes, other activities...”* Moudon (1991) claimed, *“There are reasons why many streets can and should be opened to uses that serve the public at large, not only drivers but for pedestrian networks within a neighborhood or a city”*. Mumford (1973) mentions the function of the street as both a warehouse and a place of transfer culturally, which constitutes the physical space of the urban space.

With the rapid change and transformation of cities, public spaces have changed. As stated in Gehl and Gemzoe's (2000), *‘New City Spaces’*, streets that have been occupied by vehicles and turned into abandoned spaces for them are

now defined as a place for shopping with no memory and meaning: *“It is in the physical properties and meanings of places. It is an urban transformation of images and memories in individuals’ memories caused by the changes that occur”* (Gehl & Gemzoe, 2000).

## METHOD

Through documentation, very limited information is available to future generations about modern people and the richness of urban life today (Counce, 2001, p.15). The clearest traces that allow us to compare the city’s past and present are the old trading centers in the city, the old trade routes through the settlements, historical sites, gravestones, road names, road routes and zoning structures that were part of the zoning. plan. Therefore, in addition to the traditional sources of history based on documents, other reading methods should be developed to interpret the traces of history that the city will carry, such as the disappearing line, to remove the materials that hide these traces, or to make traces obvious (Danacıoğlu, 2001, p.31-33). Oral history is the stories of the cities where people live and are able to record their thoughts on any issue that needs to be addressed. Be able to study the factors that make cities more human despite their flaws. An oral history approach builds on the organic nature of development, builds on the past rather than suppresses it, and can help revive a sense of need (Counce, 2001, p.41-42).

A shared identity and sense of belonging is another benefit of oral history in urban studies. A sense of belonging to the city greatly contributes to local social activity. This sense of belonging is fostered through oral history, which is an important tool. The ability to express oneself is one of its greatest strengths, and in the same way, listening to life stories can help researchers escape the feeling of being trapped in rigid social systems. People become stronger by listening to their lived experiences, because it allows them to realize how important and meaningful their lives are, even in the society in which they live (Thompson, 2006, p.37) Through the oral history of cities and urban spaces, it is possible to generate information about the past and/or current state of urban spaces and/or elements of the built environment that have changed, transformed or completely disappeared. This information is unique to the city and cannot be found anywhere else. The importance of this information is that it can only be learned through the oral history method, and it also includes the corresponding counterparts of the elements in the city’s memory and their relative importance in the city as a whole (Selvi Ünlü, 2019).

Through personal stories, narratives, memories, documents and images that make up collective memory, it is easier to understand the connection between cities and urbanists, to understand the history of cities and to understand urban change and transformation (Tosh, 2005). The practice of oral history of urban spaces was realized for the first time in the 1960s. Since then, oral history methods have been used to preserve the symbolic and social significance of historic urban spaces and allow future generations to experience them in their natural environment (Danacıoğlu, 2001). It is important to read social memory and build urban identity through public space, which has a large share in the formation of social relations (Boyer, 1993).

Oral history methods allow us to question symbolic and social meanings in the construction of identity in urban space (Köksoy, 2009). This is the most common approach of many researchers and authors (Selvi Ünlü, 2019; Asur et al., 2022; Doğu et al., 2017) to understand the interaction between urban spaces and their urban memory.

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This research aims to explore how collective memory is stored, constructed and reproduced, focusing on the relationship between space and memory and considering the spatial images that people have in mind. To this end, oral history interviews were conducted with 23 Uray Street residents to explore in detail the historical features of the collective memory of Uray Street in the port city of Mersin. The research reveals an insight into the history and memory of the space, and provides the experiences of shop owners and local residents who have lived and worked there for more than 10 years to understand the changes and transformations of the street.

**Table 1.** Age, gender and profession distribution of the participants who are Uray Street residents.

Number	Gender	Year of Born	Profession
1	M	1980	Shopkeeper (restaurant)
2	M	1957	Shopkeeper (jewelry)
3	M	1954	Retired lawyer
4	F	1957	Housewife
5	F	1957	Housewife
6	M	1954	Merchant
7	M	1954	Merchant
8	M	1954	Retired Lawyer
9	F	1984	Shopkeeper (jewelry)
10	F	1956	Shopkeeper (restaurant)
11	F	1956	Housewife
12	M	1956	Shopkeeper (restaurant)
13	M	1954	Retired teacher
14	F	1982	Shopkeeper (jewelry)
15	M	1954	Merchant
16	F	1954	Retired teacher
17	M	1979	Berber (Hairdresser male)
18	F	1954	Retired teacher
19	M	1957	Shopkeeper (owner of the coffeeshop)
20	M	1954	Merchant
21	M	1954	Shopkeeper (jewelry)
22	M	1967	Merchant
23	M	1965	Merchant

Oral history interviews with street dwellers were conducted and videotaped. These recordings were then transcribed. Users were asked to describe their past and present use of the street, as well as memories of the street and memories related to their own life stories. Qualitative content analysis was used to analyse the obtained data.

## FINDINGS

In order to understand the physical and social changes on Uray Street that are deeply rooted in history, and to uncover the specifics of individuals' collective memory, this study conducted oral history interviews with a total of 23 people on Uray Street. Winter 2019 (pre-COVID-19). All interviews were video recorded. The age distribution of the participants was 17 people after 60 years, 2 people over 50 and 4 street residents aged 25-40. These different age groups help us understand change by understanding the physical and social condition of the

street over time. During the oral history interview, the respondent was asked to tell their life story in relation to the spatial structure of Uray Street. They had to describe everyday life on the street.

When the research findings were examined, it was seen that cultural activities were mostly mentioned about the street. However, it was emphasized that these socialization activities were more intense before the 2000s. From this point of view, it can be said that the street functions as a place of cultural socialization. One participant talked about his memories of the street as follows: *“resting and pleasant places of Uray street residents are located in the immediate vicinity of Uray street. Ziya Pasha Casino with a view of the pier on the beach and Mersin Kiraathanesi, I remembered all these spaces. And these spaces were important for the social life of Mersin”* (From the Oral History interview with E.A.).

Another participant emphasized that the street is also used at night and has entertainment venues, and Ziya Pasha casino is famous here. *“People went there for both have a dinner, listen to music, dance and drink.”* He explained: *“...it was a comfortable place where you could dance and entertained freely but this freedom was like a learning ceremony. You could look around and how people behaved each other and how they entertained”* (From the Oral History Interview with S.G.).

Another participant stated that the street is commercially important:

*“Traders and partnerships in Uray street are the most prominent entrepreneurs of the surrounding cities and countries. Kayseri-based people in Mersin were in the iron and construction sector trade. Southeastern based people in Mersin were made pulses and cereals trade. And the Beirut and Halep based people trade on cotton and pulses in the logistics function. Mersin's production and marketing of citrus sector entrepreneurs Uray street as another face of Uray street was taking their place in the economic life. Uray street has been a street gate to the old and new ones of the people of Mersin. It was not for the source of employments, but the entity of sea and harbour is the main factor for the commercial. It is possible to say that the main reasons for the rapid increase in the population of Mersin and the migration from Mersin targeted to Anatolia are the employment opportunities in Uray street and the surrounding piers. The gains of business and trade on Uray street in Mersin has taken its place in the economic history as the beginning of the capital accumulation of the people of Mersin. How can we forget the monumental places like Azakhan and Tashan in this intense economic and commercial life? It is the most indicator of international commercial life in Mersin in the languages spoken in and around the Uray street. Commercial language of Uray street residents is Turkish, Arabic, French, English, Greek”* (From the Oral History Interview from the M. T.).

One of the respondents expressed his emotions about the street as: *“I had really important memories about the street which was changed my life completely. It was the place where I met with my wife. I went to street for promenading almost every day. Three or four times, I saw a girl who was shining like a star on the street. I was really curious about her, and I wanted to meet her but I couldn't know how. By chance, one day I saw her with one of my friends from high school sitting in Ahmet and we met. Then, we got married for almost 55 years now”* (From the Oral History Interview with S.Ö.).

*‘Uray Street was an important street with high commercial activity, where merchant inns (Azakhan, Tas Han, Susok Han), shops, warehouses, banks and post offices were located. Uray Street, where maritime trade was intensively*

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carried out, was especially important in terms of its relationship with the sea and the piers. As far as I know, it must have been in the 1930s or 40s, I'm not sure, but there was a rail system called decovil on this street. Thus, with this rail system, Uray Street was in a position to connect the railway station and the main pier of the city. There were entertainment venues and pavilions here in the evenings. But I also remember Akkahve' (From the Oral History Interview with Y.S.).

## RESULTS AND DISCUSSIONS

The changes and transformations highlighted in the respondents' oral history interviews fall into two broad categories. Known as the heart of the city until the 2000s, Uray Street has lost its former importance and vibrancy as commercial space has moved west of the city, particularly with the opening of the new Forum shopping centre. Allusions to the physical layout of the street, its size and the activities taking place there show that social interaction has played an important role in shaping the growth of the street space, leaving a lasting impression on the memory of every citizen. The spatial context of the street in question, both the activity on the street and in the public space, is significant, as citizens often remember it with shared meanings and responses.

Oral history interviews emphasized Mersin's identity as a port city, and spaces such as Akkahve and Azakhan were mentioned as spatial components associated with Uray Street and highlighted the street's commercial identity. This study examines streets as correspondences to urban spaces in urban memory, using methods that use personal testimonies and oral information as



**Figure 1.** Uray Street before the 20 th century (Source:Salt research, Harika-Kemali Söylemezoğlu archive).



**Figure 2.** Uray Street after the 20 th century (Source: Personal archive).

data. In this vein, oral history interviews are conducted with people who use and experience Uray Street on a daily basis, in an effort to access and analyse information recorded in the collective memory of the city's residents as a whole. As a result of this research, the memory of the city has been obtained as a collective memory that is registered in the memory of the street users of Uray and shows various similarities. In other words, this study uncovers the relationship between memory and space, as well as the relationship between users of different ages in the coastal city of Mersin Ulay Street, exploring places that leave lasting traces in their memory. Over time, the experience becomes one with the space, allowing street users to feel a sense of belonging and memories to live on in memory.

## CONCLUSION

Cities that have changed and grown with the progress of immigration, industry and new technology are gradually losing their past, history, traditions, customs and traditions are gradually disappearing or being forgotten.

Technological progress, population growth and mobility that come with the development or reproduction of capitalism make cities gradually forget their past and create problems of urban identity. Memory and spatial research should be increased to document the city's lost or forgotten past and present, to pass it on to future generations and to build urban identity and urban consciousness. Nora (1989, p.8) defines memory as '*a dynamic operational phenomenon*'. Urban collective memory, on the other hand, expresses spatial, social and temporal continuity in the urban environment. Underlining the importance of memory, he argues that without memory, it is not possible to interpret, analyse, make suggestions for the future or make improvements in current urban and social conditions. This situation confirms Hayden's (1996, p.49) argument that '*a politically conscious approach to urban conservation... should emphasize public processes and public memory*'.

Streets can also be defined as temporary and permanent commercial areas that are part of everyday life, meeting places and intimate environments where we meet friends. Or take it a step further, it can sometimes be compared to the living room or dining room, where urbanites spend long stretches of their daily lives. On the other hand, the changing social and spatial structure of the city over time also affects the street, changing and transforming its identity.

Authentic spaces in an individual's daily life reflect his experiences. The living space is not only a passive arena in which social life takes place, but also an additional element of social life. Changes and transformations in social practices and meanings of places lead to changes in the experiences of individuals. This transformation also affects the relationship of the city that interacts with the street. Thus, the social and spatial markers of the urban environment can be read and identified in the changes of the social and spatial structure.

## ACKNOWLEDGEMENT

This is the extended version of the paper "Street as A Space of Urban Memory: A Case Study of Uray Street in Mersin" presented at the LIVENARCH VI-2019: Replacing Architecture Symposium on September 25-28, 2019 Trabzon, Türkiye.

## Financial Disclosure

The authors declared that this study has received no financial support.

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## Ethics Committee Approval

Ethics committee approval was not required for this article.

## Legal Public/Private Permissions

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions and organizations) during the survey, in-depth interview, focus group interview, observation or experiment.

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## Food Producing Facades Key to a Sustainable Future

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### Abstract

The built environment uses substantial and increasing amounts of energy, contributing to Urban Heat Island effect, while population growth and urban development have outpaced food production globally. There is a growing trend to introduce green infrastructure into the built environment via green roofs, green façades, and urban agriculture. Research is limited, however, into the use of food producing plants being grown on a living façade to improve total building performance. The purpose of this research study was to test the assertion that food producing plants can be grown successfully in a vertical greenery system or green wall integrated into an existing commercial building façade. Specifically, this dissertation investigates the role of integrating food producing plants into a living facade to positively impact four outcomes: food production, thermal performance, air quality and rainwater management in a temperate climate.

This was a six-year long longitudinal research study. The findings from this study conclusively demonstrate that a maximum average production of 2.64 kilograms of produce per square meter of façade panel can be generated annually (0.54 lbs./ft<sup>2</sup>). The façade temperatures were reduced between 5.56oC-20.53oC (10oF-36.95oF) with approximately 20% reduction in cooling energy, reducing urban heat island. Airborne small particulates (PM<sub>2.5</sub>) were reduced a maximum of 5.6% for the living facade compared to the control. An average of 14.26 litres of rooftop rainwater per square meter of facade per day (0.35 gal/ft<sup>2</sup>/day) was used for irrigation. In addition, observational studies revealed enhanced access to nature for building occupants, wildlife habitat and biodiversity.

**Keywords:** Building Performance, Green Infrastructure, Living Façade, Urban Agriculture, Urban Heat Island.

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**Received:** 12.02.2022 - **Accepted:** 14.02.2023

Leininger, L. (2023). Food producing facades key to a sustainable future. DEPARCH Journal of Design Planning and Aesthetics Research, 2 (1), 15-38. <https://doi.org/10.55755/DepArch.2023.15>



## Sürdürülebilir Bir Geleceğin Anahtarı Gıda Üreten Dış Cepheleler

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### Özet

Nüfus artışı ve kentsel gelişim küresel olarak gıda üretimini geride bırakırken, Yapılı Çevre Kentsel Isı Adası etkisine katkıda bulunarak, önemli ve artan miktarda enerji kullanmaktadır. Yeşil çatılar, yeşil cepheleler ve kentsel tarım yoluyla yeşil altyapıyı yapıları çevreye dahil etme yönünde artan bir eğilim vardır. Bununla birlikte, gıda üreten bitkilerin, yaşayan bir cepheye entegre edilerek toplam bina performansını artırmada kullanımı konusundaki araştırmalar sınırlıdır. Bu araştırmanın amacı gıda üreten bitkilerin ticari bir bina cephesine entegre edilmiş dikey yeşillik sistemi veya yeşil duvarlar içerisinde başarılı bir şekilde yetiştirilebileceğini test etmektir. Spesifik olarak, bu tez, yaşayan cephe üzerindeki gıda üreten bitkilerin rolünün iliman iklim koşullarında, gıda üretimi, termal performans, hava kalitesi ve yağmur suyu yönetimi olmak üzere dört sonuca pozitif etkisi olup olmadığını inceler.

Bu çalışma 6 yıl süren uzun soluklu bir araştırmadır. Bu çalışmadan elde edilen bulgular, yıllık olarak ortalama 2.64 kilogram (0.54 lbs./ft<sup>2</sup>) ürünün cephe paneli başına üretilebileceğini kesin olarak göstermektedir. Cephe sıcaklıkları 5.56°C-20.53°C (10°F-36.95°F) arasında düşürülerek, soğutma enerjisinde yaklaşık %20 azalma ile, kentsel ısı adası etkisi azaltıldı. Hava kirliliğine neden olan küçük partiküller (PM<sub>2.5</sub>), yaşayan cephe için kontrol grubuna kıyasla maksimum %5.6 oranında azalmıştır. Bir metrekare cephe paneli başına ortalama olarak günde 14.26 litre (0.35 gal/ft<sup>2</sup>/gün) yağmur suyu sulama için kullanılmıştır. Ayrıca, gözlemsel çalışmalar, bina sakinlerinin doğaya erişiminin arttığını, doğal yaşam alanının ve biyo-çeşitliliğin arttığını ortaya koymuştur.

**Anahtar Kelimeler:** Bina Performansı, Kentsel Isı Adası, Kentsel Tarım, Yaşayan Cephe, Yeşil Altyapı.

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**Alınma Tarihi:** 12.02.2022 - **Kabul Tarihi:** 14.02.2023

## INTRODUCTION

### Key Challenges Addressed by Food Producing Living Façades and Hypotheses

There are many challenges that can be met by increasing vegetation in cities through urban gardens, green roofs and living façades. This thesis identified a set of four challenges to set the hypothesis and metrics for food producing living façades to address food shortages, heat increases, air quality challenges and flooding in cities around the world.

Alongside rapid urbanization around the world, there is a growing gap between growth in human population and food production. Over 1.7 million global deaths each year (2.8%), attributed to low fruit and vegetable consumption (World Health Organization, 2004). The percentage in the U.S. is also striking, with over 11.1% of all US Households identified as "Food Insecure" (USDA, 2018), 9-12% of Pennsylvania households (Coleman-Jensen, Rabbit, Gregory & Singh, 2018) and 13.7% of Allegheny County households (Sundaram, 2018). The vertical surfaces of buildings provide an underutilized opportunity for urban food production, while also reducing surface temperatures, improving air quality and rainwater management – the subject of this research.

Buildings in the U.S. use 76% of all electricity (Mazria & AIA, 2006); 10% for cooling in 2019 (EIA, 2020), with 9.6% of component loads due to heat gain on building surfaces (Huang & Franconi, 1999). Air Conditioning accounts 15% of total energy costs for commercial buildings (ASi Controls, 2014). Cooling loads contribute 117 million metric tons of CO<sub>2</sub> per year in the U.S., other greenhouse gasses and pollutants (US Department of Energy, 2021). Air conditioning contributes 20% or more to peak power demand, challenging grid reliability (Energy Storage Center, 2013). This leads to high façade surface temperatures and increased air conditioning exhaust which contributes to and exacerbates urban heat island effect. Annually in the US 600-700 people die due to heat waves. *"Heat wave mortality risk increased 2.5% for every 1°F increase in heat wave intensity and 0.38% for every 1-day increase in heat wave duration."* (Anderson, 2010).

Air pollution kills an estimated 7 million people worldwide annually (World Health Organization, 2021). Forty-five percent of the U.S. population live in counties with unhealthy levels of particulate or ozone pollution (Hahn, 2020). Pittsburgh consistently ranks among the top ten cities in the US for small particulates (Lynn, 2020). The lack of landscape in urban environments is correlated with a 4% increase in fine (PM<sub>10</sub>) and ultra-fine (PM<sub>2.5</sub>) dust particles (Kohler, 2008).

In natural ecosystems, evaporation accounts for 80% of water, with 1% going to runoff, while in the built environment evaporation is only 25%, with 70% going to runoff (Dreiseitl, 2005). In cities with combined storm sewers, the immediate runoff quantities result in Combined Sewer Overflows (CSO's). In Pittsburgh as little as 1/10<sup>th</sup> of an inch of rain (2.54 mm) can cause CSO's (Knauer, 2003). Present rainwater management allows immediate building and site runoff into urban storm sewer systems resulting in increased flooding. Storm water management with grey infrastructures also increases the frequency and severity of drought compromising the hydrological cycle due to the lack of natural groundwater recharge (Lyle, 1994; Schmidt, 2009; Dreiseitl, 2005).

### Hypothesis and Research Questions

Bringing nature into the city is a tradition as old as the hanging gardens of Babylon, but it is only in the late twentieth and early twenty-first centuries that

this concept has matured into a strategy for incorporating plants and living systems into a performance-based approach to the design and functioning of the built environment. This includes the introduction of urban agriculture not only on land within the city, but also on top of and integrated with the green roofs and green façades of local commercial and residential buildings. This new approach of bringing productive landscape and agriculture right into the city, integrated within the building envelope itself, provides a new opportunity to increase food production on previously unproductive urban surfaces. The challenges are to quantify how much food can be produced in a temperate climate and what other benefits might be gained alongside food production. This research answers one overriding hypothesis:

The use of food producing plants grown on a living façade will generate a substantial, measurable, and useful amount of fruits and vegetables and also improve total building performance in three key metrics: decrease urban façade surface temperature, improve urban air quality, and decrease stormwater runoff.

Specifically, four research questions were asked:

1: Living Facades will increase urban food production, producing measurable amounts of fresh vegetables, fruit and herbs.



2: Living Facades will decrease façade surface temperatures during the heat of the day in summer.



3: Living Facades will improve air quality by reducing PM<sub>2.5</sub> particulates at the building façade.



4: Living Facades will decrease Stormwater runoff through the collection and redeployment of rainwater for irrigation.



## THEORETICAL FRAMEWORK OF THE METHOD

### A Taxonomy of Choices for Configuring Living Façades

To quantify the potential of living façades to increase urban food production and offer other environmental benefits, it is important to distinguish the types of living wall configurations and background research on their relative performance impacts. A review of more than ninety research articles helped to define types of vertical greenery systems (VGS), design variables, performance metrics and outcomes shown in Table 1. Areas highlighted in green are studied in this experimental research effort.

Physical Metrics						
Green Wall Type	Growing Media	Plant Types	Irrigation / Filtration	Openings / View	Access / Maintenance	Innovative / Technologies
Carrier System (Panels)	Soil Mix	Deciduous	Stormwater	Transparency	Low rise	Photovoltaics
Support Systems (container & Trellis)	Depth	Evergreen	Greywater	Seasonality	High rise	Hydroponics
	Soil less / Felt	Agricultural	Blackwater			Wastewater Treatment
		Ornamental				

Table 1. Physical metrics

In the book *Vertical Greenery for the Tropics*, (Wong, 2009) Vertical Greenery Systems (VSG's) were defined in two general categories – support systems or trellises that are coupled with the ground or containers and carrier systems with panels of growing medium to support a broader range of plant types, as shown in Figure 1:

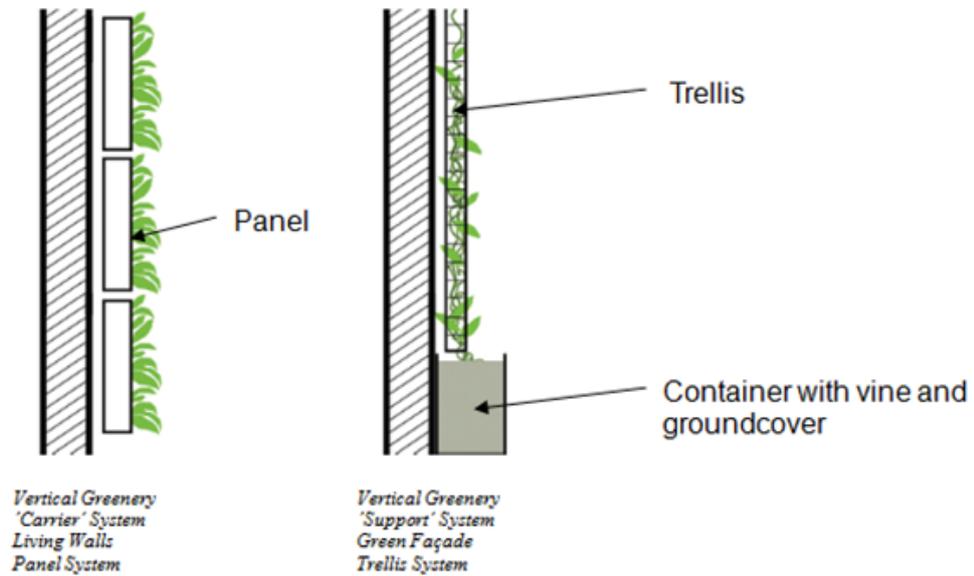


Figure 1. Living Wall and Green Façade Systems definitions (Wong, 2009).

In a definitive paper produced at the Queensland University of Technology Centre for Subtropical Design, *Living Walls – A Way to Green the Built Environment* (Loh, 2008), three basic green wall systems are defined, as shown in Figure 2:

- Panel Systems (like the Carrier System described above).
- Felt Systems, with pockets hung from a backing support.
- Container and/or Trellis Systems, with a ground container to support vine growth.

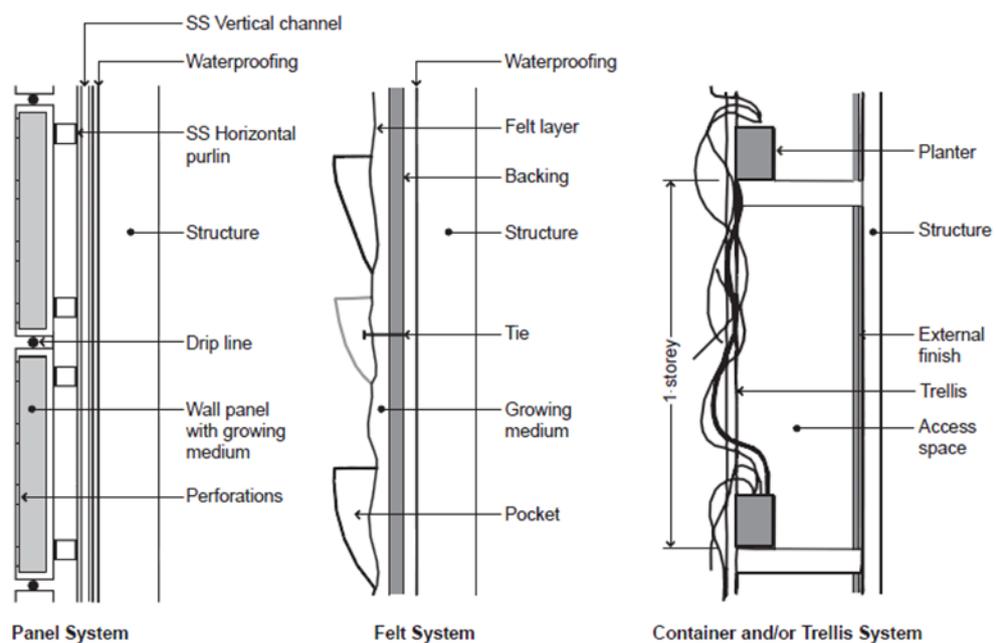


Figure 2. The three generic green wall systems (Loh, 2008).

The system used at this experimental research on the south and west façades of the Intelligent Workplace living lab in Pittsburgh was a hybrid panel and trellis system, with the soil panels providing the fabricated soil mix to grow the polyculture of plants used in this study. The research installations used a diversity of food and ornamental plants, captured rainwater for irrigation, vines for air filtration and seasonal transparency of the glazed areas, and photovoltaics to power the automated drip irrigation system. The experimental installation was evaluated over six growing seasons, using a range of instruments to quantify the performance benefits of living, food producing walls, highlighted in green in Table 2.

Performance Metrics						
Thermal Qualities	Air Qualities	Water Qualities	Visual Qualities	Acoustic Qualities	Material Qualities	Spatial Qualities
Shade	Air Quality	Stormwater	Daylight	Sound Transmission	Food & Flower Production	Size
Cooling Load Ratio	Oxygen	Greywater	Shade	White Noise	Biophilia	Ergonomics
Heating Load Ratio	Carbon Sequestration	Blackwater	Glare	Habitat	Soil Nutrient Cycle	
Evapotranspiration	Bio-Filtration		Color		Public Relations/Marketing	
Urban Heat Island						
Energy Production						

**Table 2.** Performance Metrics.

### Background Literature on Living Food Producing Façades

Twenty-one papers of precedent research on living façades, and more significantly food producing façades, were reviewed to determine critical test bed configuration and performance measurements for food, heat, air and water impacts, with an identification of the climate region where these studies were conducted.

Author	Food	Temperature / Cooling	Air	Water	Climate		
					Temperate	Subtropical	Tropical
Akbari		✓	✓			✓	
Amir	✓						✓
Bass		✓			✓		
Cameron		✓			✓		
Connelly (BCIT)				✓	✓		
Davis		✓					✓
Eumorfopoulou		✓				✓	
Köhler		✓	✓		✓		
Kontoleon		✓			✓		
Kew				✓	✓		
Martensson	✓				✓		
Nagle	✓				✓		
Othman		✓					✓
Petit			✓			✓	
Perini		✓	✓		✓		
Schmidt		✓		✓	✓		
Stec		✓					
Susorova		✓			✓		
Tilley		✓			✓		
Wang				✓	✓		
Wong		✓					✓
Leininger	✓	✓	✓	✓	✓		

**Table 3.** Table of major green wall research authors and areas of focus.

A majority of the research on green walls and living façades has been focused on the temperate climate region, which is the dominant climate type in the United States and in Europe. While there is a growing body of research on living façades, there is remarkably little research to date on food producing façades. At the time of this research, only two studies had been completed quantifying the benefits of food production on the vertical faces of buildings. At Penn State University, Nagle et al identified that a range of 1.5– 12.7 kg/m<sup>2</sup> of herbs and collard greens can be produced on panel based living façades in a

temperate climate (Nagle et al., 2017). At the Swedish University of Agricultural Sciences, Martensson et al identified that edible perennials - Chives, Lesser Calamint and Wild Strawberry – could thrive over winter in a living wall system in Malmo, Sweden (Martensson et al., 2014). These two studies offer insight into the production capability of food producing walls and the potential durability and vitality of horticultural plants as components of a living façade in cold and temperate climates. Critical validation of the veracity and replicability of these results is one purpose of this study.

A review of more than a dozen green façade and living wall studies related to thermal performance benefits, these five illustrate the typical findings. Akbari et al. (2001), identified that “urban trees and high albedo surfaces can...reduce national energy use in air conditioning by 20% and save over \$10B per year in energy use and improvement in urban air quality”. A field study of trellis and panel Vertical Greenery Systems (VGS) by Wong et al, identified that living walls reduced surface temperatures by 5°C (9°F) on average. In a subsequent simulation study, Wong et al identified heat gain reductions of 10%-74% based on the extent of vertical greenery coverage (Wong, 2008).

A field study of green façade exterior surface temperature differentials on a building in Northern Greece determined the average reduction was 5.7°C (10.3°F) (Eumorfopoulou & Kontoleon, 2009). An energy simulation study on the same building identified cooling load reductions of 18% on the east façade, 8% on the south, 18% on the west and 5% on the north (Kontoleon & Eumorfopoulou, 2010). Tilley et al, identified an average façade surface temperature reduction of 11°C (20°F) in green façade test cells at the University of Maryland, with a maximum of 14°C (25°F) cooler than the bare wall control (Tilley, Price, Matt & Marrow, 2012). Perini et al, identified 17%-40% energy savings in cooling with vertical greenery systems on the south façade of an office building in Genoa, Italy (Perini et al., 2017). These findings show the surface temperature reduction and potential cooling load reduction benefit generated by green façades and living walls planted with non-edible plant varieties. Verifying that horticultural plants will yield similar façade surface temperature reductions is the second point of this study.

The four studies reviewed on the benefit of plants relative to small particulate reduction, illustrate the major findings in this area. Kohler identified a 4% reduction in annual dust-fall ( $PM_{10}$  and  $PM_{2.5}$ ) through a maximization of green façades (trellis) and living walls (panel) in dense urban environments (Kohler, 2008). Variation in leaf texture and surface characteristics of three tree species, and the use of daily irrigation to increase the opportunity for wet deposition, are effective mechanisms for reducing  $PM_{2.5}$  in urban environments (Wang, Gong, Liao & Wang, 2015). The performance of four different evergreen plant species to reduce fine and ultra-fine dust particles ( $PM_{10}$  and  $PM_{2.5}$ ) when planted in a vertical greening system was studied by Perini, et al. Shrubby, non-edible plants indicated that waxy leaves (*T. Jasminoides*) collected the highest number of particulates, whereas plants with hairy leaves (*P. Frucitosa*) were less effective (Perini et al., 2017). Petit et al identified that fern species had a single pass removal efficiency of 46% for  $PM_{0.3-0.5}$  and 92% for  $PM_{5-10}$  when integrated into a bio-wall HVAC filtration system (Petit et al., 2017). These studies show that small tree and shrub species produce leaves that provide effective surface area for small particulate deposition, effectively reducing airborne levels. Verifying that horticultural plant leaves can provide similar benefits in terms of improving air quality by reducing  $PM_{2.5}$ , while producing measurable amounts of fresh produce, is the third important aspect of this study.

The two most relevant studies on rainwater absorption by living façades illustrate their potential value as green infrastructure. Living façade panels planted with sedum angelina, sedum ternatum, sempervivum tectorum, and ajuga reptans reduced rainwater runoff an average of 52-68% (Kew et al., 2014). Connelly et al identified that different vining plants will absorb different rain quantities, with Silverlace at 2.83 L/m<sup>2</sup> (0.07gal/ft<sup>2</sup>), vine, Evergreen clematis at 4.28 L/m<sup>2</sup> (0.11gal/ft<sup>2</sup>), and Oriental bittersweet at 5.58 L/m<sup>2</sup> (0.14gal/ft<sup>2</sup>) (Connelly et al., 2012).

### Food Producing Living Façades – System Design and Food Production Methods & Materials

After a review of living façade designs and precedent research, the design and implementation of the Intelligent Workplace food producing living façade project was developed to contribute a semi-controlled field experiment on the existing south and west façade areas of the Robert L. Preger Intelligent Workplace (IW) on the campus of Carnegie Mellon University (see Figures 3-7). The drawings illustrate the concept.

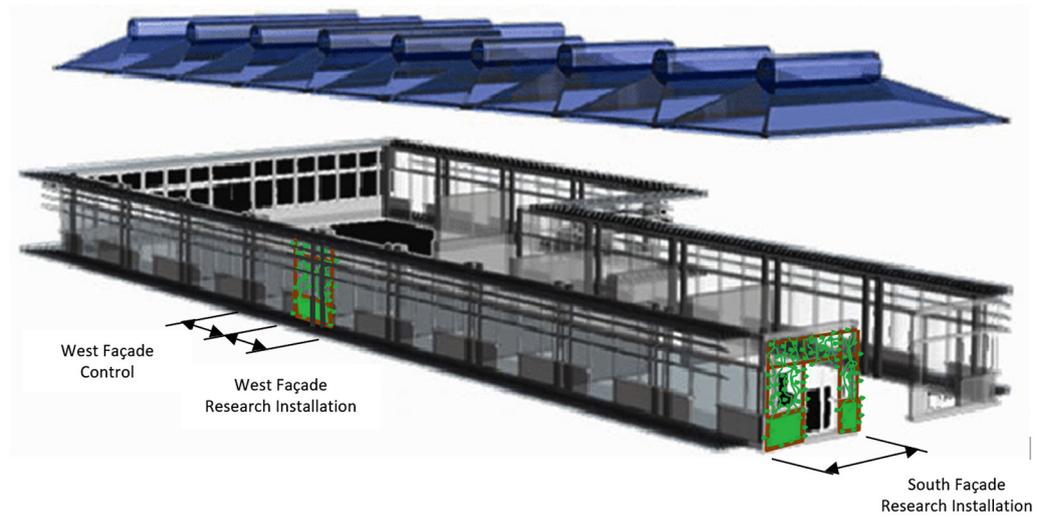


Figure 3. Axonometric of IW showing Living Façade Research Areas.

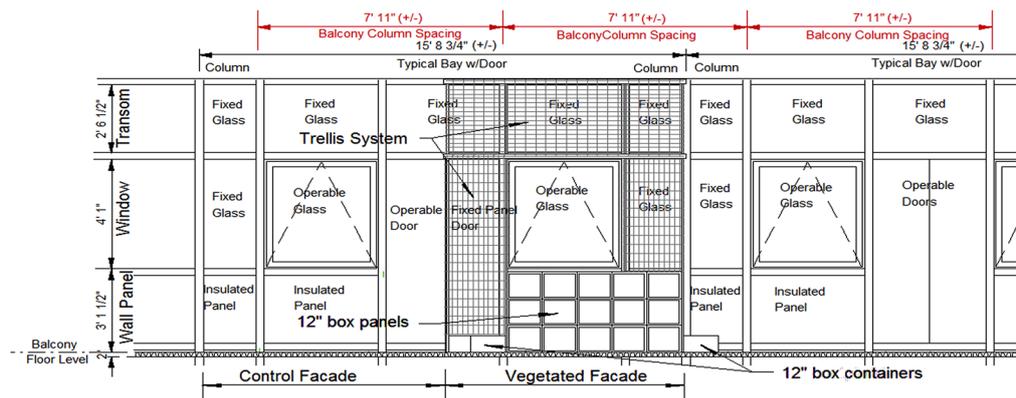
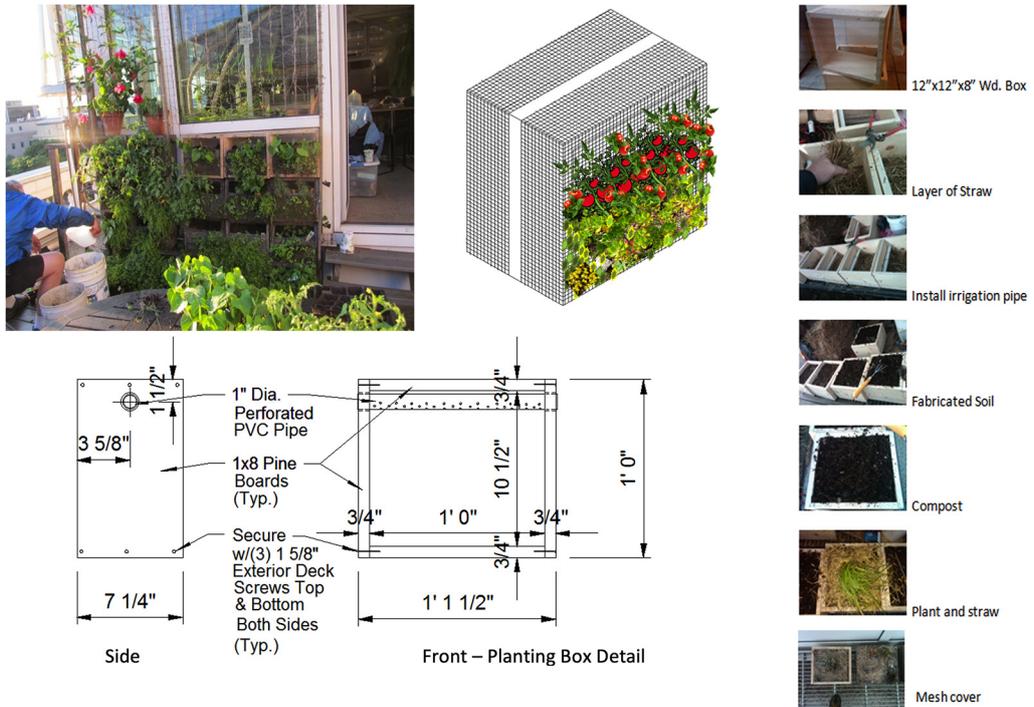
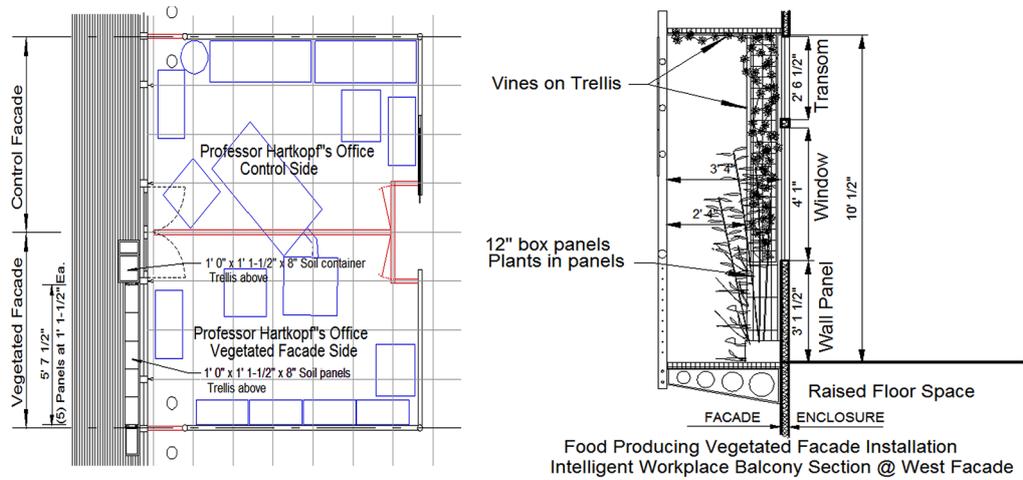


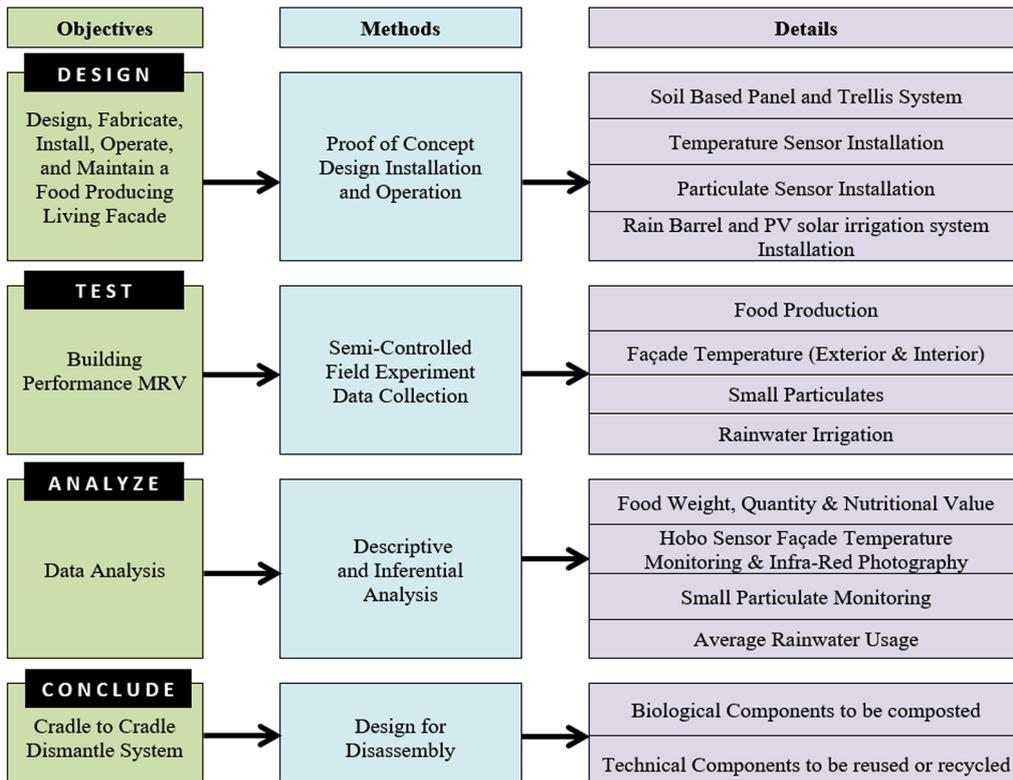
Figure 4. Food producing living façade installation, Intelligent Workplace west façade elevation

The IW is a 7,000 square foot living and lived-in laboratory dedicated to the research, demonstration and development of building systems integration for increasing energy efficiency and environmental effectiveness within the built environment. It is designed to be a flexible platform for building systems research and innovation, while occupied with faculty, staff and graduate student researchers (Hartkopf et al., 2005). The system was designed as a panel and trellis hybrid Living Façade system planted with food producing plants. The west

façade research bay elevation and floor plan show the research façade and control façade. The details drawings and step by step assembly and planting images illustrate the individual soil panels. The photo shows the south façade system in place.



The steps necessary to conduct this experiment were to design, test, analyse and conclude the system installation, operation, performance, and disassembly, outlined in Table 4 below. The aim of this research study was to measure, record and verify performance, comparing the field data results to existing research and contributing original results not previously collected or recorded. The four sections that follow outline the data sets, analysis methods, and results that confirm food producing living façades contribute measurable food production, heat gain reduction, air quality improvement and rainwater redeployment.



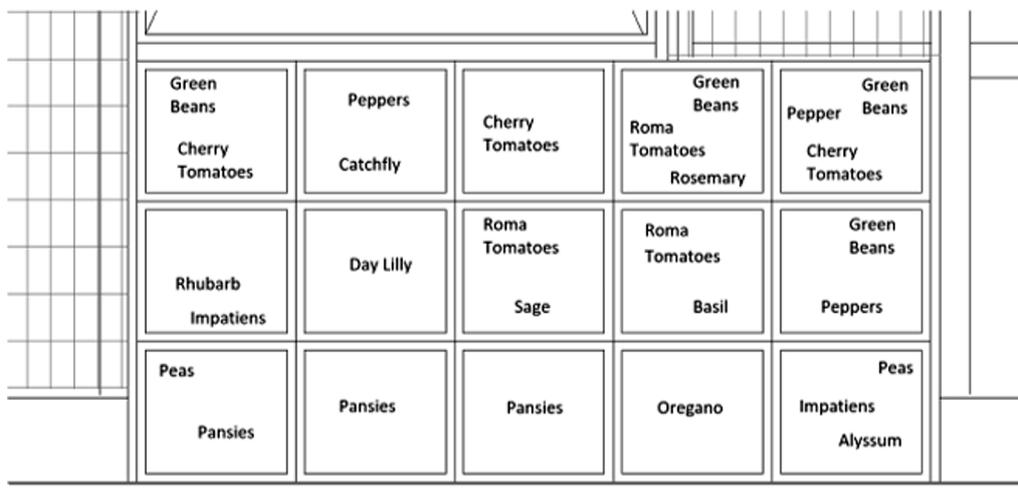
**Table 4.** Conceptual Diagram of Research Objectives, Methods and Details.

**FINDINGS/RESULTS**

**Food Producing Living Façades – Façade fruit and vegetable production**  
**Food Producing Living Façades generate an average of 2 kg/m<sup>2</sup> of nutrition per growing season.**

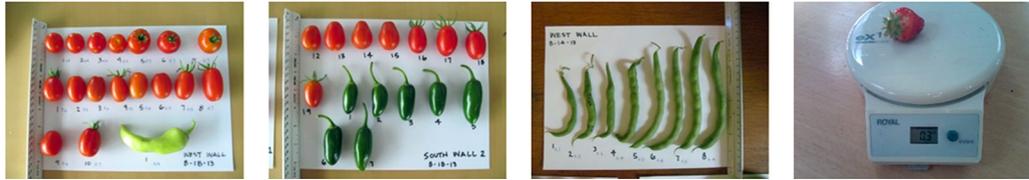
The primary hypothesis of this dissertation is that building façades can produce measurable amounts of fresh produce when updated with living façade assemblies planted with food producing plants. Quantification of fresh produce harvested from the south and west façade research installations was systematically documented to test this hypothesis. The same number and type of food producing crops planted on both façades each year included:

- 6 Cherry Tomato plants
- 6 Roma Tomatoes plants
- 2 Heirloom Tomato plants
- 6 Sweet Banana Pepper plants
- 6 Hot Pepper plants
- 18 Green Bean plants



**Figure 8.** West façade planting diagram (May 2014).

Production was broken down by weight, quantity, and façade orientation. Replicability and fluctuations in productivity over the six growing seasons were captured and graphed as well. The goal was to quantify potential production levels attainable on a consistent basis with this type of system in this climate region, as well as to look at the potential for variety in the production output of such a system, in terms of the diversity of potential future plantings. Vegetables, herbs, and fruit grown on the living façade system were harvested as they ripened. Every vegetable and piece of fruit, and small bundles of herbs, were arranged on single letter sized (8.5" x 11.5") sheets of white paper, numbered and then weighed. Each sheet of paper was photographed, and then weight and quantity were recorded in a spreadsheet database.



**Figure 9.** Fresh produce weight and quantity, measured, verified, and recorded.



**Figure 10.** Harvested vegetables and herbs.

There are several significant conclusions drawn from this 6-year experimental study that confirm that living food producing façades can produce an average of 2 kg/m<sup>2</sup> of nutritious fruits and vegetables for south and west orientations in the temperate climate of Pittsburgh (see Table 5).

- Food Producing Living Façades can produce a maximum of 2.64 kilograms/m<sup>2</sup> of fresh produce (0.54 lbs./ft<sup>2</sup>) and a six-season average of 2.04 kg/m<sup>2</sup> across south and west façades in a temperate climate.
- To achieve 400 grams daily of fresh fruit and vegetable, approximately 37 m<sup>2</sup> (400 ft<sup>2</sup>) of façade would be needed per person to provide for a nutritional diet that meets WHO standards, during the growing season.
- Food producing living façade produce showed similar nutrient levels as store bought produce, but will support local economies and reduce embodied energy – and tastes better.

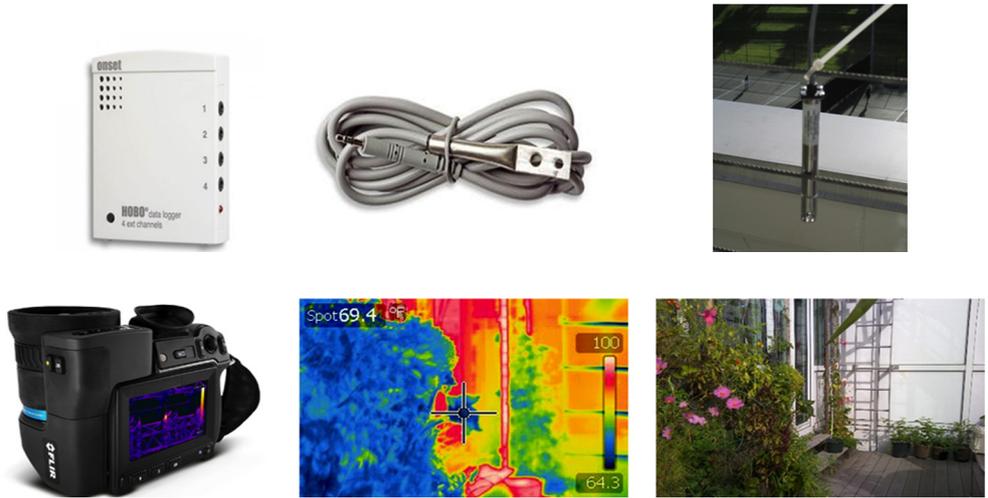
**Table 5.** Living Façade Food Production Totals by Weight per Unit of Area per Year.

	2013	2014	2015	2016	2017	2018	Avg
<b>Total West Façade Food Production (kg/m<sup>2</sup>)</b>	<b>2.66</b>	<b>1.61</b>	<b>1.82</b>	<b>1.34</b>	<b>2.61</b>	<b>1.56</b>	<b>1.93</b>
Total West Façade Food Production (lbs/ft <sup>2</sup> )	0.54	0.33	0.37	0.27	0.53	0.32	0.40
<b>Total South Façade Food Production (kg/m<sup>2</sup>)</b>	<b>2.51</b>	<b>1.41</b>	<b>2.70</b>	<b>1.70</b>	<b>2.68</b>	<b>1.91</b>	<b>2.15</b>
Total South Façade Food Production (lbs/ft <sup>2</sup> )	0.51	0.29	0.55	0.35	0.55	0.39	0.44
<b>Total Food Production (kg/m<sup>2</sup>)</b>	<b>2.59</b>	<b>1.51</b>	<b>2.26</b>	<b>1.52</b>	<b>2.64</b>	<b>1.74</b>	<b>2.04</b>
Total Food Production (lbs/ft <sup>2</sup> )	0.53	0.31	0.47	0.31	0.54	0.36	0.42

**Food Producing Living Façades – Façade surface temperatures reduction**  
**Food producing living façades reduce exterior façade surface temperatures 5.56°C-20.53°C (10°F-36.95°F).**

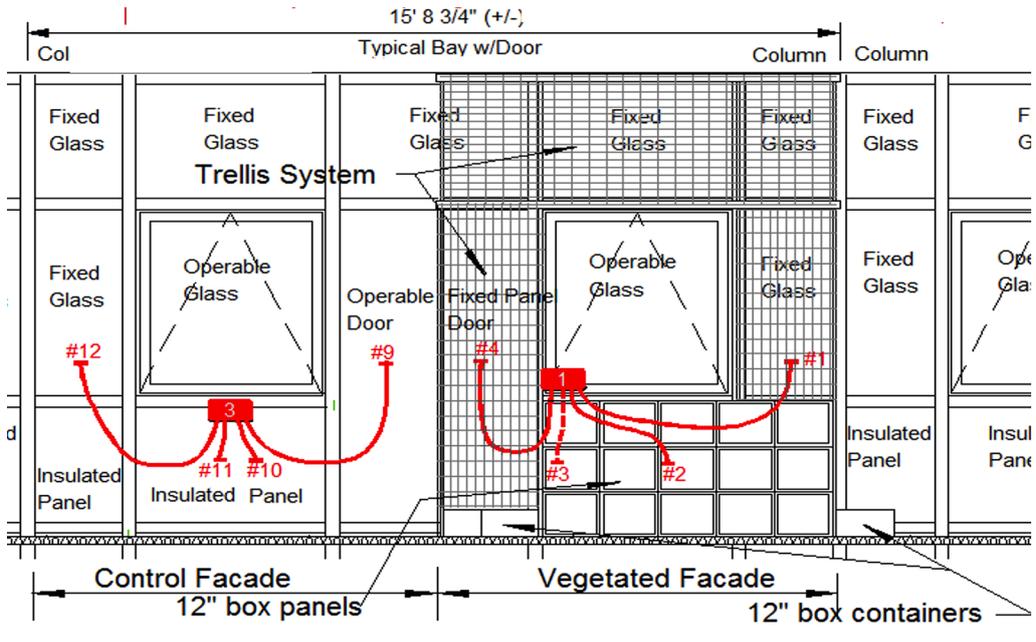
A second research question is that food producing living façades will measurably reduce façade surface temperature, compared to a control of that same façade, which in turn will reduce conductive heat gain and total cooling load. Temperature data was collected for the research and control façade areas over two one-week periods in August and September 2013 to show typical summer conditions.

- Air temp 1 meter away from west façade – indoors and outdoors (HOBO and Omega sensors)
- Exterior and interior surface temp - opaque west façade (HOBO U12 data logger and sensors)
- Exterior and interior surface temp - glazed west façade (HOBO U12 data logger and sensors)
- Thermographic Imaging of exterior façade (FLIR Thermal Imaging Camera)



**Figure 11.** Hobo U12 data logger, temperature sensor and Omega air temperature sensor.

**Figure 12.** FLIR T1020 HD Thermal Imaging camera, south façade installation photos.



**Figure 13.** Surface temperature sensor locations, Intelligent Workplace west façade elevation.

The opaque façade temperature measurements for the week of August 5-11, 2013, reveal a number of statistically significant findings:

- The average temperature differential ( $\Delta T$ ) during heat gain periods was reduced by 40% to 79% for the living façade compared to the control.
- Peak exterior façade surface temperature was reduced by 20.5°C (37°F) on the hottest day.
- At night, the living façade kept the façade surface temperature an average 4.74°C (3.77°F) warmer than the control façade as temperatures dropped below comfort.
- The food producing living facade reduced the length of heat gain periods for the living façade 23% to 94% on hot days.
- The length of heat gain periods was shorter for the control façade on the cooler days, due to the thermal lag of the living façade.

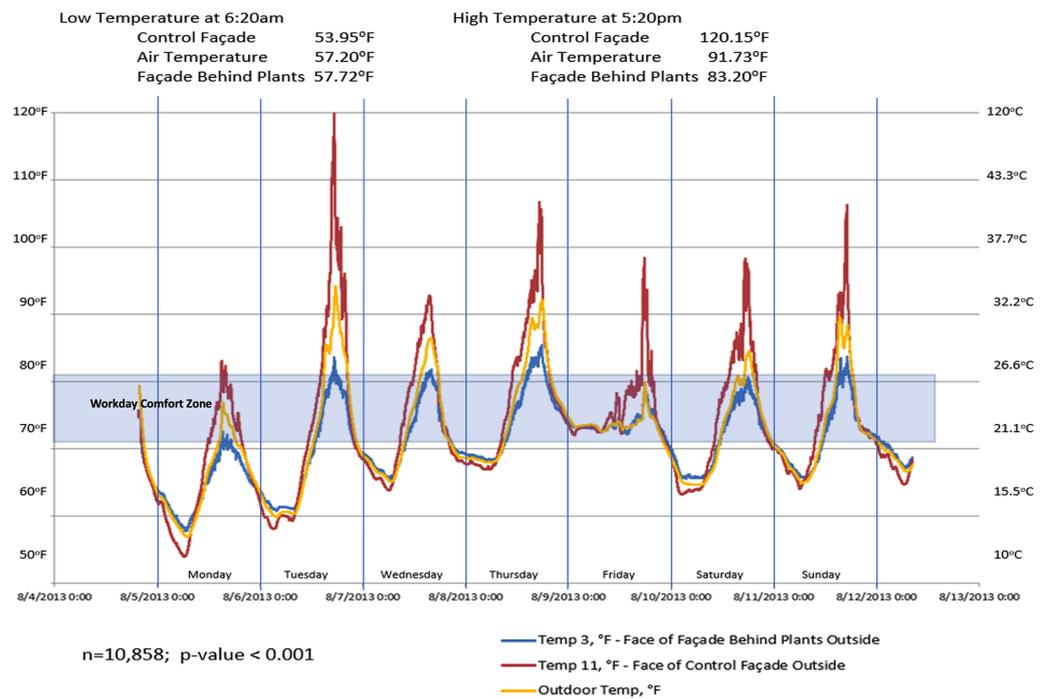


Figure 14. Exterior Opaque Façade Surface and Air Temperatures, Aug. 5-11, 2013.

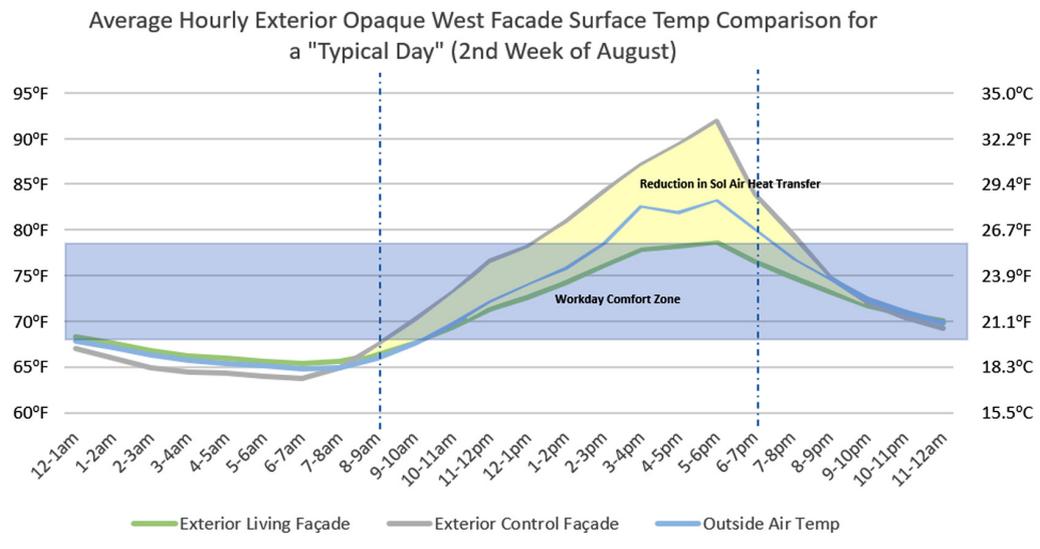


Figure 15. Average Hourly Exterior Opaque West Façade Surface and Outside Air Temperatures, "Typical Day".

To understand the implication of these temperature differentials for a buildings cooling load, the hour-by-hour comparison of the temperature changes for an averaged typical summer day are shown in Figure 15.

On an averaged "Typical Summer Day" living façade temperatures never exceed the comfort zone upper limit of 25.6°C (78°F), while the control façade exceeds the comfort zone from 1 to 8 pm. The highlighted area between the exterior surface temperatures of the living façade compared to the control represent the potential contribution to the cooling load.

As a field research study in an occupied building, it was not possible to fully isolate the control and living façade test areas from the mechanical systems. However, the continuous minute by minute monitoring of interior and exterior surface temperatures for two summer weeks with a mix of sun and overcast days allowed for a statistically significant profile of surface temperatures and temperature differentials to be developed for living façades in a temperate climate. Other researchers have identified that reductions in surface temperatures and temperature differentials correspond to a reduction in air conditioning loads of 20% (Stec et al., 2005) (Akbari et al., 2001) or greater, between 35%-68% in various cities globally (Alexandri & Jones, 2008).

### **Food Producing Living Façades – Air quality improvement via small particulate reduction**

**Food producing living facades generate 3.2%-5.6% reductions in  $PM_{2.5}$  at the exterior façade.**

The third research question on the value of food producing façades was the ability to reduce outdoor air pollutants. Measurement of air quality performance focused on small particulate levels ( $PM_{2.5}$ ) critical for improving the air quality of cities with high traffic and industrial pollution, such as Pittsburgh. (Figures 16-18). The small particulate data was collected with the IW Aircuity Optinet™ system that utilizes nanotube technology to take air samples every few minutes. Samples were pulled to a robust central sensor suite from locations on the exterior and interior of the façade.

Analysis of the exterior data for the entire seven-month period, from February to August 2014, revealed statistically significant but modest improvements in air quality due to the living façade.

- Over the monitoring period from February to August,  $PM_{2.5}$  levels were 3.2% to 5.6% lower at the surface of the living façade ( $p < 0.001$ ).
- Neither façade exceeds the federal National Ambient Air Quality Standards (NAAQS) levels of  $35\mu\text{g}/\text{m}^3$  over 24 hours, or  $15\mu\text{g}/\text{m}^3$  as an annual mean (USEPA, 2020).

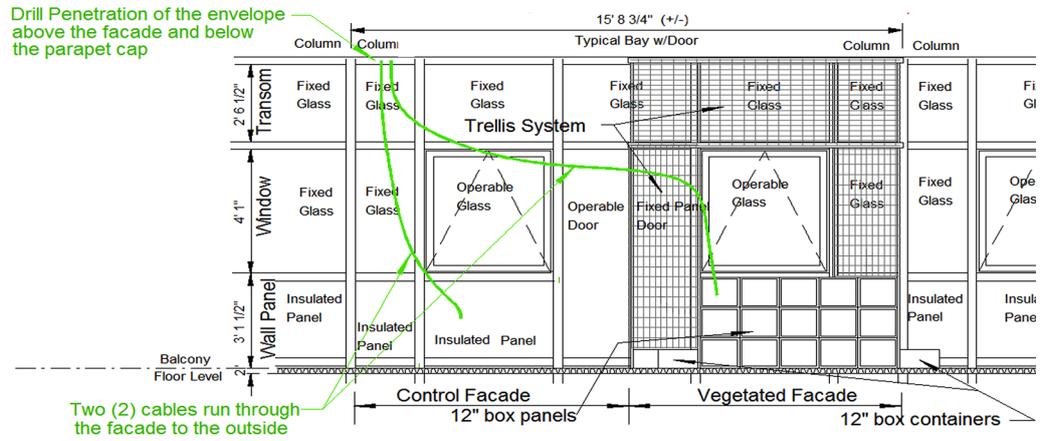


**Figure 16.**  $PM_{2.5}$  sensors @ control façade.

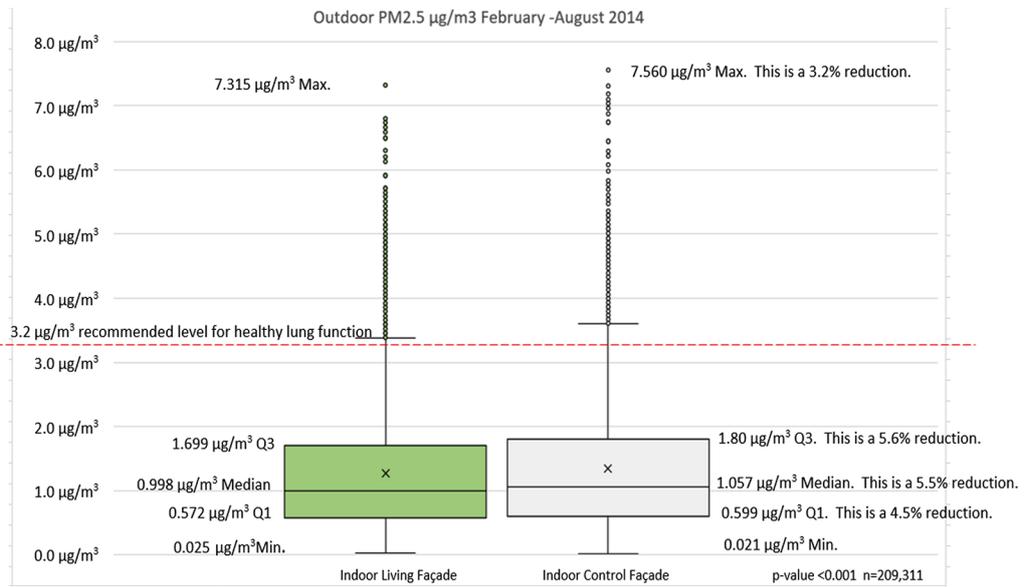
**Figure 17.**  $PM_{2.5}$  sensors @ living façade.

- Rarely does either façade exceed the American Lung Association's recommended level of  $3.2\mu\text{g}/\text{m}^3$ . (American Lung Association, 2020).

**Food Producing Living Façades – Rainwater Runoff Reduction**  
**Food producing living façades can absorb 14 litres of water per m2 per day.**



**Figure 18.** PM2.5 sensor locations @ living and control façades, IW west façade elevation.



**Figure 19.** Outdoor West Façade PM2.5  $\mu\text{g}/\text{m}^3$  at Living and Control Façades February – August 2014, n=209,295, p<0.001.

To benefit the significant number of temperate climate cities with challenges of storm-sewer overflow in heavy rains, quantifying irrigation water usage relative to surface area of food producing living façade is an important aspect of this study. The average irrigation requirements were measured in litres (gallons) per day throughout the growing season from May 1 to December 1, over six growing seasons. Irrigation for the living façade assemblies was integrated with rainwater capture and storage to address predictable periods of no rain. Since rainfall is never consistent, roof rainwater capture was stored in two 45-gallon rain barrels, with an overflow capability to the building drains. To establish water requirements of the living food producing façade, Echo EC-5 moisture sensors were attached to a HOBO U30 monitor system which triggered the pump to turn on and off as required, and established the optimum watering quantities for the remaining seasons (see Figures 20-22).

The pattern of readings for irrigation demand suggested that watering once every 24 hours was adequate for keeping the food producing plants sufficiently moist, but two days without irrigation caused the plants leaves to begin to wilt.



**Figure 20.** Irrigation system components.  
**Figure 21.** Hobo U30 Monitoring System.  
**Figure 22.** ECHO EC-5 Soil Moisture Sensor.

Although solar panels were added to power the pumps for the drip irrigation system, an uneven pattern of irrigation through the automated system led to an undesirable condition called “blossom end rot” on the bottom of the Roma tomatoes. As a result, daily hand watering of the system was implemented during the growing season.

The results are significant: Food Producing Living Façades in temperate climates can effectively redeploy 14.26 litres/m<sup>2</sup> (0.35 gallons/ft<sup>2</sup>) per day of rainfall for the 214-day growing season, from May 1st to Dec 1<sup>st</sup> each year (see Table 6) in the Pittsburgh climate.

This means that every 1 m<sup>2</sup> of living façade can absorb the rainwater from 5 m<sup>2</sup> of roof (54 ft<sup>2</sup> of roof), in combination with on-site water storage to address rainfall variability, significantly reducing stormwater runoff. In the Pittsburgh climate, rainwater Storage should be sized at 28.6 gallons storage per m<sup>2</sup> façade.

Research Installations	Area	Irrigation/Day	Irrigation/Day/Area
<b>West Façade</b>	1.39 m <sup>2</sup> (15 ft <sup>2</sup> )	18.9 liters (5 gallons)	13.60 liters/m <sup>2</sup> (0.333 gal/ft <sup>2</sup> )
<b>South Façade</b>	1.76 m <sup>2</sup> (19 ft <sup>2</sup> )	26.5 liters (7 gallons)	15.06 liters/m <sup>2</sup> (0.368 gal/ft <sup>2</sup> )
<b>Totals</b>	3.15 m <sup>2</sup> (34 ft <sup>2</sup> )	45.4 liters (12 gallons)	14.26 liters/m <sup>2</sup> (0.353 gal/ft <sup>2</sup> )

**Table 6.** Daily Irrigation Totals and Total per Unit of Area per Façade and Overall.

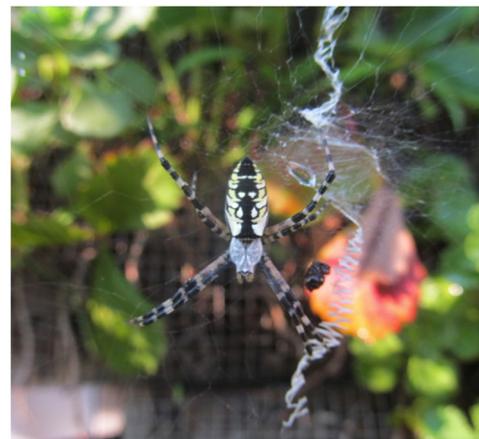
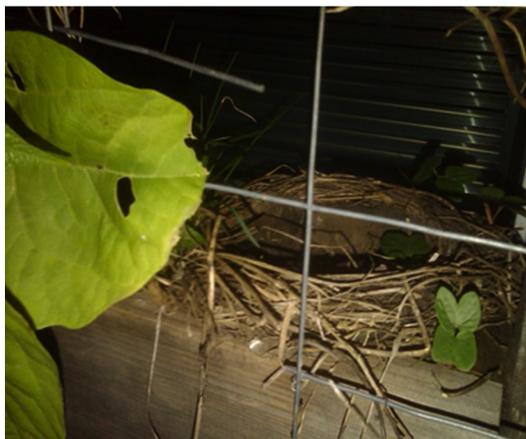
### Food Producing Living Façades - Increase Biodiversity

**Food producing living façades provided additional habitat where a mix of species were observed.**

Food producing living façades support biophilic advantages and biodiversity. The food producing living façades developed provided increased access to nature. Across the six seasons studied in this thesis, a variety of birds, spiders and insects were observed:

- American Robin
- Hawk
- Grasshopper
- Praying Mantis
- Yellow Garden Spider
- European Paper Wasp
- Northern Paper Wasp

Considering the extent of work and living environments that have no visual or physical connection to nature, in spaces too deep or too tall, the introduction of food producing living façades that bring full sensory experience to every floor is an important contribution to the quality of the indoor environment.



**Figure 23.** American Robin *Turdus migratorius*.  
**Figure 24.** Hawk Species Unknown.  
**Figure 25.** Robin's nest.  
**Figure 26.** Yellow Garden Spider *Agriope aurantia* bruary – August 2014, n=209,295, p<0.001.

## DISCUSSION

Throughout the United States and around the world, major cities have been utilizing vacant lots and flat or low slope roof tops to develop urban farms, education programs and jobs training to support this expanding sector of urban agriculture. The surface area of urban building rooftops is only a small proportion of the overall area of the building façade on multi-story buildings. Transforming building façades into food producing vertical gardens would, in effect, create “new land” drastically increasing the area for food production within the urban environment.

Food Producing Living Façades could provide the 400g/day of fresh vegetables needed per person to 8-10% of the occupants of a residential or commercial building floor, entire building, or group of buildings, during the 214-day growing season in Pittsburgh. Application of the food producing living façade to three façades of the IW (a single-story building) would yield 190Kg's (832 lbs.) of produce. This is enough to provide 400g/day of fresh fruit and vegetables for 2 individuals out of 22 occupants or 9% of that population.

Application of the food producing living façade to all four façades of Donner House (a six-story building when renovated) would yield 1,756 kg's (3,720 lbs.) of produce; enough for 20 individuals out of 239 occupants to meet their nutritional needs or 8.4% of that population. When applied to thirty-three buildings of the same scale on campus, the yield would be 57,912 kg's (122,779.80 lbs.) of produce; enough for 676 individuals out of 6947 occupants or 9.7% of the campus undergraduate population.

Application of the food producing living façade to 70 ten-story Buildings in Downtown Pittsburgh would yield 2,160,000 kg's (4,762,000 lbs.) of produce. This is enough for 25,000 individuals to meet their nutritional requirements out of 15,060 downtown residents or 168% of that population, or out of 457,000 workers downtown or 5.5% of that population. When applied to 25% of commercial building façades in the United States, 186 million m<sup>2</sup> of façade, would yield 490,528,050 Kg's (1 billion lbs) of produce which is enough for 5.7 million individuals to meet their nutritional needs out of 64 million working professionals in the U.S. (DPE, 2020) or 8.9% of that population.

**The annual production from food producing living façades could meet 8-10% of the nutritional needs of the population locally, nearly equal to the 9-12% of Pennsylvanians who are food insecure.**

Food Producing Living Façades could absorb 0.003 inches of rainfall per m<sup>2</sup> of roof per day for each m<sup>2</sup> facade throughout the 214-day growing season in Pittsburgh. Application of the food producing living façade to three façades of the IW (a single-story building) would absorb 465 gallons per day over 122.25 m<sup>2</sup> of facade (3.8 gal/m<sup>2</sup>) utilizing 100% of the rainfall on the IW roof per day (on average). Applied to all four façades of Donner House (a six-story building when renovated) would absorb 4,902 gallons per day over 1,290 m<sup>2</sup> of facade utilizing 100% of the rainfall on the IW roof /day.

**The annual rainwater absorption from food producing living façades would utilize 100% of rainfall falling on roofs of buildings with extensive living façade installations.**

This research study was limited by the variability in plant availability, due to seasons fluctuations in the local retail supply of horticultural plant starts. Additional limitations of the study included the inability to control for variables such as the unique geometries creating installation configuration differences between the south façade at the lower roof deck, without automated solar shading louvres, and the west façade at the balcony, at the same level as the interior floor level, which did feature the automated solar shading louvres. A multi-variable air quality analysis was not conducted to limit the complexity and quantity of the variables collected to a singular focus on small particulates (PM<sub>2.5</sub>).

## CONCLUSION AND RECOMMENDATIONS

There are a number of areas that could become the focus of future research immediately if funding was available now. The research results presented here provides a baseline of data in the areas of urban food, heat, air and water, upon which numerous future research studies could expand. Maximizing food production for specific species and demographics to address food insecurity tailored to specific regional and cultural tastes is a great area for additional investigation. Investigating vegetation variability for shading, including maximizing leaf area index (LAI), dynamic bioshading, and total cooling load calculations, in both energy simulation modelling and field verification is an important area for additional research. Design development of a commercially

viable, modular, food producing living façade system with integrated irrigation, closed loop water applications, including aquaponics, and automated operation with building robotics and controls could elevate this approach to the scale of urban vertical farming.

In addition, full scale human health implications related to reduced mortality linked to malnutrition, heatwaves, small particulate related respiratory health, and CSO's should be investigated at the community scale. Integration with ongoing initiatives such as the Pittsburgh Downtown 2030 District (2030 Districts Network, 2021), P4 Initiative (P4 Pittsburgh, 2021), the investigation of applications of the United Nations Sustainable Development Goals within Pittsburgh by Covestro and other industry partners (Covestro North America, 2019), and specific project applications such as in Aliquippa, Pennsylvania, as identified in an EPA USDA funded Local Foods, Local Places workshop in 2019 (EPA, 2020). There are existing opportunities to apply the baseline results from this dissertation at the local, state and federal levels right now. Each of these applications should be a field research project gathering appropriate performance data to verify the results of this study. Applications at a large enough scale would reach a critical mass that would begin to change the energy and environmental performance of the built environment, replacing fossil fuel energy and materials, with biology and design intelligence, providing ecosystems services to urban populations.

## **ACKNOWLEDGEMENTS**

My sincere thanks go everyone who has helped me prepare this summary of my research dissertation. A version of this paper was presented as part of the 2022 International Conference on Sustainable Cities and Urban Landscapes.

In addition, I would like to acknowledge the critical support and efforts of my Dissertation Committee in completing this important research study; Chair Dr. Volker Hartkopf, Founding Director of the Center for Building Performance and Diagnostics in the School of Architecture at Carnegie Mellon University, Professor Vivian Loffness, FAIA, School of architecture at Carnegie Mellon University, and Dr. Patricia DeMarco, former Director of the Rachel Carson Institute at Chatham University.

Finally, I want to thank Dr. Valentin Kefeli, a microbiologist and plant physiologist who is also my mentor, colleague, and friend, as well as an original member of my dissertation committee, who was instrumental in guiding the ecological and architectural integration which is a hallmark of this study. This is a concept he termed phyto-architekton. The comprehensive experience and professional insight of this extraordinary team provided this research investigation with the advice, guidance, and inspiration necessary to keep toiling toward a successful conclusion.

### **Financial Disclosure**

The author declares that this study has received no financial support.

### **Ethics Committee Approval**

Ethics committee approval was not required for this article.

### **Legal Public/Private Permissions**

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions and organizations) during the survey, in-depth interview, focus group interview, observation or experiment.

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## Reading Mixed Buildings from the Perspective of Public Space: The Case of Zorlu Center

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### Abstract

Mixed buildings bring together different functional units scattered throughout the city and show their users a new face of public space under a single roof. While the spatial qualities that shape the architecture at the design stage offer goals that improve public life, they highlight the continuity of the urban fabric within contextual implications. Large-scale mixed buildings are strongly involved in the urban pattern as a building typology that is being applied and scaled up more and more day by day; with its large volumes in the combined parcels, it determines not only the quantity of its own areas but also the quality of the urban area. Mixed buildings should have a feature that is responsive to human movements, and that communicates through the public spaces they create, not with two-dimensional surfaces in the areas where they come into contact with the city. Living and moving spaces are shaped by architectural structures and systems. In this sense, architectural spaces prepare the ground for the formation of contemporary experience beyond visual interaction. In the study, the changing qualities in the relationship between physical architecture and thematic formations that shape the design of Zorlu Center were examined through spatial analysis. These analyzes made on mixed building designs and discourses, which are at the center of current discussions, have brought a different perspective to the phenomenon of public space in memory with site-specific shaping and design decisions, and an infrastructure that will allow the production of information for new designs has been constructed.

**Keywords:** Mixed Structure, Public Space, Spatial Quality, Living Center, Zorlu Center.

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**Received:** 04.10.2022 - **Accepted:** 09.02.2023

Şahin, F., & Sennou, Y. (2023). Reading mixed buildings from the perspective of public space: The case of Zorlu Center. *DEPARCH Journal of Design Planning and Aesthetics Research*, 2 (1), 39-62. <https://doi.org/10.55755/DepArch.2023.16>



## **Karma Yapıların Kamusal Mekân Perspektifinden Okunması: Zorlu Center Örneği**

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### **Özet**

Karma yapılar, kent içinde dağılmış olan farklı işlevsel birimleri biraraya toplayıp, kullanıcılarına kamusal mekânın yeni bir yüzünü tek çatı altında göstermektedir. Tasarım aşamasında mimariye yön veren mekânsal kaliteler, kamusal yaşamı geliştiren hedefler sunarken, bağlamsal çıkarımlar içinde kentsel dokunun sürekliliğini ön plana çıkarmaktadır. Büyük ölçekli karma yapılar gündün güne daha çok uygulanan ve ölçek büyüten bir yapı tipolojisi olarak kentsel örüntüye güçlü bir etkinlikle dahil olmakta; birleşik parsellerdeki büyük hacimleriyle sadece kendi alanlarının niceliğini değil, aynı zamanda kentsel alanın da niteliğini belirlemektedir. Bu tipoloji, büyük ölçekli kamuya açık alanları ve işlev çeşitliliği dolayısıyla kent kullanıcısının birçok kullanım biçimi için önemli bir çekim alanı oluşturmakta ve bir anlamda kentsel kullanımı da yeniden tarif etmektedir. Karma yapıların, insan hareketlerine duyarlı, kentle temas ettiği alanlarda iki boyutlu yüzeylerle değil yarattığı kamusal mekânlar yoluyla ilişki kuran özelliğe sahip olması gerekmektedir. Yaşanılan ve hareket edilen mekânlar, mimari yapılanış ve sistemlerle biçimlendirilmektedir. Bu anlamda mimari mekânlar, görsel etkileşimin ötesinde güncel deneyimin oluşumuna zemin hazırlamaktadır. Çalışmada, Zorlu Center tasarımına yön veren, fiziksel mimari ve tematik oluşumlar ilişkisinde değişen kaliteler, mekânsal analizler ile irdelenmiştir. Güncel tartışmaların odağında olan karma yapı tasarımları ve söylemleri üzerinden yapılan bu analizler, yere özgü biçimlenme ve tasarım kararları ile bellekte yer alan kamusal mekân olgusuna farklı bir bakış açısı kazandırmış, yeni yapılacak tasarımlar için bilgi üretimine olanak sağlayacak altyapı kurgulanmıştır.

**Anahtar Kelimeler:** Karma Yapı, Kamusal Mekân, Yaşam Merkezi, Mekânsal Kalite, Zorlu Center.

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**Alınma Tarihi:** 04.10.2022 - **Kabul Tarihi:** 09.02.2023

## INTRODUCTION

The spaces that aim to meet the social and cultural needs in different places on the urban scale appear with the feature of being packed into a box. The concept of a meeting place, a single roof where people can be together and symbolize their power, is changing and developing. Today, depending on the developing technique and technology, the use of mixed structures, in which different units are together, gains importance among the problems that are tried to be solved with sustainable approaches. What is perceived as innovative design today is not only reduced to the fiction of physical space. At the same time, the necessity of the building program to integrate with the urban space and direct the communities comes to the fore.

Human in order to survive, it must interact with the environment and other people in order to meet some of its social and physical needs. A person who changes his environment in line with different economic and social norms is affected by all the components surrounding him in every sense. Due to the social, physical, behavioural and psychological effects of mixed structures on users, planning and organization gain importance in order to predict a healthier society and a better quality of life (Şahin & Tavşan, 2018, p.842-847).

The main point regarding the reading of public spaces in the general perception of the city is that space should have semantic and usage qualities for the individual or society. In this context, the criteria that determine and reflect publicity lie primarily in the use of the space itself, and then in the relationship of use depending on the needs and conditions arising from the social structure. The ability of urban residents and users to identify with the space they live in depends on the qualities offered by public spaces. While well-designed and implemented public spaces contribute to the image of the city, they help to create more harmonious spaces (Şahin, 2011, p. 219). For public spaces to be lively hybrid zones, instead of neutralizing differences, they should be spaces that support the theme and cosmopolitanism (Demirtaş et al. 1996, p. 39-44). In addition to understanding why mixed buildings are public spaces, revealing their contribution to urban life are important as a problem area and approach to spatial formation and usage possibilities.

Mixed building designs, which started from the planning stage and brought to the usage stage, offer new living spaces to their users with the qualities they contain. Mixed building designs that provide the formation of an urban environment, integrates its own texture with the urban texture, with the preservation of local features and, if any, neighbouring settlements. Mixed buildings, which are designed with different theme features, ensure that the requirements are met in order to integrate into the city with their sustainable infrastructure (Şahin & Hoccoğlu, 2015, p. 1). With the opportunities offered, this building group should be examined in detail with its diversity of user potential, increase/decrease in density, and its symbolic aspect that introduces the city.

## DESIGN OF MIXED-USE BUILDINGS AND PUBLIC SPACE

Buildings with multiple functions, different capacities and serving different users are called mixed-use structures or multifunctional structures (Soja, 2000; Aslankan, 2014, p. 18). Multifunctional buildings appear as a building style imposed by the chaotic production style on modern cities. The need for production to come together with marketing and administrative functions is gradually starting to bring the buildings where these functions meet into urban life. These buildings

are presented as a single block in the chaos of the city, and sometimes as a site consisting of interrelated blocks (Derman, 1989; Bilgin 2006, p. 5-9).

In terms of people's mutual relations with their environment, people-human groups show different characteristics as they are under different and multifaceted conditions (economic, socio-cultural, historical-social, life process, personality and group characteristics, etc.). It is considered important to investigate the needs related to the space, which can be explained as a result of condition-ground, perception and behaviour. The needs that can be explained regarding the physical space, social and cultural environments of people can be examined in different scales such as the city, the city part and the city region within the theories of perception and behaviour (Çevik, 1991, p. 48).

Mixed-use buildings are defined in two categories within the physical criteria; Category 1; are monoblock structures in the city. These structures are generally located in city centres or close to the centre, where there is intense human circulation; next to shopping malls, office function, residence or hotel, hospital etc. It consists of adding different functions (Figure 1, 2).



**Figure 1-2.** Meridien (architectural design: EAA) and YDA Center (architectural design: YDA) monoblock mixed buildings views (Authors Archive, 2022).

Category 2; are the sites just outside the city centres and on the coast. Usually, the production function is added on these sites. Due to their size, production creates the need to spread out over several blocks. While these sites include wholesale groups and shopping centres in addition to production, office centres within the same group are included in the project in cultural and social functions. Mixed



**Figure 3-4.** Kuzu Effect (architectural design: EAA) and Torun Center (architectural design: EAA) mixed buildings views (Authors Archive, 2022).

buildings are buildings that meet the needs of the time and integrate with the urban fabric (Hoppenbrouwer & Louw, 2005, p. 967-983), (Figure 3, 4).

Mixed-use buildings form a city model with their different functions and sizes. These structures, which form a micro-city within the city, have recently been in great demand by the citizens. All kinds of needs are now met in these structures without wasting time. These requirements are related to each other, they are ground-breaking and they show transitive features (Bora, 2009, p. 65).

From past to present, building typologies have always emerged as a product of the context of the societies in which they were produced, as a part of their social life styles, they have been included in this context with a cyclical effect. As a contemporary building typology, mixed-use buildings are also a part of the pattern of events, situations and relations created by the contemporary metropolis as the ground on which the building typology is produced and by the social actors active in its production. In the modern world, metropolises, which are the heart of social life, are considered as important elements that shape the metropolitan area and therefore social life due to the volumes they increasingly occupy (Özoral, 2015, p. 1).

The residential function in the mixed building typology example is integrated with the other functions in the building; with the effects of consumption indicators that highlight brand value; offers the user a new modern lifestyle and social identity. The existence of the housing function also creates a core consumer mass that is there at all hours of the day. This positively affects the human circulation and economic mobility in the space (Bali, 2002, p. 122).

In many examples, the office function is designed with spatial variants. In a free market economy, where commercial relations are determined by private initiatives, the trust created by work offices in the market is an important determinant; for this reason, office units in typology are mostly marketed with an emphasis on prestige. In a modern world where working time and leisure time are separated with clear lines, a close single integrated structure creates a consumption-oriented free time user group. This situation makes an important contribution to economic mobility. (Noraslı & Doğan, 2020, p. 3).

Shopping centres, which are the counterpart of the trade function, constitute important urban attraction points in societies where shopping is constantly triggered, and leisure activities are associated with consumption-oriented activities. It appeals to a wide audience in terms of usage, and a variable consumer group from different socio-economic levels is in the domain of a comprehensive commercial cycle where items that are not needed are also constantly accessible (Şahin & Tutkun, 2007, p. 52-60).

Functions such as movie theatres, performance centres, entertainment and playgrounds, which are produced on the axis of entertainment and culture-art activities have recently found a place in the typology with an increasing momentum. These functions mean that the user can access both consumption-oriented and cultural leisure activities together by deactivating the transportation factor in the remaining time of the working time. This integration significantly increases shopping-oriented economic mobility as well as the direct income from entertainment functions (Şahin, 2008, p. 84-90).

In addition to accommodation services, which are the basic functions of hotels, they also include additional services such as food and beverage, sports and entertainment; usage characteristics of tourism functions that provide vitality

throughout the project; The fact that it offers accommodation to non-daily users is a very important trigger in terms of user volume. In addition, the presence of strong hotel brands in the building, which are recognized on the basis of society and identified with the perception of prestige, directly contributes to the public representation of the building operator and creates an urban attraction with brand associations (Varol, 2009, p. 43).

The fact that users from all walks of life make their own inferences and find alternative answers to their needs causes public awareness to come to the fore. The definition of the meeting zones where active and passive interaction comes together in mixed buildings, the spatial arrangement, the size-ratio formation and the grading of publicity depending on the support elements surround the new living centres (Şahin, 2011, p. 76). Constructed spatial qualities affect the meaning and causes of publicity in social organization. The meaning of the public space, which changes depending on the place and the social structure, causes it to be reinterpreted in the mixed structures designed in the concept of the city model.

Typological classifications to be made by considering the plan, number/type of focal spaces, spatial projections-floor connections, depending on the interior setting of the centres/squares/courtyards, reveals the qualities, usage density, activities, perceptual and semantic implications of the selected focal spaces (Berk, 1996, p. 93). The fact that mixed buildings have new meeting/living spaces and alternatives in terms of evaluating time increase the feature of popular space offered for citizens. In addition to the shopping activity, its users can gather, meet, wander, watch, learn, develop skills, etc. The qualities/alternatives of the actions presented reveal the distinctions of mixed buildings from each other and their stance/role at the point of urban continuity (Şahin, 2011, p. 76).

One of the requirements of being public is the existence of other people and being together with them, transforming the living space into a social space and social situations (Kruse, 1974, p. 105). Adaptation to physical and social conditions (actual, potential place of action) emerges when one feels peaceful, comfortable, reliable and at home. It can be considered as harmony-active adaptation that develops in the process of mutual relationship between those who live without alternatives or forced-passively and consciously with a natural adaptation to existing-given spatial and social environmental conditions (Çevik, 1991, p. 25).

People want to connect with the places they live in. Some of these ties arise from their habits or from the activities in the places. Experiences in public space create meanings that transcend time. If the resulting meanings are positive meanings that are pleasing to the user and create excitement, they become permanent by exceeding the instantaneous experience of the place and its environment (Rapoport, 1990, p. 236-238).

In mixed buildings, in addition to creating spaces with special functions, interior spaces that enable people to come together should be designed. Urban spaces should be maintained both inside the building and attention should be paid to the design of structures suitable for transforming the interior space into a physical, functional and social public space. Therefore; the development in mixed buildings depends on the development of urban public spaces. These spaces consist of physical-architecture, use-function related, social space-related qualities (Şahin, 2005, p. 172). Mixed buildings are put into practice with a design that excludes or does not exclude from the city, under the design

approach in which urban public spaces and their gradations are presented together. The spatial reflections revealed are of a nature that corresponds to the users and the elements found in urban spaces, and they provide support for the existence of publicity in meeting the needs (Şahin, 2011, p. 4).

Mixed buildings, which are constructed with thematic design approach, gain meaning by transforming the physical space concept brought by the system into social space. Building groups, which have been increasing in numbers recently in our country and abroad, are creating new environment-friendly living spaces. Architectural space organization integrated with the city can and should be developed with the participation of the citizens. In this context; Zorlu Center mixed-use complex, chosen as the sample area, stands out in terms of presenting the combination of prototype and qualified new living spaces for other public applications.

## AIM AND METHOD OF THE STUDY

The possibilities offered by alternative spaces designed with the physical architectural setup of mixed buildings are increasing. The uses of these centres in the vicinity of the city and in the urban public space features are similar. The social, cultural aspects and architectural formations of the places with the qualities they contain take the appearance of a part of the city due to the fact that people prefer these places and spend a lot of time at the point of the continuity of the city. The aim of the research is to examine the reflections of the urban public space related to the use of the centres without abstracting from the city, the interaction of social and cultural space integrity that we encounter with their separate location in the city, and the physical architectural aspect of meeting the needs under one roof. In the study, literature research, fieldwork/on-site detection, observation, photography and online interview with the designer (Emre Arolat-EAA) were used as a method.

**Literature Search:** A general literature search was conducted on the subject. Determining the physical and thematic space qualities adopted by Emre Arolat and Murat Tabanlıoğlu for their designs, Sketches, photographs, drawings, notes, seminars, thesis on the subject, books written and application-idea projects designed by EAA-TA offices until today were examined.

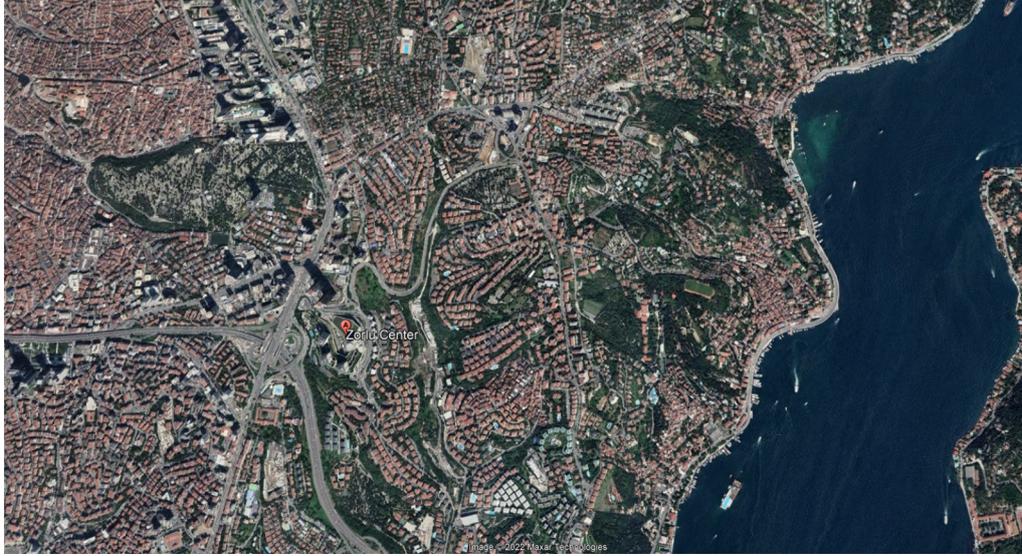
**Field Study:** At this stage, Zorlu Center's public spaces, in particular, are the common areas that are at the disposal of users from all walks of life and where alternatives are presented against their needs, form formations that enable them to be positioned in the piece-whole relationship, spatial order-syntactic setups, circulation-focus spaces, spatial closure-inside- external relationship and spatial reflections of other qualities that support the design have been determined in situ. Zorlu Center, which has been selected and examined on site by considering the differentiation of architectural space qualities it offers, its innovativeness beyond the ordinary, and original design thought, has been proven to be an effective example within the mixed structure function. The data obtained from the examined structure were interpreted by turning them into tables graphically for physical formation analysis.

**Interview with the Designer:** Questions were prepared to determine the qualities of the public space depending on the physical architectural space, and Emre Arolat (EAA) was interviewed on 03.06.2021 and 17.06.2021 in a digital environment using the online interview technique. The first interview was considered as a pilot study in order to determine the concept setup on Zorlu Center, where the fieldwork was conducted, and the physical architectural

formation analysis studies were directed with the data obtained in the second interview.

## PHYSICAL ARCHITECTURE AND THEMATIC STRUCTURE OF ZORLU CENTER

Zorlu Center is located at the junction of the Bosphorus Bridge Europe connection and the Büyükdere axis, which connects the city centre to the business district Maslak (Figure, 5), with a construction area of 720,000 m<sup>2</sup>, which was implemented between 2007 and 2014. The design of the project was done by Emre Arolat (EAA) and Murat Tabanlıoğlu (TA). Intellectual/intellectual approach concepts that support thematic formation include contradictions such as grandeur-modesty, public-private, institutional-local and social-exclusive (URL 1; URL 2).



**Figure 5.** Zorlu Center's urban location and view of road connections (Google Earth, 2022).

The reinterpretation of the hills identified with Istanbul, taking into account the structural and topographic concerns, brings different functional and social spaces to the design and turns into a building mass that integrates horizontally and separates from the vertical with the sub-base function offered for the towers rising above it. Four towers and five functional building groups are shaped within a courtyard/centre/square, taking into account the horizontal-vertical mass balance and human scale (Figure 6, 7). The squares of historical cities and the qualities of the surrounding buildings are thematically included in the design, and the structural framework is established over the sky and green arrangements (Arolat, 2021a).



**Figure 6-7.** Zorlu Center tower, shell formation and courtyard/centre/square (Authors Archive, 2021).

Zorlu Center, which gives an identity to the city in the formation of a symbolic structure, shows itself in the shopping centre with the change/transformation of alternative spaces and actions that are open to everyone, while the renewed usage feature of the mixed structure is increased (Figure 8, 9). While the spatial transitivity of the building complex is ensured between open floors and with planar urban spaces, the fact that it is the meeting point of people from all walks of life and reflects the spatial identity of the usage focus strengthens the perception of public space.



**Figure 8-9.** Zorlu Center shopping mall main entrance and indoor common area (Authors Archive, 2021).

The soft and green hill formation, which stands out in the design parameter, transforms into an urban balcony accessed by steps, facilitating the establishment of mutual audio/visual connection with the environment and inward-looking stepped planes, accompanied by the Bosphorus view. The relationship of the building complex with the city is supported by the formation of the courtyard opening to different heights, while inviting its users to its own atmosphere with surprise spaces (digital performance arts area, exhibition area, etc.) (Arolat, 2021b).

Zorlu Center offers many functions, consisting of a shopping centre, residence, office, hotel, performing arts centre, park, courtyard and urban balcony. The part-whole relationship of the physical architectural structure, which is a mixed structure, transforms into a social space, increasing its attractiveness/favouredness and preference for users. Although public and private use spaces are kept separate from each other, their connection with the place and its surroundings is in a holistic approach.

While socio-cultural activities and commercial areas are dispersed on different planes, its relationship with the park is ensured and the structure of the Bosphorus is reinterpreted. The roads coming out of the urban texture on the ridges of the Bosphorus open to green gardens, public/semi-public spaces, open/semi-open streets and show the contemporary urban feature throughout the building (URL 3; URL 4; URL 5; URL 6).

### **ANALYSIS OF PHYSICAL ARCHITECTURAL SPACE QUALITY**

The mass-space relationship, which is shaped in line with various approaches in architectural design, can be observed through physical dimensions and solution proposals. It is the design qualities of public spaces that reveal the healthy relationship between buildings and other components that make up the urban environment. These qualities constitute the city-specific pattern language

that enables the spatial and formal conditions of the city to be formed with a meaningful integrity. While designing new/different faces of publicity, the physical architectural features it offers are seen as effective in the quality of life of the society and include all kinds of physical, social, psychological and economic values that people need in the environment they live in. Many theorists researching the quality of physical architectural space construct their studies on perception and information processes. It is also stated that urban structures and their environments may change according to the perceptibility of the images of that place and the ease of coding them into spatial memory.

A group of comparator concepts and terms such as complexity, diversity, visual dispersion, perceptual richness, order, legibility, clarity and coherence come to the fore to describe the factors of physical architectural space-related qualities. While the search for spatial quality is based on differences that respond to needs, people are expected to be in public spaces in their daily activities and to perceive and transform the presented environmental data into a series of preferences. It is argued that architectural quality should be considered not only with its functional features, but also with many features that define it or make it meaningful because of its multidimensional and layered nature. The physical architectural spaces of urban public spaces can be read through qualities related to use-function and connected to social space. In accordance with the purpose of the study, spatial quality inferences are made from researches and analyses on physical formations and public spaces, and a method for understanding the form and getting to the essence of the building and space is revealed. In this context, the following sources were examined for the determination of the physical formation qualities that come to the fore in the design of Zorlu Center and the analysis methods.

- David J. Madden (2010). *Urbanism in Pieces: Publics and Power in Urban Development*
  - Jan Gehl, Birgitte Svarre (2013). *How to Study Public Life*
  - Jan Gehl (2010). *Cities for People*
  - Rob Krier (1979). *Urban Space*
  - Amos Rapoport (1977). *Human Aspects of Urban Form: Towards a Man-Environment Approach to Urban Form and Design*
  - Jürgen Habermas (1994). *The Structural Transformation of the Public Sphere: An Inquiry Into a Category of Bourgeois Society*
  - Matthew Carmona, Matthew Carmona, Tim Heath, Taner Oc, Steve Tiesdell (2010). *Public Places Urban Spaces: The Dimensions of Urban Design*
  - Stephen Carr, Mark Francis, Leanne G. Rivlin, Andrew M. Stone (1992). *Public Space*
  - Miodrag Mitrašinić, Vikas Mehta (2021). *Public Space Reader*
  - Ali Madanipour (2003). *Public and Private Spaces of the City*
  - Mattias De Backer, Lucas Melgaço, Georgiana Varna, Francesca Menichelli (2016). *Order and Conflict in Public Space*
  - Quentin Stevens (2007). *The Ludic City: Exploring the Potential of Public Spaces*
  - Jostein Gripsrud, Hallvard Moe, Anders Molander, Graham Murdock (2010). *The Idea of the Public Sphere: A Reader*
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From the definitions, explanations, examples and evaluations put forward by the authors who were researched to determine the techniques and qualities of physical formation analyses; form formation; deduction, addition, deduction and addition, division, integration are provided freely, but for mass analysis; spatial order, syntactic construct, circulation, focal spaces, spatial closure, interior-exterior relations and other qualities on the structures constitute the basis of spatial readings (Table 1, 2, 3, 4).

- **Formation of Form:** According to Ching (2002) the prime geometric shapes are triangle, square and circle. Other geometric shapes are considered to be variations derived from them. Applying different changes to the prime forms brings out the basic shapes (square, triangle, and circle) involved in architecture. Interventions to the form can be in the form of adding, deduction, or by combining the two for more comprehensive forms. In this case, it is known that in addition to the visual effects of the geometry used in the effect, the arrangement style and organization will also have a visual effect (Onat, 1991, p. 4).

- **Spatial Order-Syntax Construct:** Space is defined as a formal phenomenon related to the whole of architecture. Being able to perceive the space is seen as the easiest way to grasp and understand the structure (Gür, 1996; Demirkaya, 1999, p. 8). The fiction method designed to provide alternative responses to user needs, to differentiate and diversify the spatial organization and to match the content of the actions, provides the sequential space formation (Şahin, 2011, p. 221).

Architectural design includes the organizational process that presents spatial togetherness in an aesthetic, useful and durable way. Spatial experiences make the black box thoughts of the designer visible and help to embody and understand the fluidity of fictional space and shared products/objects. In the organization of space, besides the tools used by the designer, factors that will affect the designer and the process emerge (Dinçer, 2005, p. 37).

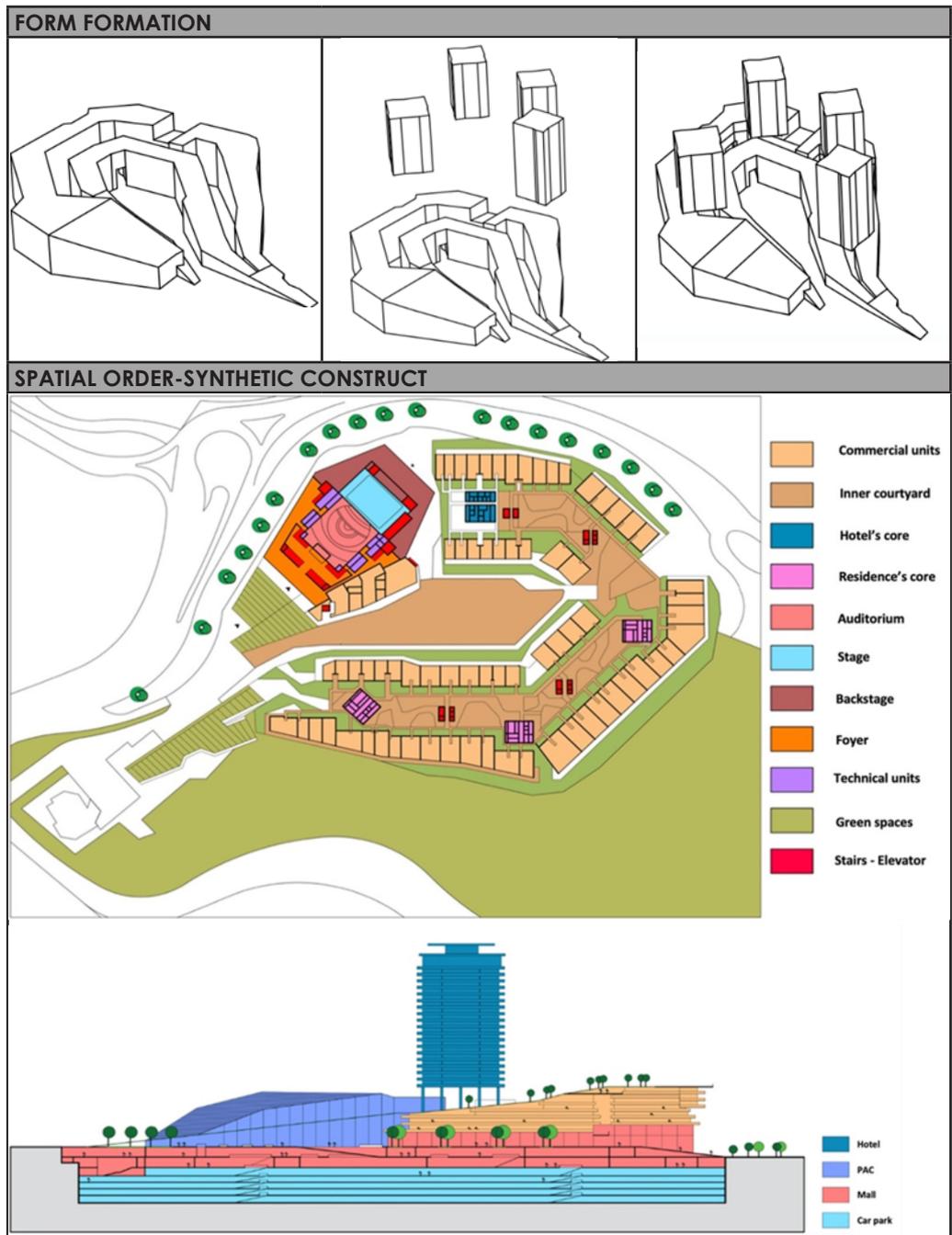
- **Circulation:** Circulation areas are an important component of the physical environment and exist semantically, formally and conceptually at every scale from city scale to building scale. Circulation areas connecting different spaces can be seen conceptually as well as physically, such as volume or surface (Ataoğlu, 2009, p. 19). The formation of circulation and the organization of space directly affect each other. Deciding on the shape of the circulation system, especially in buildings with complex functions, in a sense means determining the spatial arrangement of the building (Ching, 2002; İnceoğlu, 2004, p. 35).

- **Focal Space:** Focal points gain a new character with the transformation of the symbolic, formal and practical feature of a limited space into an operational/behavioral space. Elements and components that differ from the features of the environment and functionally central spaces are considered as focal points. The quality, quantity and diversity of the activities offered affect the intensity of use positively/negatively and cause the spatial patterns to differ (Şahin, 2011, p. 120).

- **Spatial Closure:** The fact that the space has the effect of closure makes the space easy to read and brings with it the effects of siege that surrounds and encompasses people. Determination is a basic character of every space; being there is considered as a basic type of environmental closure (Çevik, 1991, p. 24). In addition, among the factors that make a place an active and social place, the effect of the closure rate has a high value (Özdoğan, 2002, p. 89).

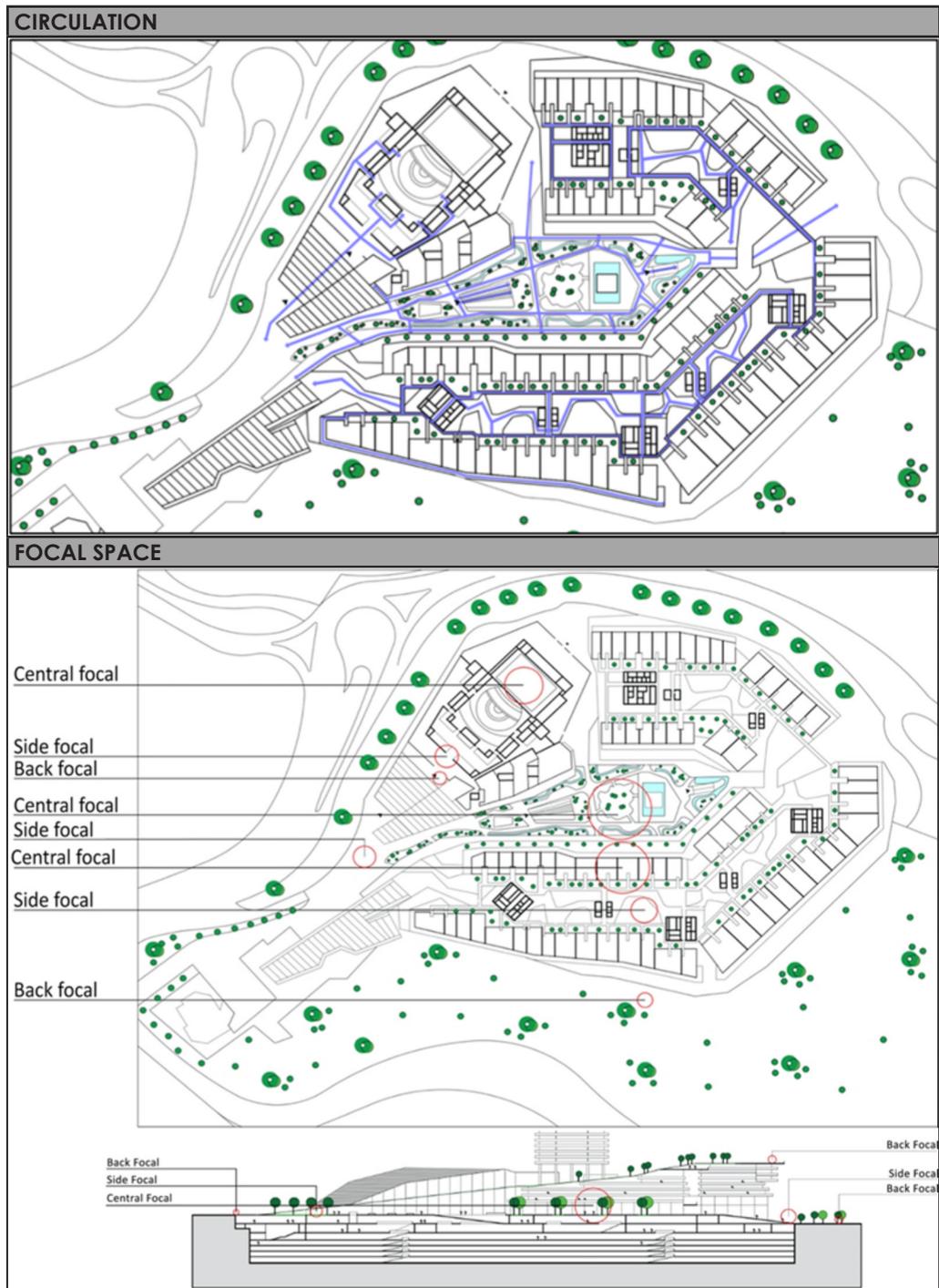
● **Internal-External Relationship:** Transparent covered interiors, which are a part of a building or building complex with a special function and open to outside users, make a direct contribution to urban life and constitute an important centre of attraction. They have more intensive programs in terms of spaces and functions. The building is sometimes more central and introverted to its urban location and function, sometimes integrating with a street or nature, creating an area of attraction (Ersoy & Sürer, 2002, p. 64).

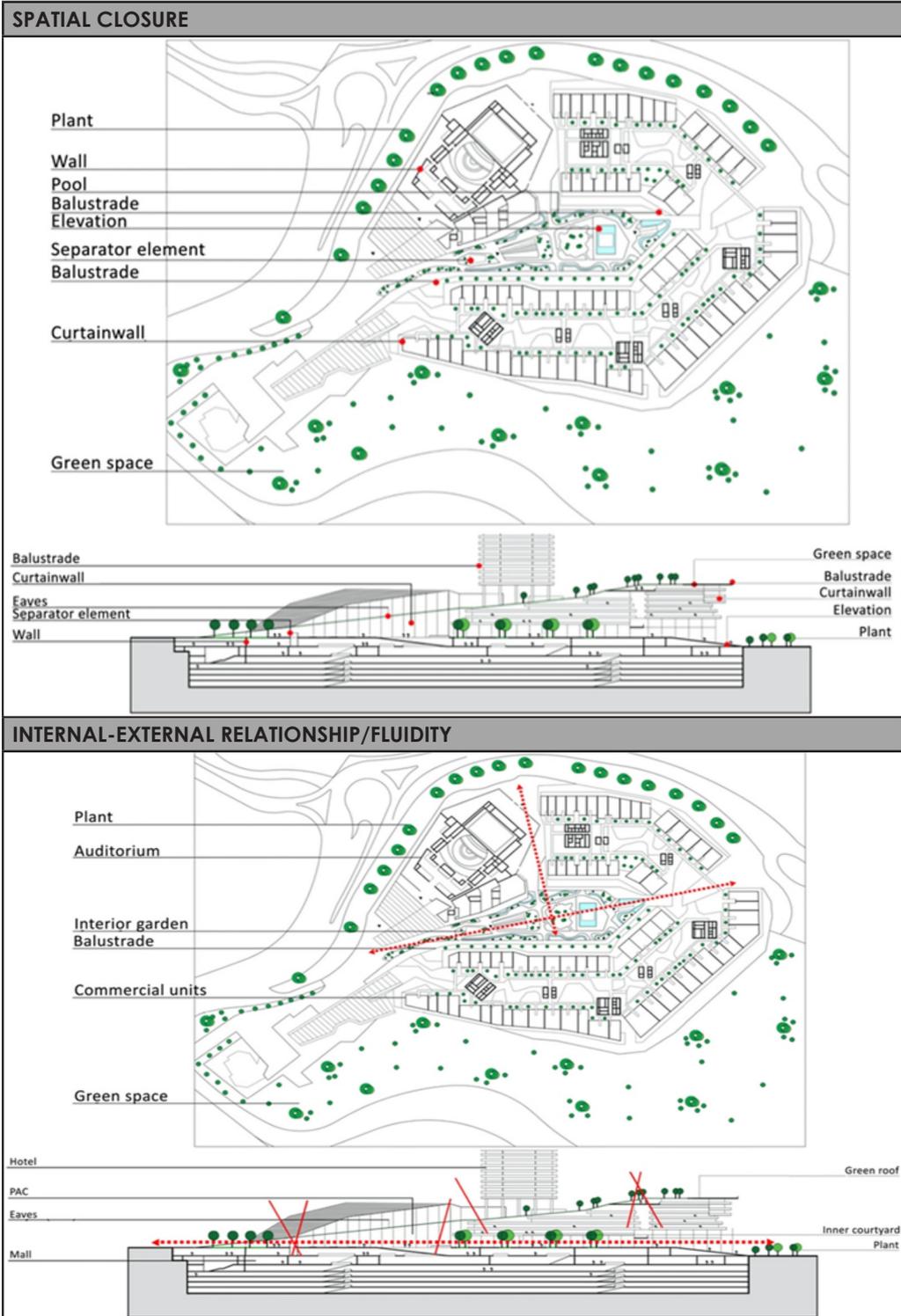
● **Other Qualities:** In the system of relations between action space, space and objects/items as action tools, fulfilling the space of realization in response to the different needs of users ensures that spatial quality is at the forefront (Çevik, 1991, p. 18). Other qualities; physical architecture is important in terms of determining and emphasizing the quality of the space and increasing its quality (Şahin, 2011, p. 66).



**Table 1.** Zorlu Center form formation and spatial order - syntactic construct analysis (Diagram/modelling was done by the authors).

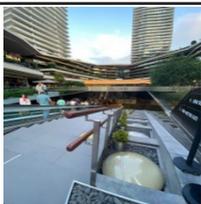
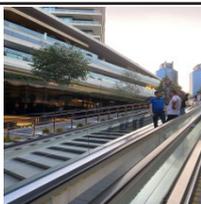
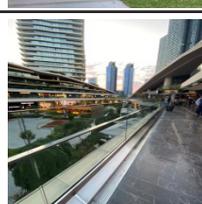
**Table 2.** Zorlu Center circulation and focal space analysis (Diagram/modelling was done by the authors).





**Table 3.** Zorlu Center spatial closure and interior-external relationship/fluidity analysis (Diagram/modelling done by the authors).

**Table 4.** Zorlu Center other qualities analysis (Authors Archive, 2021).

OTHER QUALITY			
WATER			
Pool	•		
Fountain			
Canal	•		
Natural			
GREENS			
Grass	•		
Flower	•		
Bush	•		
Tree	•		
LIGHTING			
Natural/Facade	•		
Natural/Roof	•		
Artificial/direct	•		
Artificial/Indirect	•		
HEIGHT DIFFERENCE			
Ramp	•		
Stairs	•		
Demotion	•		
Elevation	•		
COLOR			
Primary			
Secondary	•		
Hot			
Cold	•		
TEXTURE			
Natural	•		
Artificial	•		
Hard	•		
Soft	•		
MATERIAL			
Wood	•	Metal	•
Natural stone	•	Glass	•
Plastic		Concrete	•
Plaster	•	Composite	•
			

## FINDINGS AND EXAMINATIONS

In this study, in which the public space phenomenon of Zorlu Center, designed by Emre Arolat (EAA) and Murat Tabanlıoğlu (TA), is examined, the analysis of the physical architectural formations of the building has been completed and social space examinations have been made. The analyses in the studies were matched with the following headings; factors defining public space, form formation, spatial order, syntactic construction, circulation, focal space, spatial closure, interior-exterior relation/fluidity and other qualities.

- **Form Formation:** Structure emerges by making additions to a free form. The structure emerges by subjecting a free form to additions. The formation of a massive green plinth connected to the ground provides the separation of the 4 towers with different functions, while strengthening the relationship between the part and the whole and the visuality of the building. Horizontal and vertical linear continuity makes the movement between floors sustainable and legibility, while defining the green valley as a static space, which is offered as a common use area. While permeability is supported by different panorama presentations, protection of visual axes, use of topography and carrier system performance, physical accessibility, spatial diversity and architectural qualities directing the structure form the form.

- **Spatial Order:** Since the spaces surround an area and are arranged in a direction, the structure is seen to have a linear organization. While the functional separation provides fluidity in the indoor-outdoor interaction, which guides the spatial setup, specialized masses emerge with the formation of the core. While spatial gradations are arranged as closed, semi-closed, semi-open and open, the action-oriented organization is supported by the cover system and furniture. While temporal and seasonal changes affect architectural objects and green, instead of monotonous/customary spatial organization, design arrangements that contain various surprises/attractive/interesting designs facilitate living/experienced spatial transformation.

- **Syntactic construct:** The structure has various functions and is divided into two interconnected main masses. While the first mass serves the performance and art centre, the other mass contains the remaining functions. Entrances to the building area are provided from two opposite entrances, one of which is the main entrance. Both entrances are directly connected to the inner courtyard, which provides dispersion within the building. The performance and arts centre, which is close to the main entrance, first greets the users with the foyer. It then directs them to the hall sections on the ground and upper floors with vertical circulation. Passing through the inner courtyard, there is a transition to the shopping centre located on the lower floors of the building, and to the hotel and residence towers that provide entrance from the ground floor. There is a multi-storey parking garage under the building.

- **Circulation:** In this building, pedestrian circulation starts from the entrances and spreads to the inner courtyard surrounded by the building. After the inner courtyard, the circulation line extends to all spaces and units such as the hotel, residence and shopping centre by dispersing through the doors in all directions besides the performance and art centre. The presence of vertical circulation elements in various parts of the building provides convenience for users to reach different places.

- **Focal Space:** Various spaces such as the stage of the performance hall, sales units, hotel rooms and the inner courtyard, which provide the main functions of the building, are perceived as central focal space. While the foyer area of Performance Art Center, the entrance area of the inner courtyard and the social areas of the floors are the side focus spaces, the entrance areas of the building and the park are the back focus spaces.

- **Interior - Exterior Relationship/Fluidity:** Interior - exterior space connections are visually provided by glass curtain walls. The elements that completely separate the interior from the exterior are the roof, eaves and walls. The fact that the building is open to pedestrians from one side to the opposite side without

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interruption provides an important fluidity feature for the user. The visual fluidity feature is achieved with glass curtain walls and terraces on the upper floors.

• **Other Qualities:** There are many ornamental pools as water elements. Green areas are in the form of grass, bushes and trees in the interior and exterior of the building. The lighting of the building is naturally provided by the glass-surfaced façades. Artificial lighting is provided directly and indirectly. As elevation differences, the elevation is in the form of stairs and ramps indoors and outdoors. While predominantly (Primary/cold) black, white and (Secondary/cold) gray colours come to the fore in the structure, diversity is increased by choosing brown (Secondary/warm) and red (Primary/warm) in some materials such as wood. While green elements are used as natural soft texture in the building, hard textures are formed with material, elevation and structure repetitions. Mainly metal is used as material, glass in façades and balustrades, wood and composite materials are used in furnishings and ceilings.

Zorlu Center's creation of an intermediate transition zone to the city, the existence of data that will transform the traces between the past and the future into urban life, adopts the idea of developing a sustainable design. Starting from the relationship of the proposed public space pattern with the city to the building physics comfort conditions required by the new functions, it has been analysed through on-site observations/detections made at different scales and the following findings have been reached:

- Environmental compatibility
- Sample/quality editing guidelines
- Shaking the image
- Architectural permeability
- Quality living/living space setup
- Urban texture continuity and urban meeting/focus
- Urban courtyard/square/center identity
- Contribution to the functions, vision and city of the building
- Identification with the place
- An urban benchmark
- A building/space that can be defined as a landmark/symbol/sign
- A change/transformation that will thematically balance different spaces

When the pedestrian transportation possibilities and vehicle approach routes are examined, it is seen that the main transportation point of the land is arranged parallel to the E-5 highway and Büyükdere Street Road in Istanbul Zincirlikuyu. At the main entrance of the complex, it is aimed to transform the courtyard/square/centre, which includes the large public space, into a kind of sign/symbol that will enable it to be noticed by the commercial axis and performance art area, as well as from the immediate surroundings. The façade orientations with horizontal spaces, which transform the mass movements of the blocks on the shell into the identity of special structures, are supported by separate entrances.

The landscaping of the campus is continued under and above the shell, and the meeting of the pedestrian artery/street with the Bosphorus is presented in visual richness. The architectural shell, designed with the influence of general

architectural tendencies, turns into an intermediate layer for this mixed-functional complex. Right in front of the pedestrian entrance, which is arranged in different directions, there is a city balcony overlooking the sea, which does not show a gradual but parallel rise and opens outwards. It is considered as a thematic approach that the shell emphasizes qualified transformations instead of divisive contradictions. However, at some points, it is foreseen to benefit from a reverse working situation, in other words, to evaluate the potential of the shell. In this context, functions that cannot be integrated with a real public are equipped with vertical circulation units that bypass the shell and are raised above it. The four blocks, which establish a kind of piloti relationship with the shell, or rather aim to break away from the shell with the pilotis, are divided into office, hotel and residence functions. Lowering the level on the linear line with the entrance and courtyard increases the perceptual quality of the performing arts centre by providing linear continuity. In these areas, which create their own microclimate, without the need for any air conditioning, the experience of a tree-filled, airy and outside light is offered.

At Zorlu Center, attracting users to the public space and increasing the possibility of spending more time are made through the change of alternative functions (programs/functionality). By creating living spaces, it is seen that the urban public space is functionalised in accordance with the human life in the region and the purpose of the building. The variety and attractiveness, change (adventure, surprise, excitement), possibilities (relaxing, getting rid of daily troubles) offered in the courtyard/square/centre show the desired and desired usage space applications. Being the scene of social events and actions in connection with social identity in common areas; In addition to this, people come together regarding the power-space relationship. The qualities of being democratic, freedom of action, being demanded, developing talents, protection/security, being meaningful in the formation of social space transform the urban focus into interaction/communication space.

Since the Zorlu Center project is a mixed-use structure that can be used by everyone and responds to different needs, it transforms into a destination that creates living new public spaces rather than the system setup that offers introverted simulation of our age. Generally; the fact that it is sustainable at the human scale, with its mass distribution and recreation areas in different layers, and the balancing of flexible indoor and outdoor public spaces show that the building can also be used as a socialization tool apart from its functions. The importance of supporting each other in the physical architectural and social-social space qualities in the part-whole relationship of a complex that is compatible with its main functions and that the building can be an alternative focal/meeting point in the city comes to the fore.

## CONCLUSION

Mixed-use buildings support the thematic design setup with the alternative units and spaces they contain. These structures, which have or do not have an architectural concept depending on the location in macro and micro design scales, show a gradation at the point of integration into the city. Accordingly, the spatial qualities considered during the design phase shape the architectural structure of mixed-use buildings and enable the transformation of physical spaces into social and social spaces. Instead of looking at the Zorlu Center mixed-use building complex project from the perspective of constructing well-designed beautiful structures in the environment/ground; it comes to the forefront that it is the product of an idea/thought that prefers to use it to produce an opinion about people, the city and nature, and to develop an idea for establishing space.

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Accepting the courtyard/square/centre, which is one of the important parts of the project in common use, between the shopping mall, the performing arts centre and the green roof as the only public space of the age, emerges as an orientation that offers architectural permeability in this design, contrary to general current trends. In this context, it strengthens the concept of an open-top meeting centre by presenting a new typology for Istanbul while completely solving all the requested functions. Zorlu Center's mega-structure design distinguishes it from other mixed-building examples in that it gains textural continuity, symbolic value and identity in the urban context, and supports the user-oriented spatial search, without making any distinction between interior and exterior spaces, with unusual alternatives. It is understood that the main goal of the design is to create an alternative place that includes the potentials of outward expansions, urban balconies that integrate with the sea, and green spaces that work like lungs in the dense texture of the city. It can easily be argued that the public space fiction nature of this project constitutes the backbone of the design decisions.

Mixed Building Design, which includes Zorlu Center, residence, office, shopping enter, hotel, performing arts centre and recreation areas, reinterprets the concept of creating public spaces open to everyone inside/outside a shell, according to the changing needs depending on time. With its sustainable architectural formation, it carries the urban continuity into the building with the spatial qualities it offers beyond the urban wall/border quality, and prepares the ground for the indoor/outdoor space to be transformed into a public space physically, functionally and socially.

#### **ACKNOWLEDGEMENTS/NOTES**

This article is an excerpt from Youssef Sennou's Master Dissertation titled "Emre Arolat'ın Mimarlığı Üzerine Monografik Bir İnceleme (A Monographic Study on Emre Arolat's Architecture)", at Karadeniz Technical University Department of Architecture supervised by Lecturer Dr. Fatih Şahin.

#### **Conflict of Interest**

No conflict of interest was declared by the authors.

#### **Authors' Contributions**

The authors contributed equally to the study.

#### **Financial Disclosure**

The authors declared that this study has received no financial support.

#### **Ethics Committee Approval**

Ethics committee approval was not required for this article.

#### **Legal Public/Private Permissions**

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions, and organizations) during the survey and in-depth interviews

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## Physical Planning Approaches of Today's Cemeteries: Kayseri Asri Cemetery Case

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### Abstract

In this study, planning and design features of cemeteries were investigated by considering the development of cemetery concept in Turks and characteristics that determine the cemetery usage status and form were investigated. In the study, visitors' satisfaction degree of their visits to Kayseri Asri Cemetery in Kayseri City centre which is continuing to grow have been examined.

As a study area, Kayseri Asri Cemetery and the evaluation of the visitor satisfaction survey, firstly the compliance of the cemetery with the planning criteria was examined in general. The survey data of 384 people were analysed with the help of SPSS Statistics program, and the data obtained were presented in graphical form.

At the end of the research, some problems were determined in terms of design in parking lot, pedestrian and vehicle access, reinforcement elements, plant design in Kayseri Asri Cemetery. In addition, it is seen that the majority of the people of Kayseri do not want to spend time other than their use for visiting cemeteries. This situation was caused by the fact that the cemetery was not designed to include park and park-like areas and which may serve passive recreation.

**Keywords:** Cemetery Design, Cemetery Landscape, Cemetery Planning, Kayseri Asri Cemetery, Cemetery in Turks.

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**Received:** 05.08.2022 - **Accepted:** 14.12.2022

Moda, A., & Öztürk Kurtaslan, B. (2023). Physical planning approaches of today's cemeteries: Kayseri Asri Cemetery case. *DEPARCH Journal of Design Planning and Aesthetics Research*, 2 (1), 63-86. <https://doi.org/10.55755/DepArch.2023.17>



## **Günümüz Mezarlıklarının Fiziki Planlama Yaklaşımları: Kayseri Asri Mezarlığı Örneği**

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### **Özet**

Bu çalışmada Türklerde mezarlık kavramının gelişimi dikkate alınarak mezarlıkların planlama ve tasarım özellikleri incelenmiş, mezarlık kullanım durumunu ve şeklini belirleyen özellikler incelenmiştir. Çalışmada, büyümeye devam eden Kayseri kent merkezinde bulunan Kayseri Asri Mezarlığı'nı ziyaret eden ziyaretçilerin memnuniyet dereceleri incelenmiştir.

Çalışma alanı olarak Kayseri Asri Mezarlığı ve ziyaretçi memnuniyet anketinin değerlendirilmesinde, öncelikle mezarlığın genel olarak planlama kriterlerine uygunluğu incelenmiştir. 384 kişinin anket verileri SPSS Statistics programı yardımıyla analiz edilmiş ve elde edilen veriler grafiksel olarak sunulmuştur.

Araştırma sonunda Kayseri Asri Mezarlığında otopark tasarımı, yaya ve araç geçişleri, donatı elemanları, bitki tasarımı açısından bazı sorunlar tespit edilmiştir. Ayrıca Kayseri halkının büyük çoğunluğunun mezarlık ziyareti dışında vakit geçirmek istemediği görülmektedir. Bu durum, mezarlığın pasif rekreasyona hizmet edebilecek park ve park benzeri alanları içerecek şekilde tasarlanmamasından kaynaklanmaktadır.

**Anahtar Kelimeler:** Kayseri Asri Mezarlık, Mezarlık Peyzajı, Mezarlık Planlaması, Mezarlık Tasarımı, Türklerde Mezarlık.

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**Alınma Tarihi:** 05.08.2022 - **Kabul Tarihi:** 14.12.2022

## INTRODUCTION

In Turkish cities, cemeteries have many cultural, ecological and passive recreational functions as well as their physical and psychological effects such as religious functions, peace of mind and hygiene of the city. In European countries, the cemeteries were designed from this perspective and dealt as a priority issue in planning. Cemeteries are areas protected by special protection law, cannot be used for other purposes with the change of zoning plan and they are complementary elements of urban green texture (Özkardaş, 2010). Cemeteries are also large green areas that differ from their surroundings with their dense vegetation (Kumru & Özçalık, 2021) (Uslu, 1997).

This study is intended to investigate the graveyard visits and satisfaction degree of the visitors of Kayseri Asri Cemetery getting bigger in the centre of Kayseri City which is developing and lets in immigrants from the neighbouring cities and where agricultural lands and existing green areas are rapidly transforming into residential and commercial areas. The use of cemeteries in Turkey with the purpose of visit only differs from the west in this respect. This situation will be investigated on Kayseri Asri Cemetery in the study and in addition to the socio-cultural factors that make up this tendency of the users, physical planning approaches of the area and the attitudes of the users related to this will be examined on the sample area.

In the evaluation of Kayseri Asri Cemetery, which is considered as the study area, and in the evaluation of the visitor satisfaction survey, firstly the compliance of Kayseri Asri Cemetery with the planning criteria was examined in general.

Survey data of 384 people were analysed with the help of SPSS Statistics program and the obtained data were presented in graphical form.

### The Concept of Grave and Cemetery

Graves and cemeteries are the places that reflect the relationship between the beliefs of society and death (Uslu, 1997). The graves can be defined as the places where the organs and cadavers which completely lose their life functions are broken down by microorganisms in the soil and where there are collectively closed disintegration chambers indicating the burial place of the deceased in accordance with legal and religious rules at appropriate depths that will not harm environmental health.

When the meaning of the word 'cemetery' is examined in different languages, it is possible to have an idea about the attitudes of cultures about death. For example, the word 'cemetery' in English was derived from the old Greek word 'koimeterion' which means 'sleeping place'. According to Walter (1993), this concept was used because the body of the deceased was placed in the grave as if he were sleeping (Ak and Akıncı Kesim 2013). The cemetery is a place name derived from the word 'grave' with Turkish affix which means 'the place of visit' in Arabic. The fact that Koran (et-Tekasür 102/2) and hadiths contain the word 'ziyaret' (visit) affects the use of 'mezar' (grave) which is more common in Persian and Turkish in exchange for the 'kabir' (grave) in Arabic which means the place where the dead is buried (Bozkurt, 1988).

In all religions and societies, it is seen that cemeteries gain meaning with the influence of spiritual values and religious beliefs. The fact that cemeteries are the symbol of peace draws attention as a common point in all the meanings it has gained (Ching Goh & Earn Ying, 2020). In all beliefs, cemeteries are respected

and believed to give inner peace. Nowadays in some cultures, cemeteries are not regarded as dead burial area and passive green area only. They are open to tourism and has become a visiting area of the city and also they are used commercially or as open-air museum. In some areas they are away from the chaos and stress of the city and open green areas to breathe.

## THE EMERGENCE AND DEVELOPMENT OF CEMETERIES IN HISTORICAL PROCESS

It is believed that the first grave after the creation of the world occurred when Cain, the firstborn son of Adam and Eve, murdered his brother Abel out of jealousy, which was the first death case. In the incident in the verse of 27-31 of Surah al-Ma'ida of the Holy Qur'an, the sons of Adam made sacrifices to approach Allah (the god) but Allah favored Abel's sacrifice instead of Cain's. Cain killed Abel because of jealousy. Cain, who killed his brother, staring around without knowing what to do, saw that a crow buried the other crow in the ground and he imitated the same and buried the body of his brother by digging the ground. This event is similarly described in the Torah. In this context, it appears that the first grave occurred by burying the dead in the soil. During the Neolithic period in Anatolia, simple earth graves were found under the floors of the houses, in the settlements and in the caves. During this period, simple earth graves were found in settlements such as Çatalhöyük, Köşkhöyük, Yümüktepe, Fikirtepe, Pendik, Öküzini and Kuruçay. The simple earth graves found in the Öküzini Cave were generally surrounded by stones. It was found out that both Fikirtepe and Pendik Mound Late Neolithic settlements in the Marmara Region had funerary tradition within the settlement (Özterzi, 2011). In this period, direct burials were performed in terracotta cube graves and in marble or ceramic sarcophagi as well as in simple graves made of rubble stones. In addition, monumental tombs, which resemble a temple, gained the appearance of a small hill by carving the rocks, and different types and shapes of tombs such as tumulus graves were used. Clothing and food were also buried with the dead in the sarcophagus burial chambers. The belief that life existed after death especially influenced this type of burial. The burial patterns seen in the early ages changed over time with the factors such as religious beliefs, tradition, socio-cultural structure (Odabaş, 1992).

The graveyard areas created in Anatolia and in the world were built in some places in the form of shrine and immortalized the mortal human being handing down the next generations; and in some places they became the place of visitation of family and relatives in the form of modest monuments. Generally, in every society, the graves of prominent figures such as kings, monarchs, religious leaders, commanders and folk heroes were designed to be more ostentatious than other graves to transfer them to future generations. The grave of every society is the only structure that reflects the history, tradition and tradition of that society. When looking at the civilizations of the past, the tombs of important people give information about the history and tradition of that society.

Nowadays, due to the population density, the cemeteries occupy a large area in the cities and are designed to respond to the mortality rates in the cities. Although cemeteries are used for tourism purposes or as a visiting area in some societies, they should be designed as green areas which generally give peace and lead to spirituality.

The Turks, who ruled in almost every region of the world, especially in their main homeland of Central Asia, have had different procedures and customs to cherish the memory of the dead, which have become a tradition within the cult of the dead and with the influence of some ethnic groups during their settlements in various regions. It is possible to combine these procedures and customs in two

main groups: before and after the adoption of Islam by the Turks. However, even after the adoption of Islam, the procedures and customs formed before Islam are seen with some changes in some regions (Karamürsel, 2002; Aziz, 2013; Roux, 2012).

### Graves and Cemeteries of Turks Before the Adoption of Islam

Before Islam, Turks were subject to various beliefs such as shamanism, Tengrism, Zoroastrianism, Manichaeism, Hinduism, Buddhism. In addition, Tengrism and Islam are the basis of traditional Turkish religion. In addition to these beliefs, they were influenced by religions such as Buddhism, Christianity and Manichaeism which were common in neighbouring countries. However, these religions could not survive much among the Turks because the basic characteristics of these religions were not suitable for the social lives of the Turks, they only played a role in shaping the Turkish social life (İltar, 2003). The first information about the Turks' pre-Islamic belief systems is found in Chinese sources. The first information about the burial ceremony of the Huns in Chinese sources belongs to 3rd century BC. According to these sources, if the deceased was a noble, he was buried in a mausolea called "kurgan" by embalming (Figure 1); if he was not, he was buried in a simple grave with stones called balbals in the bedside (Figure 2) (Başkan, 1996). Kurgan is one of the oldest Turkish grave structures (Sağiroğlu Arslan, 2017



Figure 1. Example of old Turkish kurgan grave (Baytok, 2016).



Figure 2. Example of Balbal Grave Stone (Sadık, 2018).

Another feature related to Hun kurgans was the size of the kurgans ranging between 6 and 46 meters according to the type and number of items placed in the graves. According to the data of the 3rd Century BC, Huns did not have cemeteries with trees (Berkmen, 2016). The Shaman tradition, placing various items in the grave, continued after the adoption of Islam and traces of this were found in various parts of Anatolia (Saraçoğlu, 1950).

The Göktürks buried their dead in the ground. Then they put a tombstone indicating the gender, age and title of the deceased. The shape and dimensions of the stone varied according to the social status of the deceased. The gravestones of ordinary people were unpretentious and had an introductory text only. The tombstones of the rich were built in larger sizes (Uslu, 1997). These stones indicated the number of people who died as in inscriptions. Undoubtedly, the most famous one is "Bengütaş" which is also known as Orkhon Inscriptions belonging to Tonyukuk (BC 720), Kül-Tigin (BC 731) and Bilge Khan (Şağiroğlu Arslan, 2017; Şeker, 1999).

The Uighurs accepted Buddhism, but buried their dead in hills like the Göktürks and Kyrgyz did. The dead were buried in the pits under the mound. Heads were placed towards East or North (Saraçoğlu, 1950). Later, Uighurs built graves called "stupa" with a dome which were thought to constitute the foundation of the tomb and dome architecture seen in Anatolia (Figure3) (Tunçel, 1989). Kipchaks, the last nomadic tribe, erected statues facing the east in the graves in honour of the dead. A tomb with a sharp top or a brick tower and sometimes a house were built on the top of the tombs of the rich (Barthold, 1947).



**Figure 3.** Uighur Turks, an example of Stupa tomb (Di Castro, 2008).

Ahlat Tombs, which belong to 12th century Seljuk Period and covers approximately 210 acres of open land and which are also known as the largest historical Islamic cemetery of the Turkish-Islamic world, are sarcophagus tombs with huge "şahide" (gravestones) (Uslu, 1997; Karamağralı, 2018).

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1 Şahide: Head and footstones erected in a grave and decorated with writing and floral motifs (Persian)(Url2).

## Graves and Cemeteries of Turks After the Adoption of Islam

While the Turks accepted Islam, they knew how to reconcile their thoughts and traditions with Islam. For example, the old Göktürk, Uighur beliefs, thoughts and idioms remained unchanged, blended with Islamic thought. Today, many customs and traditions on death are based on pre-Islamic times. After The Turks were converted to Islam, they only adopted the style of burial in the ground (İltar, 2003).

In the periods before Islam, there was not a specific direction but the tombs were directed towards Qibla with the Islamic Religion. The body of the deceased was buried directly into the soil to allow getting into the soil as soon as possible. The tradition of erecting the tombstone continued with the Islamic religion, and the headstone and footstone were used to direct the tombstone towards the Qibla. The tradition of symbolizing the tombs of the great people started with the tomb monuments called dome in Karakhanids for the first time after Islam. The origin of the tomb form, which started in the Islamic period, is based on Shaman period "bark<sup>2</sup>". Ceremonies such as prayer and funeral prayer, which are required by the Islamic religion, were performed on the upper part of the vault while the dead was buried in the ground floor. The domes were turned into a tomb in the Ottomans. Thus, it is possible to say that pre-Islamic concepts exist with new religion and a different interpretation (Tuncer, 1991). During the Anatolian Seljuk period, the tombstones were generally made in the form of marble sarcophagus. There were also samples made of tile, plaster and wood. The tomb stones whose head and foot stones were made separately started in the period of Seljuk (Oral, 1949).



Figure 4. The examples from Ottoman tombstones (Mutlu, 2018).

During the reign of the Principalities and Ottomans, şahide (gravestones) types were enriched with different examples. On the head of these gravestones, as in the sarcophagi, verses, hadiths, poems, the name of the deceased and the date of death were written (Figure 4). The head stone was larger than the foot stones and gained importance in terms of decoration. It is seen that the name and history were sometimes written on the footstone. The footstones were sometimes left unadorned and sometimes decorated and crowned as headstones (Özkardaş, 2010).

2 Bark: The name given to the kurgans made of stone with roof covering. It is said that the Seljuk domes and the Ottoman tomb architecture were inspired by these barks (Berkmen, 2016).

In the Ottoman cities, cemeteries were almost like urban parks within the settlements. First of all, the graveyards were always established where the scenery was beautiful. For this reason, they were used as a visiting, resting and meditation place and also as a recreation area for the people of the city (Özkardaş, 2010). At the same time, because they were built within the settlement, the cemeteries played an important role in almost all the activities of the daily life as green spaces of the city where people dried the laundry, had a picnic under the big cypress trees in the hot afternoons in the summer and from time to time grazed their animals (Karaoğlu, 2007).

The cemeteries and "hazires" (burial area reserved for special people) occupied an important place in the topography of the Turkish cities and towns. The cypress forests formed by the cemeteries surrounding the main settlements, especially Istanbul, became a symbol providing a distinct beauty to the city. The hazires inside the city contributed to the city ecosystem as green spots in the settlement areas of the city with its trees (Eyice, 1996). Karacaahmet Cemetery, a good example in this regard, began to be established by Murat I in the 14th Century and fascinated foreign travellers for centuries with its impressive landscape. The cemetery, in which many bird species live and nest, has the appearance of a forest with various plants and trees like cypress, plane trees, laurel and nettle trees. Seyit Ahmet Creek and creek valley, which was a recreation area, were within the cemetery previously but they were removed later (İşli, 2001).

### CEMETERY CONCEPT IN MODERN TURKEY

In the Ottoman cities, cemeteries became areas where life was intertwined with death. During the bairams, weddings and circumcisions, they were places which were visited quite often for jogging and play for children, and resting and chatting for adults (Uslu, 1997). In this regard, the cemetery concept in Ottoman cities is different from Turkey today. In general, cemeteries are planned outside the city today. Those in the city were previously established outside the city but they later became areas within the city due to the urbanization as a result of population growth. The cemeteries are surrounded by the walls and fences that are isolated from living spaces around them. On the other hand, there is no doubt that much more plants were used in the old cemeteries than today's cemeteries. The tradition of planting trees on the tomb of the deceased, which was seen as a tradition coming from pre-Islamic beliefs in the Turks, continued after Islam. It is now seen that there are more trees and shrubs in the old cemeteries than newly planned and established cemeteries. Unfortunately, in the society where many traditions are forgotten today, such traditions have also been forgotten and lost. While the cemeteries were being built in our country, they became reinforced concrete structures which were embedded in the soil, covered with concrete plaques and one-meter-wide two meters long and one meter deep in blocks. The newly constructed cemeteries were surrounded by stones and standard-shaped marbles were erected on the head and even the water reservoirs that were previously used in the cemeteries for the birds were removed and turned into monotonous areas covered with cold concrete and marble. While most of the cemeteries in Turkey are under threat of abandonment and neglect, just some of them resemble a clean, tidy parks with flowers (Örnek, 1966). Unlike cemeteries in our country, cemeteries in America, Europe and Asia have become the areas used for recreational purposes. The cemeteries here are used as places without a surrounding wall generally, as an open-air museum where people get away from city noise and relax.

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## CEMETERY PLANNING AND DESIGN: KAYSERİ ASRİ CEMETERY

The cemetery planning includes the selection of the land with the appropriate size and characteristics and the design and implementation stages of the selected land depending on the population growth rate and mortality rate in the urban settlement. In addition, plans should be made with a flexible approach that can adapt to the character, change process and requirements of the city (Aktan, 1999).

Good cemetery planning and design can directly contribute to the city's landscape and ecosystem, and provide the preservation and transfer of tombs and cemeteries, which are the cultural and historical heritage of the city, to future generations. The planning of the cemeteries includes the evaluation of the demographic, socio-cultural and religious structure of the city, the analysis of the physical data and the identification of the problems, the projections according to the death statistics, the suggestion of alternative cemetery areas and the implementation of these selected areas and maintenance and repair of them.

Kayseri Asri Cemetery, which was established in 1952, is the largest cemetery of Kayseri Province with an area of 853.000 m<sup>2</sup> and consists of two parts: Eski Mezarlık (Old Cemetery) and Taşlıburun Cemetery. The part called Old Cemetery was not enough due to the increase in the population of the city in time, so Taşlıburun area was established and it still continues to expand in the direction of Hacılar district of Kayseri province. Kayseri Asri Cemetery (City Cemetery) is located in Hacılar district. It is centrally located as it is 3.5 km away from Kayseri Cumhuriyet Square in the city centre (Figure 5).

There are 9 main gates of the cemetery; 1 main entrance and 8 small entrance doors. In 2019, a pull-off was made at the entrance of the Old Cemetery, on Şehit Nazım Miralay street and a 1 km long area was cleared of traffic and turned into a parking lot, and also a parking lot of approximately 800 vehicles was established on the road.

Within the cemetery there are 1 newly built mosque (Figure 6), 1 masjid, 2 condolence areas, 2 ablution rooms, 1 cemetery service building and 1 sales unit. There is a morgue and a "gasilhane" (the place to wash the deceased) within the cemetery service building.



**Figure 5.** The Location of Kayseri Asri Cemetery (Original, 2019-Google Earth-2019).



**Figure 6.** Gen. Hulusi Akar Mosque and surroundings (Anonymous, 2018a).

There are few and smaller open-green areas around Kayseri Asri Cemetery. Two of these are university campuses, one is a recreation area and five are parking areas. The cemetery is a very large green area within the urban environment. According to Uslu (1997), the areas with a slope of 20% and above should not be selected while the graveyard planned and the slope standard should be 10% and below. In this context, before establishing the cemetery, Kayseri Metropolitan Municipality made area planning and performed terracing works where slope was high and made the area suitable for the cemetery facility. In areas with high slope, cemetery facilities at different elevations were established with retaining walls. This makes the contact and transportation easy in the cemetery.

Kayseri Asri Cemetery is very close to the dwellings and is within easy reach. There are 78 blocks in Old Cemetery and 50 blocks in Taşlıburun area. The plots were placed in the blocks steadily and suitable and equal distances were placed between the plots. The direction of all tombs in the cemetery was arranged in accordance with the Islamic Religion. The cemetery has 9 vehicle entrances and 7 pedestrian entrances including the main entrance. The main gate of the cemetery was renewed in 2019, thus entering vehicles, exiting vehicles and pedestrian entrances were separated from each other.

Graveyard walls and railings with appropriate height provide visual communication to pedestrians and vehicle users inside and outside the graveyard.

In the field research, there was no bicycle and motorcycle in the parking lot of the cemetery. Although parking problem was not observed in the whole area, it is seen that there was a parking problem in the 5th, 6th and 7th gates. There are 4.70 m wide main roads and 3.40 m wide byroads between the blocks within the cemetery. While two vehicles can pass side by side on main roads, this is unfortunately not possible on byroads. There are structural elements such as service building, mosque, masjid, toilet and ablution room, gasilhane, condolence places, sales units within the cemetery.

The equipment elements in the cemetery can generally be evaluated as follows: There is at least 1 fountain on each block in the cemetery. As a result of the interviews with the authorities of the cemetery, it was stated that the lighting was not used consciously and night lighting could create a security weakness at late hours in the graveyard area which was spread over a large area. There is no trash can on the main road and the byroads between the cemetery blocks and the plots. Those who visit the cemetery on hot summer days or those who come to the funeral, need seating elements in the shadow. Although there are signs

indicating the block number in the corners, there is no sign indicating where the blocks are located. Signs of hadiths and verses are seen on the main and byroads of the cemetery. The same hadiths and verses are often repeated in these plates with a certain concept.

As it was the first area to be established, the vegetation cover is denser and older in the Old Cemetery, with trees over 65 years old. Coniferous and broad-leaved trees in the cemeteries provided a forest view and enriched the image (Figure 7). Alee afforestation was performed in roads with broad-leaved species and shadow areas were formed along the way (Figure 8). Bushes were used especially among the graves and seasonal flowers were planted on the sides of the main road.



**Figure 7.** Gen. Hulusi Akar Mosque and surroundings (Anonymous, 2018a).



**Figure 8.** Road afforestation in Kayseri Asri Cemetery (Original 2019).

## THE SURVEY AND THE ANALYSIS OF THE DATA TO DETERMINE VISITOR SATISFACTION IN KAYSERİ ASRİ CEMETERY

A survey was conducted to determine the importance of Kayseri Asri Cemetery, which was considered as a study area, within urban open-green area systems that rapidly diminished with the urbanization in Kayseri and also to determine the recreational potential in the city and the satisfaction of the people of Kayseri from the Asri Cemetery. The surveys were conducted face to face at the weekend and on the eve and Eid al-Fitr (Festival of Breaking the Fast) when the cemeteries attracted the most visitors and in April, May, June in 2019.

The users of Kayseri Asri Cemetery and those who came to visit were identified as target groups in the survey. Asri Cemetery is used extensively by residents of

central districts of Kayseri. To determine the number of surveys, the sample size was accepted as 1.105.027, the total population of these three districts, and the number of the questionnaire was obtained as 384 from Kalıpsız (1981) formula.

$$n = \frac{Z^2NPQ}{ND^2 + Z^2PQ}$$

n = Number of questionnaires  
 N = Sample size (1.105.027)  
 Z = Confidence Coefficient (1,96)  
 P = Possibility of the feature being in the mass (0,5)  
 Q = 1- P (0,5)  
 D = The error to be accepted (0,05)  
 $n = \frac{(1,96)^2 \times 1.105.027 \times 0,5 \times 0,5}{1.105.027 \times (0,05)^2 + (1,96)^2 \times 0,5 \times 0,5}$   
 $= \frac{1.060.825,92}{2.762,56 + 0,9604}$   
 $= \frac{1.060.825,92}{2.763,52}$   
**= 384**

### Socio-demographic structure of the surveyed visitors

Among the visitors to the Asri cemetery, 27% of the respondents were women and 73% were men (Table 1). In the surveys conducted at different times, there were no female visitors who visited individually when there were no collective visits. It has been observed that the visitors who visit on the days except holiday eve and feast holidays are usually male visitors.

Gender	n	%
Woman	104	27
Man	280	73

Table 1. Gender rates of visitors

The age ranges of the surveyed visitors are as shown in Table 2. When the age range of 40 - 49 is taken as a middle age, it is observed that it is rarely possible to meet the visitors under the middle age except for the holiday eve and the feast holidays, and it is observed that the middle age and over age group generally participate in the cemetery visit regardless of the special days. It was observed that the visitors over the middle age came to the cemetery care during the week and spent more time around the cemetery.

Age groups	n	%
18-29	34	9
30-39	54	14
40-49	81	21
50-59	111	29
Above 60	104	27
Total	384	100

Table 2. Age groups of visitors

Since the cemetery visits mostly took place with the family on the special visit days, the marital status of the married people took place more in the survey. It is observed that the rate of married people is high since 77% of the visitors to the cemetery visit are middle-aged and older (Table3).

Marital status of visitors	n	%
Married	276	%72
Single	42	%11
Other	66	%17
<b>Total</b>	<b>384</b>	<b>100</b>

Table 3. Marital status of visitors

## Satisfaction analysis of the surveyed visitors

In order to determine the views of Kayseri Asri Cemetery visitors about the cemetery; questions were asked about the accessibility of the cemetery, the status of the parking lot, the status of the equipment elements, transportation within the cemetery, planting design, the status of the service buildings and the status of the cemetery again (Table 4). The answers show satisfaction grades 1 to 5 (1: very satisfied, 2: satisfied, 3: undecided, 4: not satisfied, 5: not satisfied at all).

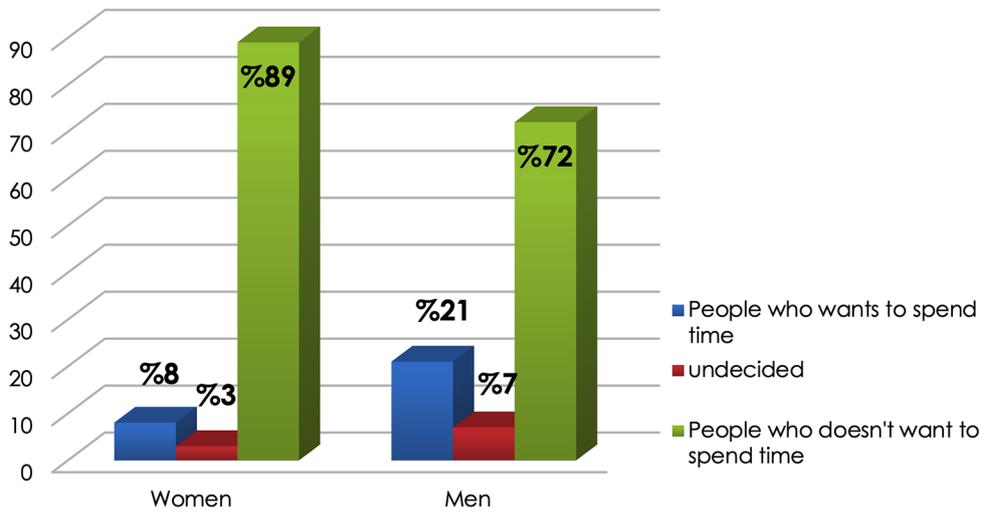
**Table 4.** The satisfaction graph to arrive cemetery

	1		2		3		4		5	
	n	%	n	%	n	%	n	%	n	%
Access to the cemetery	104	%27	184	%48	0	%0	84	%22	12	%3
Satisfaction in terms of parking	138	%36	192	%50	31	%8	23	%6	0	%0
Satisfaction in terms of bordering elements	31	%8	184	%48	100	<b>%26</b>	58	%15	12	%3
Satisfaction in terms of accessibility in the cemetery	35	%9	265	%69	8	%2	65	%17	12	%3
Directive signs	38	%10	204	%53	46	%12	92	%24	4	%1
Satisfaction in terms of quantity of fountains	77	%20	108	%28	23	%6	123	%32	54	%14
Satisfaction in terms of seating elements	19	%5	38	%10	54	%14	211	%55	84	%22
Satisfaction in terms of quantity of trash bins	42	%11	77	%20	42	%11	177	%46	46	%12
Satisfaction in terms of quantity of lighting elements	27	%7	38	%10	188	%49	96	%25	35	%9
Satisfaction in terms of block-plot arrangement	105	%27	200	%52	15	%4	54	%14	12	%3
Satisfaction in terms of planting design	169	%44	142	%37	8	%2	42	%11	23	%6
Satisfaction in terms of trees' providing shade	61	%16	111	%29	12	%3	146	%38	54	%14
Satisfaction in terms of Service buildings	154	%40	165	%43	15	%4	8	%2	42	%11
Satisfaction in terms of general organisation	58	%15	192	%50	50	%13	65	%17	19	%5

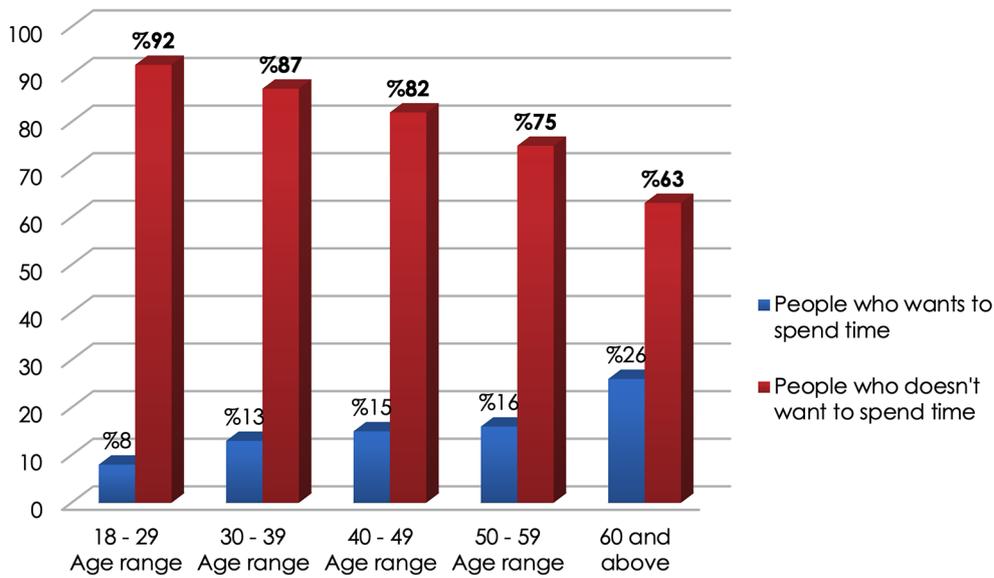
Apart from the purpose of visiting the cemetery, the visitors' wishes to spend time in the cemetery for purposes such as socializing, resting (passive recreation), staying alone with nature and turning to spirituality were questioned and the results are given in Table 5. This situation was investigated and compared according to gender in the graph in Figure 9, and according to age groups in Figure 10.

Willingness to spend time in the cemetery apart from a visit	n	%
People who want to spend time in the cemetery apart from a visit	65	%17
People who don't want to spend time in the cemetery apart from a visit	292	%76
I decided	27	%7
Total	<b>384</b>	<b>100</b>

**Table 5.** Willingness to spend time in the cemetery apart from a visit



**Figure 9.** The graphic of using cemetery apart from a visit according to gender



**Figure10.** The graphic of using cemetery apart from a visit according to age groups

Of the 104 female visitors surveyed, 89% (342 people) did not want to spend time except for the aim of visiting, 8% (31 people) wanted to spend time except for the visiting aim, and 3% (12 people) were undecided. Of the 280 male visitors surveyed, 72% (276 people) did not want to spend except for the aim of visiting, 21% (81 people) wanted to spend time except for the visiting aim, and 7% (27 people) remained undecided. It is also observed in the gender distribution of female visitors that the habits of visiting cemeteries are much less than that of men, except for special occasions. The main reason why women do not want to spend time except for the aim of visiting, is that the cemetery is not secure enough. Such problems make people feel unsafe in secluded and quiet places. Considering the nature of the green area, the cemeteries are among the other open-green areas and are the quietest areas after the forests.

In the survey conducted, 60% (230 people) of the 104 female visitors surveyed were satisfied with the general layout of the cemetery, 27% (104 people) were not satisfied, and 13% (50 people) were undecided. Of the 280 male visitors surveyed, 67% (257 people) were satisfied with the overall cemetery layout, 19% (73 people) were dissatisfied, and 14% (54 people) were undecided.

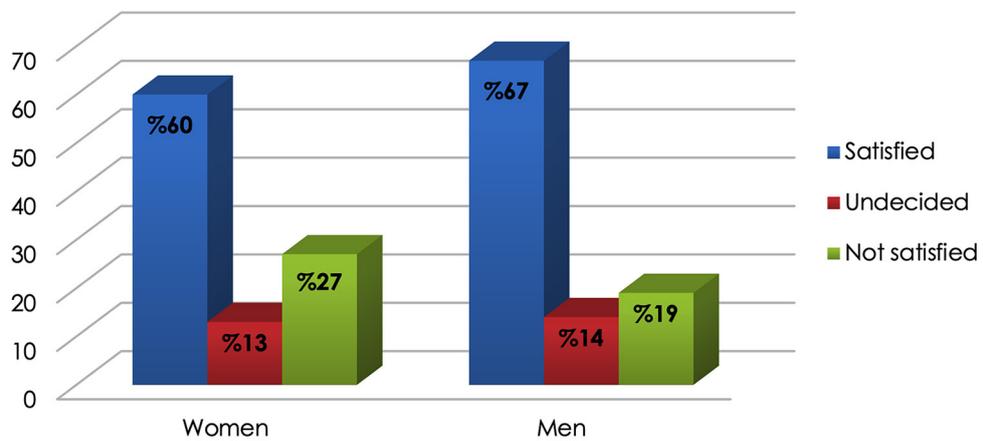


Figure 11. Satisfaction graphic with the overall layout of the cemetery by gender.

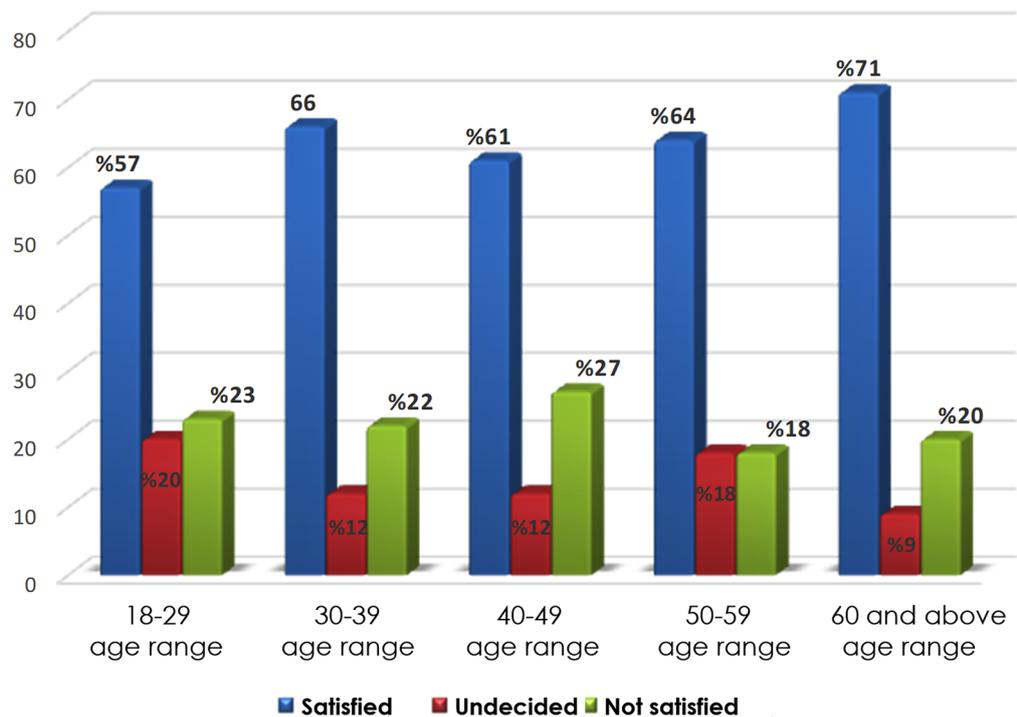


Figure 12. Satisfaction graph with the overall layout of the cemetery by gender.

Of the 35 visitors between the ages of 18 and 29, 57% (219 people) are satisfied with the general layout of the cemetery, 23% (88 people) are not satisfied and 20% (77 people) are undecided. Of the 53 visitors aged 30 to 39, 66% (253 people) were satisfied with the general layout of the cemetery, 22% (84 people) were not satisfied, and 12% (46 people) were undecided. Of the 82 visitors aged 40 - 49 years, 61% (234 people) were satisfied with the general layout of the cemetery, 27% (104 people) were not satisfied, and 12% (46 people) were undecided. Of the 110 visitors between the ages of 50 and 59, 64% (246 people) are satisfied with the general layout of the cemetery, 18% (69 people) are not satisfied and 18% (69 people) are undecided. Of the 104 visitors aged 60 and over, 71% (273 people) are satisfied with the general layout of the cemetery, 20% (77 people) are not satisfied, and 9% (35 people) remain undecided.

## CONCLUSION AND RECOMMENDATIONS

The Turks have been a society that love green in their cemeteries since pre-Islamic times and they have brought these features to the present day. The reason why this feature has survived to this day is that this behaviour corresponds to the Islamic religion. In Islamic religion, it is mushbooh (neither obviously haram nor obviously halal) to pick the living plants on the graves. According to Islamic belief, every living creature does Dhikr – remembers Allah- in different ways including plants.

As Karaoğlu (2007) points out, the cemeteries were the areas of urban parks within the settlement areas of the Ottoman Cities. First of all, the cemeteries were always located in places with the most beautiful views. For this reason, they were used as a visiting, resting and meditation place and also as a recreation area for the people of the city. Since the cemeteries were established within the settlement in that period, they also existed as living spaces and textures in daily life. After the Ottomans, cemeteries were positioned far away from the settlements and isolated from daily life being surrounded by high walls by Public Health Law in Turkey in 1930 and Cemetery regulations in 1942. Today, cemeteries have become quiet places where people visit on special occasions and holidays and don't like spending a lot of time. However, due to the rapid urbanization and the loss of the green areas, people have come to understand the importance of the values they have lost.

In this study a result of the surveys, it was discovered that the people of Kayseri were not willing to use the cemeteries as (passive) recreation areas, the majority of them did not want to spend time in the cemetery and did not want to use them except visits and funerals. When the users who did not want to spend time in the cemetery apart from the visits were evaluated according to their gender, it was observed that most of the women did not want to spend time in the cemetery apart from the visits. It was found that men were more willing to spend time in the cemetery than women, and those who were willing were retired over the age of 50. In Kayseri Asri Cemetery and generally in Turkey, the reason why people want to use the cemeteries for visit only is basically socio-cultural problems and design problems. These two problems are not independent of each other and changing the perspective of design can lead to changes in socio-cultural structure.

In this study, it was found that Kayseri people did not have any difficulty in reaching the cemetery, and since the cemetery was in the central position, they could easily arrive at the cemetery both by vehicles and on foot. It is free to enter the cemetery by car except for special occasions, so there is no need for parking lot. However, on special days, people need a parking lot because

there is no entry for vehicles on those days; but this need is met with the car parks established inside and outside.

Visitors can go to each block of the cemetery by car and can easily reach the tombs through the pedestrian roads. While the main roads of the cemetery are large enough, on the side roads it is not possible for vehicles to pass side by side. The plot layout of the Asri cemetery within the blocks is quite regular. The satisfaction level of the visitors was found to be quite high, but the fact that the arrangement of the cemetery blocks is not in order causes confusion and makes it difficult to find the graves. Even if someone who comes to the cemetery for the first time knows the grave, the block and the plot, it is not so possible to find the blocks apart from the first 20 ones since there are no directive signs or there is not a sign with cemetery plan.

The most disturbing thing for the visitors in the cemetery is the lack of reinforcement elements. Visitors find fountains, rubbish and seating units inadequate. There is no specific distance and planning between the fountains and they are positioned randomly. No trash can be found inside the cemetery, on the side of the road or on the cemetery blocks, only it was found around the mosque at the entrance. However, one of the main issues that visitors are very satisfied with is the cleanliness of the cemetery in general. Another issue is that there are no seating units except condolence places throughout the cemetery. Asri cemetery has a large area, so seating units are needed especially during hot summer months.

The mosque and the nation's café in the cemetery are important facilities that attract the public apart from the visit to the cemetery. People who come from the settlements near the cemetery for salaah (prayers) spend time here. Some of the people who complete their prayers in the mosque during the day or on fridays spend time reading books and drinking tea in the nation café or chatting with the people around the mosque.

These facilities will lead up to the ground to open the graveyards as green spaces, and will attract people, except for the visit, by overcoming the prejudices of the public about the cemetery. However, although the cemetery has this potentation, the lack of reinforcement elements plays an active role in the public's unwillingness to spend time outside the cemetery. For example, a person who wants to come to the cemetery and wants to relax in the silence of the cemetery will need a seat after a certain period of time, but since there are no seating units, he will soon sit on the tomb walls because he is tired, but this will disturb him.

The cemetery consists of two locations, namely "Old Cemetery Location" and "Taşlıburun Location". As Taşlıburun location was established later, plant density is less frequent and younger than the Old Cemetery location. Since the shadow of young plants is insufficient, the satisfaction for the vegetation is low in the surveys conducted here but it is high in the Old Cemetery. If we compare the Old Cemetery and Taşlıburun, the Taşlıburun location has sparser and undersized vegetation than the Old Cemetery area, the trees provide less shade, the lawn area facilities are more sloppy, the graves, blocks and plots are more neglected and the roads are narrower. For this reason, it is the Old Cemetery area of Kayseri Asri Cemetery which is suitable for construction as an urban green area and to be put into service.

Based on the results of the satisfaction survey and problems in planning of the Kayseri Asri Cemetery in this study, some measures can be taken and suggestions

can be made for the more convenient use of the cemetery. For example, the scale and designs of tombstones should be designed and placed in harmony. In the design of the cemetery entrances, a style unity should be provided with the new main entrance. This unity of style should also be provided in the design of the cemetery walls. Parking places for the disabled and bicycle and motorcycle parks should be included in the car parks.

Pull-offs should be opened at certain distances on roads that are not wide enough to allow the passage of two vehicles within the cemetery. The walls with a height of 3 m in some places and created in the cemetery area due to the elevation difference and with a poor appearance should be softened by using holding and climbing plants and they should be integrated with the green texture of the cemetery. Certain areas of the cemeteries should include signs that show the cemetery block-plot plans and there must be directive signs indicating the direction of the blocks. A unit that sells live flowers and cemetery maintenance tools should be established for the citizens who want to take care their graves with seasonal flowers and want to do cemetery maintenance. A certain standard should be brought to the fountains of charity inside the cemetery, and they should be built by the benefactors within these standards, not in the place they want, but in the places planned by the administration. At the corners of each of the 4 blocks in the cemetery, containers should be placed that can be used by the caregivers. In the cemetery, seating units should be placed on shade areas, on view points and view hills for both visitors and citizens who wish to benefit from the tree shadows in the cemetery on hot summer days. Ornamental pools should be designed according to the concept of the cemetery and the silence and serenity within the cemetery should be accompanied by the sound of water. Biological ponds should be built into the cemetery and these biological ponds should be used to enrich wildlife diversity by bringing a new ecosystem. Thus, without disturbing the peace and silence here, people will be allowed to come to the cemeteries not only for a visit but for recreation purposes and they will listen to the sounds of birds, see the butterflies and escape the noise of the city and taste the peace of nature.

In accordance with the suggestions mentioned above, Kayseri Asri Cemetery will be more useful and can be integrated with the city; and it could become an urban green area that is far from being just a burial and visiting centre. For this purpose, the cemetery concept during the Ottoman period and which is intertwined with the recreation areas will still be revived today. As a matter of fact, the nation's cafe in Kayseri Asri Cemetery, which is used extensively, is an indication that the people of Kayseri need socialization places in the cemetery. In this regard, in Asri Cemetery and in the newly planned cemeteries in Turkey, the areas that serve the common use and passive recreation facilities which offer the peace of nature such as parks and gardens should be included in the cemeteries. Thus, as in all Muslim cemeteries, the graveyards will not contain anything grieving or pathetic, and the prevailing feeling will be peace and serenity.

### **Conflict of Interest**

No conflict of interest was declared by the authors.

### **Authors' Contributions**

The authors contributed equally to the study.

### **Financial Disclosure**

The authors declared that this study has received no financial support.

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## Ethics Committee Approval

Ethics committee approval was not required for this article.

## Legal Public/Private Permissions

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions, and organizations) during the survey and in-depth interviews

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## Affect, Architecture and Water: Bibliometric Analysis of the Literature

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### Abstract

Effects of water in the space is the subject of study in many scientific fields. The research question is that whether the water features are included in the studies carried out the intersection of affect and architecture. Therefore, the purpose of this study is to explore the literature regarding the concepts of affect-architecture-water and to determine the concepts in current research areas and the primary authors. The scope of this study consists of documents in Scopus database. The keywords "Affect, Affective, Architecture, Water" were selected for the systematically analysed scan made in Scopus database. Scanning was done by creating three different combinations with the selected keywords. First combination is "Affect" and "Architecture"; Second combination is "Affective" and "Architecture"; Third combination is "Affect", "Architecture" and "Water". After collecting the bibliometric data of a total of 1557 documents according to three different combinations from the database on November 21, 2022, the downloaded data files were transferred to the VOSviewer (1.6.18.0) software. Bibliometric analysis with science mapping techniques was applied to the dataset by the VOSviewer. Firstly, Scopus analysis search results were examined. Secondly, Visuals were created by science mapping techniques. As a result, nine concepts and 26 authors were determined. The concepts for the gaps are "Architecture, Affect, Atmosphere, Perception, Space, Sensory Experience, Architectural Design, Built Environment, Emotion". The authors are "Deleuze, Guattari, Davidson, Anderson, Barrett, Damasio, Krafft, Lyubomirsky, Manzo, Massumi, P. L. Russell, Wigley, Scherer, J. A. Russell, Böhme, Abusaada, Matteis, Bachelard, Merleau-Ponty, Pallasmaa, Plutchik, Watson, Zumthor, Lefebvre, Sørensen, Ebbensgaard".

**Keywords:** Affect, Architecture, Water, Bibliometrics, VOSviewer.

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**Received:** 05.12.2022 - **Accepted:** 12.03.2023

Katuk, D., & Köseoğlu, E. (2023). Affect, architecture and water: Bibliometric analysis of the literature. DEPARCH Journal of Design Planning and Aesthetics Research, 2 (1), 85-114. <https://doi.org/10.55755/DepArch.2023.18>



## Duygulanım, Mimarlık ve Su: Literatürün Bibliyometrik Analizi

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### Özet

Suyun mekândaki etkileri birçok bilimsel alanda çalışma konusudur. Araştırma sorusu, duygulanım ve mimarlık arakesitinde yapılan çalışmalarda, su özelliklerine yer verilip verilemediğidir. Dolayısıyla bu çalışmanın amacı, duygulanım (affect)-mimarlık (architecture)-su (water) kavramlarına ilişkin literatürü araştırmak ve güncel araştırma alanlarındaki kavramları ve birincil yazarları belirlemektir. Bu çalışmanın kapsamını Scopus veri tabanındaki dokümanlar oluşturmaktadır. Scopus veri tabanında yapılan sistematik analiz taraması için “duygulanım, duygulanımsal (affective), mimarlık, su” anahtar kelimeleri seçilmiştir. Seçilen anahtar kelimelerle üç farklı kombinasyon oluşturularak tarama yapılmıştır. Birinci kombinasyon “duygulanım ve mimarlık”; ikinci kombinasyon “duygulanımsal ve mimarlık”; üçüncü kombinasyon ise “duygulanım, mimarlık ve su” dur. Üç farklı kombinasyona göre toplam 1557 doküman ait bibliyometrik veri, 21 Kasım 2022 tarihinde Scopus veri tabanından indirilmiştir ve veri dosyaları VOSviewer (1.6.18.0) yazılımına aktarılmıştır. VOSviewer tarafından, bilim haritalama teknikleri ile bibliyometrik analiz yöntemi uygulanmıştır. İlk olarak Scopus'taki arama sonuçlarından elde edilen analizler incelenmiştir. İkinci olarak, VOSviewer yazılımında bilim haritalama teknikleri ile görseller oluşturulmuştur. Sonuç olarak dokuz kavram ve 26 yazar belirlenmiştir. Araştırma boşluklarına yönelik belirlenen kavramlar: Mimarlık, duygulanım, atmosfer, algı, mekân, duysal deneyim, mimari tasarım, yapılı çevre ve duygudur. Belirlenen yazarlar: Deleuze, Guattari, Davidson, Anderson, Barrett, Damasio, Krafft, Lyubomirsky, Manzo, Massumi, P. L. Russell, Wigley, Scherer, J. A. Russell, Böhme, Abusaada, Matteis, Bachelard, Merleau-Ponty, Pallasmaa, Plutchik, Watson, Zumthor, Lefebvre, Sørensen ve Ebbensgaard' dir.

**Anahtar Kelimeler:** Bibliyometrik, Duygulanım, Mimarlık, Su, VOSviewer.

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**Alınma Tarihi:** 05.12.2022 - **Kabul Tarihi:** 12.03.2023

## INTRODUCTION

This study remarked that the water in the space can create an affect with an impression. So, this study was considered that water can have a significant role as an affective aspect in architectural design. For this reason, this study was focused to examine the research on water at the intersection of affect and architecture. The concept networks of "Affect", "Affective", "Architecture" and "Water" and whether there are findings supporting this regarding in the literature were investigated.

In a rare article example indexed on Scopus, concepts of came together. Ebbensgaard (2017, p. 441) examined that "how landscape design orchestrates the sensation of nature" by following discussions within cultural geography on landscape design, affect and emotion in this article. Water was one of the elements that landscapes orchestrate sound, smell, tactility, and view by focusing on the sensation of nature in this article (Ebbensgaard, 2017). Furthermore, the terms that may be related to relationship among affect, architecture and water based on this article could be summarized as "sensory experience, sensation of nature, landscape architecture, landscape design, green lungs, nature, natural environment, urban nature, urbanism, wild nature, transformed nature, natural landscape, sustainability fix, well-being, atmospheres, feel of place, see-feel-act and aesthetic" (Ebbensgaard, 2017).

During this research, some studies in related to concepts of affect and architecture apart from concept of water have been noticed about expressions such as "atmosphere", "affective power", "affective atmospheres", "distinction between affect and emotion", "affective spaces", "non-representational effect", "affective urban atmospheres", "affectivity" and "affective bonds".

One of the studies about concept of atmospheres expressed that experienced in bodily presence in relation to people and things or in spaces, "affective powers of feeling, spatial bearers of moods and related with the aesthetics" (Böhme, 1993, p. 119). Moreover, the expression "atmospheric" was applied to people, spaces, and nature (Böhme, 1993, p. 113). Another study about that examined emotion, space, and society concept of affective atmospheres considered context of distinction between affect and emotion (Anderson, 2009). In this article, distinction between affect and emotion was examined in the subjective (emotion)/objective (affect) problematic via two oppositions: narrative (emotion)/non-narrative (affect) and semiotic (emotion)/a signifying (affect) (Anderson, 2009, p. 80). Additionally, landscapes were one of the terms that include atmospheres according to this article (Anderson, 2009, p. 78). A recent study was about atmospheres and concept of "affective space" in relation to architecture which "helps to clarify the first-person, direct experience of the environment and how it impacts a person's emotional states, influencing their perception of the world around them" (Matteis, 2020, p. 6-7). According to these three studies, water can be included in studies in affect-architecture-water as an element of both nature and landscape by presence of an experiencing subject.

In contrast, Sørensen (2015) referred condition as "clause of subjectivity" for the atmosphere dependent on the presence of an experiencing subject. This article attempted to challenge this condition, exploring the potential for analysing atmospheres in the prehistoric past by adopting Böhme's notion "ecstasies of things" and using "emergent forms" (Sørensen, 2015, p. 67). In addition, this article explored a ground that "even in the absence of an experiencing subject, there could be affective and sensuous engagements between human beings

and architecture for the archaeological condition" (Sørensen, 2015, p. 71).

A study which was drawing a new concept and connected the relation of architectural space and affect from a different point was about "non-representational effect" (Krafft & Adey, 2008). Krafft and Adey (2008, p. 215-216) explored how buildings represent the attempts to encourage forms of affect that should educate, calm, and promote a reverential and spiritual experience according to "authentic" ecological architecture and "placeless" modern architecture. A recent study presented toolkits that based on the communications between people and place for creating "affective urban atmospheres" (Abusaada, 2020). In this article, the concept of "affectivity" was one of the terms that were the processes of interpretation related to daily experience (sociocultural) and the perceptual mechanisms that affected people's feelings and changed their behaviours towards the city (Abusaada, 2020, p. 381).

Another research in this field was on exploring the other dimensions of emotional relationships with places and focused on positive "affective bonds" to "embrace an array of places, feelings, and experiences" (Manzo, 2005, p. 67). A review article which was published the same year focused on "pursuing happiness" by positive feelings, positive experiences, and positive affect (Lyubomirsky et al., 2005).

Thus, the purpose of this study is to explore the literature regarding the concepts of affect, architecture, and water. Thanks to this exploration, update terms and concepts, current research gaps, authors and theorists can be identified by reaching the research done in the selected scientific disciplines which are Arts and Humanities or Psychology or Environmental Science. The bibliometric analysis with science mapping techniques was found to be the most suitable and fast method for the exploration to be made within the scope of this study. Therefore, documents in Scopus database that supply bibliometric data are included in this study.

## METHODOLOGY

It is aimed to investigate what kind of findings there are in the literature on the approach to water in the relation of affect and architecture. In this context, it is thought that the bibliometric analysis method is quick to find these approaches. Applying the bibliometric analysis method to the collected data can determine which fields are more up to date, which keywords are used, and which authors can be primary. For this reason, Scopus database was scanned with the bibliometric analysis with science mapping techniques. Scopus is one of the world's leading academic databases containing a large number of scientific documents (Xiao et al., 2022).

This study was a quantitative research design, and quantitative data were collected from Scopus Database. Bibliometric analysis is quantitative study that evaluates and examines data from any discipline on bibliometric data as a research method (Pritchard, 1969; Broadus, 1987; Santos et al., 2017; Şen, 2020; Donthu et al., 2021; Karagöz & Savaş, 2021; Özkaraca & Halaç, 2022; Ding & Yang, 2022). In this context, a quantitative research design was designed for this study as bibliometric analysis with science mapping techniques (Table 1). In addition, the bibliometric analysis technique is considered as exploratory or descriptive study (Kokol & Blažun Vošner, 2019; Kurutkan & Orhan, 2018).

**Table 1.** Quantitative research design for this study

<b>Bibliometric Analysis with Science Mapping Techniques</b>
<p><b>Purpose:</b> Exploring the research related to affect-architecture-water by three types of scanning techniques and determining the concepts in the current research gaps and the primary authors.</p> <p><b>Material and Methods:</b> Bibliometric analysis with science mapping techniques</p> <p><b>Sample:</b> Documents</p> <p><b>Data Source:</b> Scopus Database</p> <p><b>Scanning Techniques:</b>                      First scanning technique (scanned keywords "affect-architecture")                      Second scanning technique (scanned keywords "affective-architecture")                      Third scanning technique (scanned keywords "affect-architecture-water")</p> <p><b>Quantitative Info:</b> Scopus Web Page</p> <p><b>Data Visualization and Analysis Tool:</b> VOSviewer Software</p> <p><b>Selected Scientific Mapping Techniques:</b>                      Mapping based on "Co-occurrences" data according to the "Author Keywords"                      Mapping based on "Co-citation" data by the "Cited Authors"</p>
<b>Findings</b>
Findings According to Scopus Web Page Findings According to Scientific Mapping Technique by VOSviewer Software
<b>Conclusion</b>

Primarily, scanning was carried out using Scopus web page using the bibliometric analysis method (Table 1). Three types of scanning techniques were used with selected keyword combinations. The keywords "Affect, Affective, Architecture, Water" are the words determined for the scan made in Scopus database (Table 2). According to first scanning technique in the documents section of the Scopus database, documents in "Title-Abstract-Keywords" were scanned with the code TITLE-ABS-KEY("Affect" AND "Architecture") AND ( LIMIT-TO ( SUBJAREA,"ARTS" ) OR LIMIT-TO ( SUBJAREA,"PSYC" ) ) in advanced search (Table 2). According to second scanning technique in the documents section of the Scopus database, documents title-abstract-keywords were scanned with the code TITLE-ABS-KEY("Affective" AND "Architecture") AND ( LIMIT-TO ( SUBJAREA,"ARTS" ) OR LIMIT-TO ( SUBJAREA,"PSYC" ) ) in advanced search (Table 2). According to third scanning technique in the documents section of the Scopus database, documents title-abstract-keywords were scanned with the code TITLE-ABS-KEY ( "Affect" AND "Architecture" AND "Water" ) AND ( LIMIT-TO ( SUBJAREA , "ENVI" ) OR LIMIT-TO ( SUBJAREA , "ARTS" ) OR LIMIT-TO ( SUBJAREA , "PSYC" )) in advanced search (Table 2). There is no date restriction on Scopus database. Scanning was performed over the entire period included in the database. The number of documents in Table 2 was obtained. A total of 1557 documents were identified (Table 2). The scans and data download date are November 21, 2022.

After three types of scanning techniques (Table 2), the bibliometric data of Scopus database on November 21, 2022, csv and txt data files were downloaded one by one. Data files were transferred to the VOSviewer program, respectively. In this program, firstly, Mapping based on "Co-occurrences" data according to the "Author Keywords" was done (Table 1). Secondly, "Mapping Based on Co-citation Data by Cited Authors" was done (Table 1).

Firstly, including the quantitative info such as document types, years, countries, subject areas, sources, authors, affiliations, sponsors in selected disciplines was determined by bibliometric analysis according to Scopus Analyse Search Results on web page in this study. Secondly, including visuals such as authors keywords and occurrences and cited authors in selected disciplines was determined by bibliometric analysis with science mapping techniques method in this study.

Finally, concepts, gaps and primary authors was determined according to all findings.

Scanning Technique in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Keywords Combination: <b>"Affect" and "Architecture"</b>	Keywords Combination: <b>"Affective" and "Architecture"</b>	Keywords Combination: <b>"Affect" and "Architecture" and "Water"</b>
Limited Subject Areas: <b>"Arts and Humanities" or "Psychology"</b>	Limited Subject Areas: <b>"Arts and Humanities" or "Psychology"</b>	Limited Subject Areas: <b>"Environmental Science " or "Arts and Humanities" or "Psychology"</b>
Code: <b>TITLE-ABS-KEY("Affect" AND "Architecture") AND ( LIMIT-TO ( SUBJAREA,"ARTS" ) OR LIMIT-TO ( SUBJAREA,"PSYC" ) )</b>	Code: <b>TITLE-ABS-KEY("Affective" AND "Architecture") AND ( LIMIT-TO ( SUBJAREA,"ARTS" ) OR LIMIT-TO ( SUBJAREA,"PSYC" ) )</b>	Code: <b>TITLE-ABS-KEY ( "Affect" AND "Architecture" AND "Water" ) AND ( LIMIT-TO ( SUBJAREA , "ENVI" ) OR LIMIT-TO ( SUBJAREA , "ARTS" ) OR LIMIT-TO ( SUBJAREA , "PSYC" ) )</b>
Scan Findings: 942 Documents (1946-2022)	Scan Findings: 341 Documents (1921-2022)	Scan Findings: 274 Documents (1960-2022)
<b>Total Scan Findings</b>		
1557 Documents (1921-2023)		

**Table 2.** Three types of scanning techniques in "Title-Abstract-Keywords"

## FINDINGS

### Findings According to Scopus Web Page

Scopus database could show some analyses on their web pages. When the analyses were examined comparatively for three types of scanning techniques, the following findings were obtained. Eight analysis types common to database was collected according to scan findings in "Title-Abstract-Keywords". These analysis types contained information about the document types, publication years, top 15 countries or territories, top 15 subject areas, top 10 sources, top 10 authors, top 10 affiliations, and top 10 funding sponsors. Moreover, the oldest document date in Scopus is 1946 according to first scanning technique; is 1921 according to second scanning technique; is 1960 according to third scanning technique.

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
Article, "614" Conference Paper, "92" Book Chapter, "86" Review, "74" Book, "63" Editorial, "3" Note, "3" Erratum, "2" Letter, "2" Short Survey, "2" Conference Review, "1"	Article, "232" Conference Paper, "31" Review, "30" Book Chapter, "28" Book, "12" Conference Review, "6" Note, "2"	Article, "230" Conference Paper, "21" Review, "15" Book Chapter, "8"

**Table 3.** Document types according to three types of scanning techniques.

According to first scanning technique, it was determined that the number of "Articles (614)" as document type was the highest when scanned with the keywords "affect-architecture" (Table 3). According to second scanning technique, it was determined that the number of "Articles (232)" as document type was the highest when scanned with the keywords "affective-architecture" (Table 3). According to third scanning technique, it was determined that the number of "Articles (230)" as document type was the highest when scanned with the keywords "affect-architecture-water" (Table 3). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that there were more document types in the first scanning technique (Table 3).

**Table 4.** Document publication years according to three types of scanning techniques

Number of Document in Scopus Database (until November 21, 2022)					
First Scanning Technique		Second Scanning Technique		Third Scanning Technique	
Document Analysis (1946-2023)		Document Analysis (1921-2022)		Document Analysis (1960-2022)	
2022, "61"	2001, "8"	2022, "24"	2005, "3"	2022, "20"	2005, "6"
2021, "103"	2000, "9"	2021, "33"	2004, "2"	2021, "20"	2004, "4"
2020, "72"	1999, "6"	2020, "32"	2003, "1"	2020, "31"	2003, "5"
2019, "72"	1998, "5"	2019, "31"	2002, "1"	2019, "20"	2002, "3"
2018, "78"	1997, "3"	2018, "31"	2001, "3"	2018, "18"	2000, "1"
2017, "77"	1996, "2"	2017, "22"	2000, "3"	2017, "17"	1998, "1"
2016, "61"	1995, "2"	2016, "30"	1999, "1"	2016, "22"	1997, "1"
2015, "52"	1994, "2"	2015, "21"	1998, "2"	2015, "11"	1996, "1"
2014, "37"	1991, "1"	2014, "12"	1995, "2"	2014, "12"	1995, "2"
2013, "39"	1990, "1"	2013, "16"	1994, "1"	2013, "15"	1992, "1"
2012, "45"	1989, "2"	2012, "15"	1993, "1"	2012, "11"	1991, "1"
2011, "30"	1986, "1"	2011, "10"	1990, "4"	2011, "9"	1990, "1"
2010, "27"	1984, "5"	2010, "13"	1989, "1"	2010, "7"	1985, "1"
2009, "25"	1981, "1"	2009, "3"	1982, "1"	2009, "8"	1981, "1"
2008, "26"	1978, "1"	2008, "8"	1978, "1"	2008, "5"	1969, "1"
2007, "21"	1976, "1"	2007, "7"	1921, "1"	2007, "12"	1960, "1"
2006, "25"	1973, "1"	2006, "5"		2006, "5"	
2005, "10"	1972, "1"				
2004, "11"	1968, "1"				
2003, "7"	1964, "2"				
2002, "5"	1960, "1"				
	1946, "1"				

According to first scanning technique, it was determined that the number of documents was the highest in "2021 (103)" when scanned with the keywords "affect-architecture" (Table 4). According to second scanning technique, it was determined that the number of documents was the highest in "2021 (33)" when scanned with the keywords "affective-architecture" (Table 4). According to third scanning technique, it was determined that the number of documents was the highest in "2020 (31)" when scanned with the keywords "affect-architecture-water" (Table 4). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that there were more new documents in the first scanning technique (Table 4).

According to first scanning technique, it was determined that the number of documents by the top 15 countries or territories was the highest in the "United States (275)" when scanned with the keywords "affect-architecture" (Table 5). According to second scanning technique, it was determined that the number of documents by the top 15 countries or territories was the highest in the "United States (102)" when scanned with the keywords "affective-architecture" (Table 5). According to third scanning technique, it was determined that the number

of documents by the top 15 countries or territories was the highest in the “United States (78)” when scanned with the keywords “affect-architecture-water” (Table 5). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that countries “United States, United Kingdom, Germany, Italy, Australia, Netherlands, Spain, Canada and France” were common intersection (Table 5).

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
United States, “275” United Kingdom, “125” Germany, “53” Italy, “51” Australia, “47” Netherlands, “45” Spain, “40” Canada, “38” France, “30” China, “27” Turkey, “24” Sweden, “18” Greece, “17” Russian Federation, “15” Switzerland, “15”	United States, “102” United Kingdom, “60” Germany, “32” Australia, “21” Spain, “21” Canada, “20” Italy, “17” Netherlands, “12” Russian Federation, “12” Mexico, “10” France, “9” Japan, “9” Switzerland, “8” Belgium, “7” Sweden, “7”	United States, “78” China, “49” Spain, “20” Australia, “17” France, “17” Germany, “15” Italy, “15” United Kingdom, “15” Canada, “14” Iran, “9” Brazil, “7” India, “7” Netherlands, “7” Argentina, “6” Japan, “6”

**Table 5.** Documents by top 15 countries or territories according to three types of scanning techniques

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
Arts and Humanities, “667” Social Sciences, “390” Psychology, “338” Engineering, “211” Computer Science, “143” Neuroscience, “132” Medicine, “86” Business, Management and Accounting, “35” Mathematics, “30” Economics, Econometrics and Finance, “24” Environmental Science, “22” Biochemistry, Genetics and Molecular Biology, “12” Agricultural and Biological Sciences, “10” Materials Science, “8” Decision Sciences, “7”	Arts and Humanities, “195” Psychology, “171” Social Sciences, “106” Neuroscience, “68” Computer Science, “66” Medicine, “47” Engineering, “35” Mathematics, “11” Business, Management and Accounting, “6” Economics, Econometrics and Finance, “4” Agricultural and Biological Sciences, “3” Biochemistry, Genetics and Molecular Biology, “3” Health Professions, “2” Pharmacology, Toxicology and Pharmaceuticals, “2” Earth and Planetary Sciences, “1”	Environmental Science, “264” Agricultural and Biological Sciences, “122” Earth and Planetary Sciences, “63” Engineering, “21” Social Sciences, “17” Biochemistry, Genetics and Molecular Biology, “14” Chemistry, “12” Arts and Humanities, “10” Energy, “10” Chemical Engineering, “9” Computer Science, “8” Immunology and Microbiology, “7” Medicine, “7” Materials Science, “5” Mathematics, “4”

**Table 6.** Documents by top 15 subject areas according to three types of scanning techniques

According to first scanning technique, it was determined that “Arts and Humanities (667)” had the highest number of documents by the top 15 subject areas when scanned with the keywords “affect-architecture” (Table 6). According to second scanning technique, it was determined that “Arts and Humanities (195)” had the highest number of documents by the top 15 subject

areas when scanned with the keywords "affective-architecture" (Table 6). According to third scanning technique, it was determined that "Environmental Science (264)" had the highest number of documents by the top 15 subject areas when scanned with the keywords "affect-architecture-water" (Table 6). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that subject areas "Arts and Humanities, Social Sciences, Engineering, Computer Science, Medicine, Mathematics, Biochemistry, Genetics and Molecular Biology and Agricultural and Biological Sciences" were common intersection (Table 6).

**Table 7.** Documents by top 10 sources according to three types of scanning techniques

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
Wit Transactions on The Built Environment, "17" Frontiers In Psychology, "14" International Journal of Architectonic Spatial and Environmental Design, "12" A Z ITU Journal of The Faculty of Architecture, "9" Frontiers In Human Neuroscience, "9" Journal of Architecture, "9" Physiology And Behavior, "9" Annals of The New York Academy of Sciences, "8" Cognitive Systems Research, "8" Cognitive Science, "6"	Biologically Inspired Cognitive Architectures, "12" Cognitive Systems Research, "9" Frontiers In Psychology, "8" Emotion Space and Society, "6" Psychological Medicine, "6" Journal of Architecture, "5" Adaptive Behavior, "4" Architectural Theory Review, "4" Interiors Design Architecture Culture, "4" Journal of Affective Disorders, "4"	Forest Ecology and Management, "13" Agricultural And Forest Meteorology, "10" Journal of Hydrology, "8" Agricultural Water Management, "7" Journal of Ecology, "7" Shengtai Xuebao, "6" Journal of Contaminant Hydrology, "5" Ground Water, "4" Iop Conference Series Earth and Environmental Science, "4" Journal of Coastal Research, "4"

According to first scanning technique, it was determined that "Wit Transactions on The Built Environment (17)" had the highest number of documents by the top 10 source when scanned with the keywords "affect-architecture" (Table 7). According to second scanning technique, it was determined that "Biologically Inspired Cognitive Architectures (12)" had the highest number of documents by the top 10 source when scanned with the keywords "affective-architecture" (Table 7). According to third scanning technique, it was determined that "Forest Ecology and Management (13)" had the highest number of documents by the top 10 source when scanned with the keywords "affect-architecture-water" (Table 7). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that no sources were common intersection (Table 7).

According to first scanning technique, it was determined that the highest number of documents by the top 10 authors were four for "Annesi" and "Tzortzi" when scanned with the keywords "affect-architecture" (Table 8). According to second scanning technique, it was determined that the highest number of documents by the top 10 authors were four for "Barnard", "Rodríguez" and "Samsonovich" when scanned with the keywords "affective-architecture" (Table 8). According to third scanning technique, it was determined that the highest number of documents by the top 10 authors were two for "listed 10 authors" when scanned with the keywords "affect-architecture-water" (Table 8). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that no authors were common intersection (Table 8).

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
Annesi, J.J., "4" Tzortzi, K., "4" Demetriou, A., "3" Smitheram, J., "3" Abel, J.S., "2" Abonce, R., "2" Arvizu, C., "2" Ballard, K.J., "2" Barnard, P.J., "2" Battilossi, S., "2"	Barnard, P.J., "4" Rodríguez, L.F., "4" Samsonovich, A.V., "4" Narayanan, S., "3" Ramos, F., "3" Abusaada, H., "2" Arda, Z., "2" Augello, A., "2" Baird, A., "2" Bernad Monferrer, E., "2"	Annable, M.D., "2" Brye, K.R., "2" Dai, Z., "2" Dal Ferro, N., "2" Dunn, S., "2" Edington, D., "2" Fang, L.D., "2" Hao, G.Y., "2" Leuschner, C., "2" Levia, D.F., "2"

**Table 8.** Documents by top 10 authors according to three types of scanning techniques

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
Delft University of Technology, "11" University College London, "11" University of Cambridge, "11" University of Michigan, Ann Arbor, "10" Universiteit van Amsterdam, "9" University of Oxford, "9" Massachusetts Institute of Technology, "8" University of Pennsylvania, "7" King's College London, "7" Stanford University, "7"	University College London, "7" Universiteit van Amsterdam, "5" University of Pennsylvania, "5" University of Melbourne, "5" University of Wisconsin-Madison, "5" Victoria University of Wellington, "4" Goldsmiths, University of London, "4" King's College London, "4" Stanford University, "4" VA Medical Center, "4"	Chinese Academy of Sciences, "9" Ministry of Education China, "8" University of Florida, "8" University of Tehran, "6" University of Chinese Academy of Sciences, "6" Consejo Superior de Investigaciones Científicas, "5" University of California, Berkeley, "5" Georg-August-Universität Göttingen, "5" Nanjing University, "5" Pennsylvania State University, "4"

**Table 9.** Documents by top 10 affiliations according to three types of scanning techniques

According to first scanning technique, it was determined that "Delft University of Technology (11), University College London (11), University of Cambridge (11)" had the highest number of documents by the top 10 affiliations when scanned with the keywords "affect-architecture" (Table 9). According to second scanning technique, it was determined that "University College London (9)" had the highest number of documents by the top 10 affiliations when scanned with the keywords "affective-architecture" (Table 9). According to third scanning technique, it was determined that "Chinese Academy of Sciences (9)" had the highest number of documents by the top 10 affiliations when scanned with the keywords "affect-architecture-water" (Table 9). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that no affiliations were common intersection (Table 9).

According to first scanning technique, it was determined that "National Institutes of Health (23)" had the highest number of documents by the top 10 funding sponsors when scanned with the keywords "affect-architecture" (Table 10). According to second scanning technique, it was determined that "National Institute of Mental Health (14)" had the highest number of documents by the top

10 funding sponsors when scanned with the keywords “affective-architecture” (Table 10). According to third scanning technique, it was determined that “National Natural Science Foundation of China (18)” had the highest number of documents by the top 10 funding sponsors when scanned with the keywords “affect-architecture-water” (Table 10). When the three types of scanning techniques were compared among themselves until November 21, 2022, it was observed that funding sponsors “National Science Foundation” was common intersection (Table 10).

**Table 10.** Documents by top 10 funding sponsors according to three types of scanning techniques

Number of Document in Scopus Database (until November 21, 2022)		
First Scanning Technique	Second Scanning Technique	Third Scanning Technique
Document Analysis (1946-2023)	Document Analysis (1921-2022)	Document Analysis (1960-2022)
National Institutes of Health, “23” National Institute of Mental Health, “18” National Science Foundation, “18” Economic and Social Research Council, “9” Deutsche Forschungsgemeinschaft, “8” Medical Research Council, “8” European Research Council, “7” National Natural Science Foundation of China, “7” Eunice Kennedy Shriver National Institute of Child Health and Human Development, “5” National Institute of Neurological Disorders and Stroke, “5”	National Institute of Mental Health, “14” Medical Research Council, “7” National Institutes of Health, “6” European Commission, “5” Horizon 2020 Framework Programme, “5” Russian Science Foundation, “5” Economic and Social Research Council, “4” European Research Council, “4” National Science Foundation, “4” Natural Sciences and Engineering Research Council of Canada, “4”	National Natural Science Foundation of China, “18” National Science Foundation, “12” National Key Research and Development Program of China, “7” U.S. Department of Energy, “7” Chinese Academy of Sciences, “5” Office of Science, “5” Seventh Framework Programme, “5” European Commission, “4” Ministerio de Ciencia e Innovación, “4” National Aeronautics and Space Administration, “4”

### Findings According to Scientific Mapping Technique by VOSviewer Software

In this section, the findings obtained according to the scientific mapping technique with the VOSviewer software are mentioned. The data which three different scanning techniques created with different word combinations were downloaded from the Scopus database. Then, the data was transferred to the VOSviewer software one by one. Visuals were created by progressing step by step according to the options presented in the software's interface. Co-occurrences and Co-citation relations were examined according to various criteria.

### Mapping based on “Co-occurrences” data according to the “Author keywords”

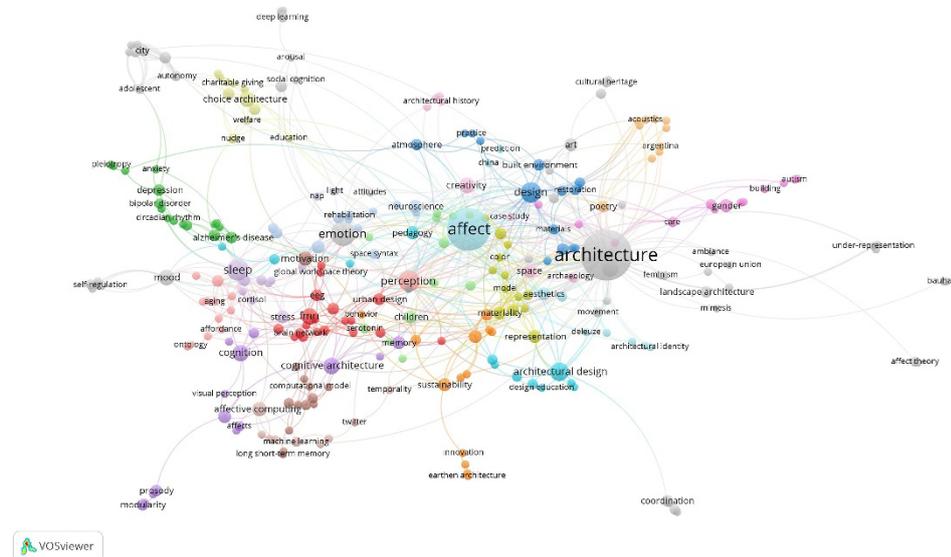
Co-occurrences analysis by author keywords is an exploration method to understand the concepts of scientific collaborations between author keywords in the specified field and the networks of conceptual space to identify themes and to reveal new study areas (Ding & Yang, 2022; Güney & Somuncu, 2020; Karagöz & Savaş, 2021). In addition, with this analysis method, growth of the study areas, new keyword networks, new gaps in some specific disciplines and highlighted changes over time can be understood (Peritz, 1988). In this analysis, the clusters and the sizes of the clusters represent the keywords. The links between the clusters express the cooperation between the keywords. The thickness of the line of networks increases according to the total link strength between the keywords.

**First scanning technique (scanned keywords “affect-architecture”):** Criteria were decided so that the minimum number of occurrences of a keyword is 2. After these selections, of the 2869 keywords, 302 that met the thresholds were selected by the software. For each of the 302 keywords, the total strength of co-occurrence links with other keywords was calculated by the software. The keywords with the greatest total link strength were selected by the software. The number of keywords to be selected was 302.

The Ranking According to The Most Occurrences			
Ranking	Selected keywords	Occurrences	Total Link Strength
1	Architecture	74	126
2	Affect	52	94
3	Emotion	17	31
4	Sleep	14	28
5	Perception	13	29
6	Design	12	34
7	Architectural Design	10	18
8	Embodiment	8	17
9	Cognitive Architecture	8	15
10	Fmri	8	13

**Table 11.** Top 10 keywords occurrences and total link strength according to first scanning technique

Before proceeding to the concept of network mapping, the ranking according to the most occurrences of the keywords can be sorted in the interface created by the software (Table 11). The keyword that came first in this ranking was “architecture”; the second keyword was “affect”; the third keyword was “emotion”; the fourth keyword was “sleep”; the fifth keyword was “perception”; sixth keyword was “design”; the seventh keyword was “architectural design”; the eighth keyword was “embodiment”; the ninth keyword was “cognitive architecture”; the tenth keyword was “fmri” (Table 11).

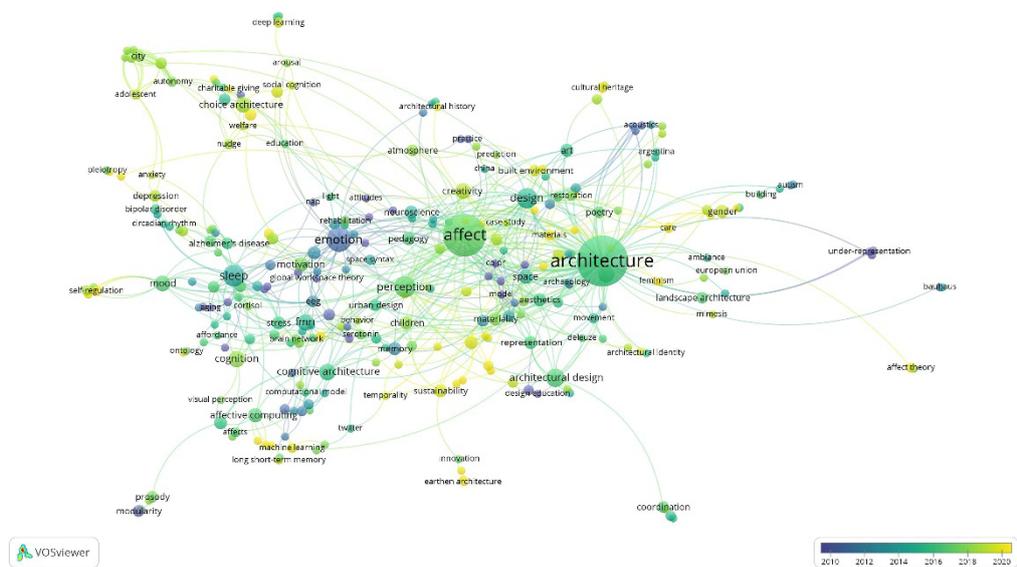


**Figure 1.** Mapping based on “Co-occurrences” data according to first scanning technique in Scopus (VOSviewer)

When proceeding with mapping in Scopus data, the VOSviewer software warned that some of the 302 items in your network are not connected to each other and the larger set of connected items consists of 281 items. Asked by the software, “Do you want to show this set of items instead of all items?”, the mapping in Figure 1. was created by answering the question “yes”. There were 29

clusters in the “Co-occurrences” mapping shown in Figure 1. These clusters were represented by circles of varied sizes and colours. According to this mapping, affect and architecture have more co-occurrences than the other keywords (Figure 1).

The VOSviewer software can also show developments over time (current trends) by overlay visualization of the keywords network mapping created in Figure 1. In this way, the relationship of new keywords that have been used in publications recently can be seen in Figure 2. New study areas are expressed with yellow and light green toned small clusters in the time mapping. The keywords “Affect” and “Architecture” were compared according to developments over time. It was observed that the keyword “Affect” was expressed in light tone green colour. It was observed that the keyword “Architecture” was expressed in mid tone green (Figure 2).



**Figure 2.** Mapping based on developments over time by overlay visualization of “Co-occurrences” data according to first scanning technique in Scopus (VOSviewer) techniques.

In the developments over time (current trends) by overlay visualization network map made in the VOSviewer analysis program, yellow and light green tones represent new study areas. According to Scopus data, it was determined that the field of “Affect” and “Architecture” are current fields of study. Therefore, the concept related to the fields of “Affect” and “Architecture” have been accepted as current research gaps according to the strength of the lines around it.

Firstly, in this context, to select new concepts that can be associated with the “Architecture” keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 3). According to Figure 3, the new areas associated with the “Architecture” cluster can be listed as follows, from yellow to mid tone green colour: “Atmospheres, Built Environment, Environmental Psychology, Creativity, Affect, Perception, Body, Materiality, Infrastructure, Urban Design, Embodiment, Aesthetics, Design, Space, Art”.

Secondly, in this context, to select new concepts that can be associated with the “Affect” keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 4). According to Figure 4, the new areas associated with the “Affect” cluster can be listed

as follows, from yellow to mid tone green colour: “Safe Spaces, Temporality, Working Memory, Atmospheres, Motivation, Emotion Regulation, Materiality, Poetry, Cognitive Architecture, Architecture, Embodiment, Design, Space”.

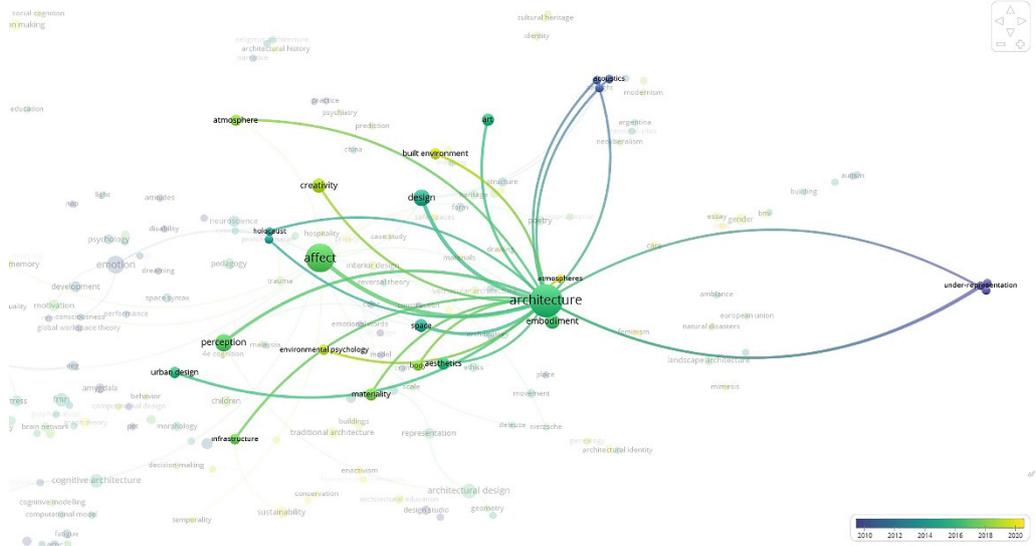


Figure 3. Strength of the lines around “Architecture” by overlay visualization according to first scanning technique in Scopus (VOSviewer).

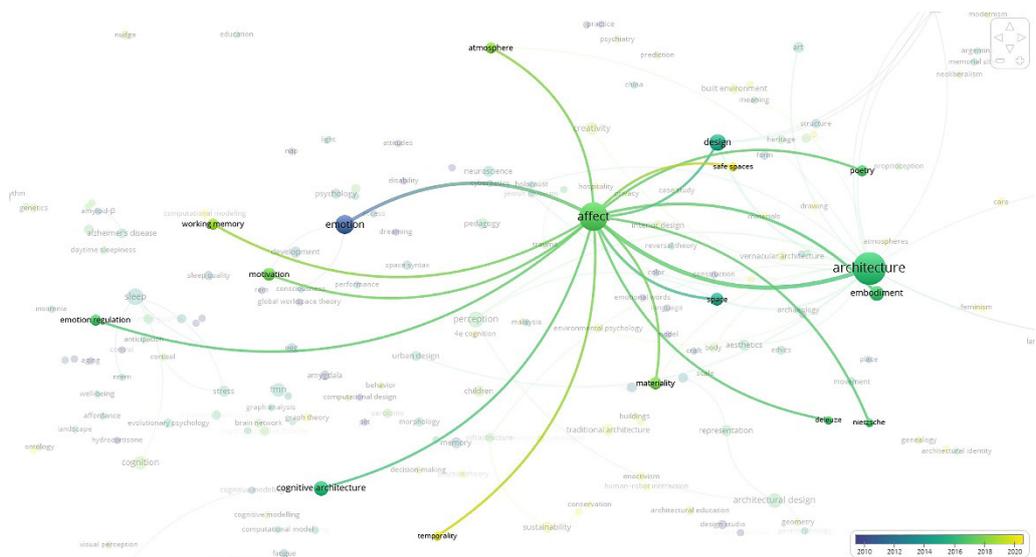


Figure 4. Strength of the lines around “Affect” by overlay visualization according to first scanning technique in Scopus (VOSviewer).

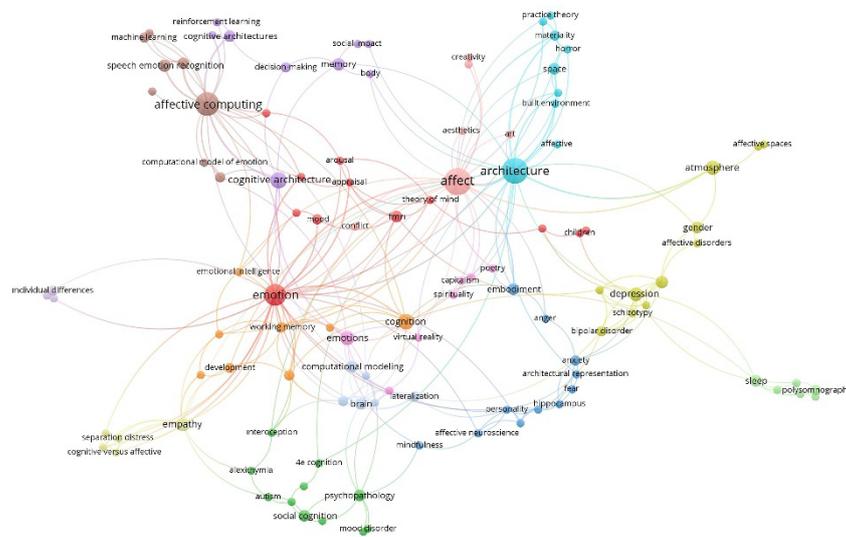
**Second scanning technique (scanned keywords “affective-architecture”):**

Criteria were decided so that the minimum number of occurrences of a keyword is 2. After these selections, of the 1082 keywords, 121 that met the thresholds were selected by the software. For each of the 121 keywords, the total strength of co-occurrence links with other keywords was calculated by the software. The keywords with the greatest total link strength were selected by the software. The number of keywords to be selected was 121.

Before proceeding to the concept of network mapping, the ranking according to the most occurrences of the keywords can be sorted in the interface created by the software (Table 12). The keyword that came first in this ranking was “affect”; the second keyword was “architecture”; the third keyword was “affective computing”; the fourth keyword was “emotion”; the fifth keyword was “cognitive architecture”; sixth keyword was “cognition”; the seventh keyword was “atmosphere”; the eighth keyword was “empathy”; the ninth keyword was “depression”; the tenth keyword was “schizophrenia” (Table 12).

**Table 12.** Top 10 keywords occurrences and total link strength according to second scanning technique.

The Ranking According to The Most Occurrences			
Ranking	Selected keywords	Occurrences	Total Link Strength
1	Architecture	30	44
2	Affect	26	35
3	Affective Computing	21	31
4	Emotion	18	46
5	Cognitive Architecture	9	12
6	Cognition	8	13
7	Atmosphere	7	7
8	Empathy	6	17
9	Depression	6	12
10	Schizophrenia	5	10



**Figure 5.** Mapping based on "Co-occurrences" data according to second scanning technique in Scopus (VOSviewer)

When proceeding with mapping in Scopus data, the VOSviewer software warned that some of the 121 items in your network are not connected to each other and the larger set of connected items consists of 112 items. Asked by the software, "Do you want to show this set of items instead of all items?", the mapping in Figure 5. was created by answering the question "yes". There were 14 clusters in the "Co-occurrences" mapping shown in Figure 5. These clusters were represented by circles of varied sizes and colours. According to this mapping, affect and architecture have more co-occurrences than the other keywords (Figure 5).

The VOSviewer software can also show developments over time (current trends) by overlay visualization of the keywords network mapping created in Figure 5. In this way, the relationship of new keywords that have been used in publications recently can be seen in Figure 6. New study areas are expressed with yellow and light green toned small clusters in the time mapping. The keywords "Affect" and "Architecture" were compared according to developments over time. It was observed that the keyword "Affect" was expressed in light tone green colour. It was observed that the keyword "Architecture" was expressed in light tone green colour (Figure 6). In addition to this situation, it was determined that the affective cluster is directly related to the architecture cluster, while the affective spaces cluster is indirectly related to the architecture cluster.

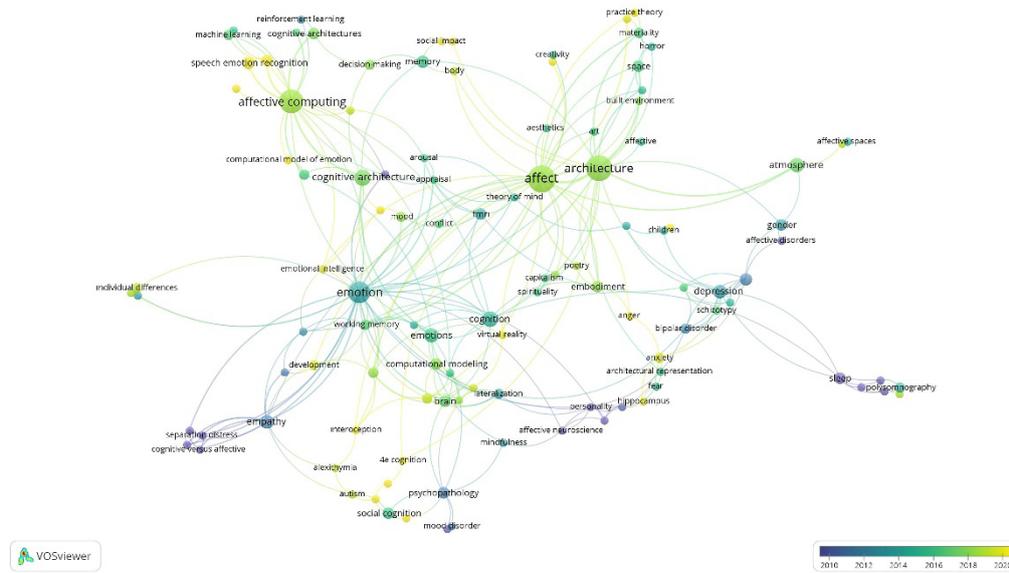


Figure 6. Mapping based on developments over time by overlay visualization of "Co-occurrences" data according to second scanning technique in Scopus (VOSviewer).

In the developments over time (current trends) by overlay visualization network map made in the VOSviewer analysis program, yellow and light green tones represent new study areas. According to Scopus data, it was determined that the field of "Affect" and "Architecture" are current fields of study. Therefore, the concept related to the fields of "Affect" and "Architecture" have been accepted as current research gaps according to the strength of the lines around it.

Firstly, in this context, to select new concepts that can be associated with the "Architecture" keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 7). According to Figure 7, the new areas associated with the "Architecture" cluster can be listed as follows, from yellow to mid tone green colour: "Atmosphere, Affect, Space, Design, Emotion".

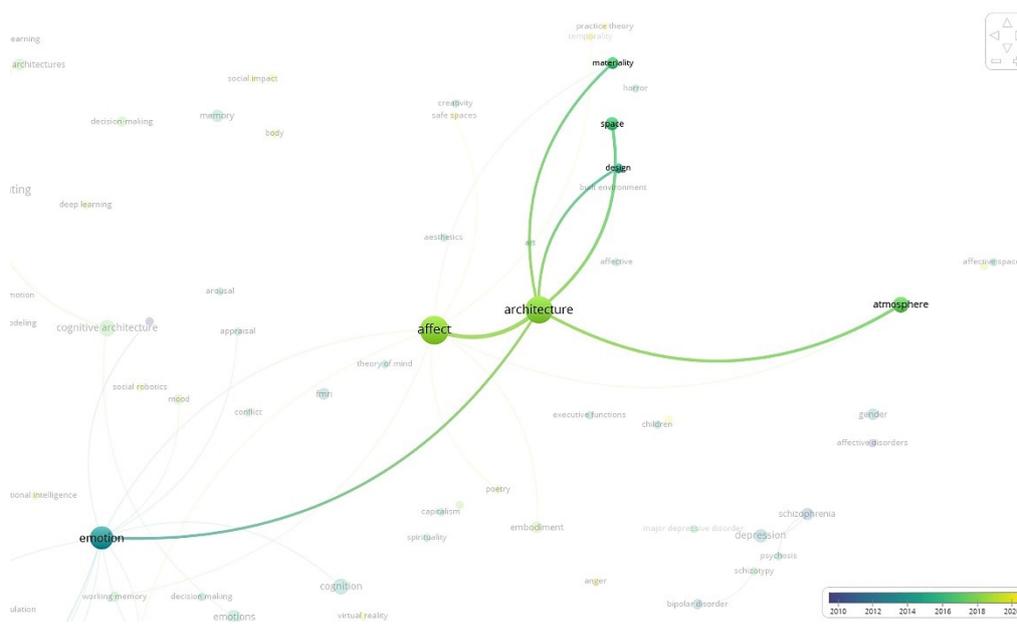
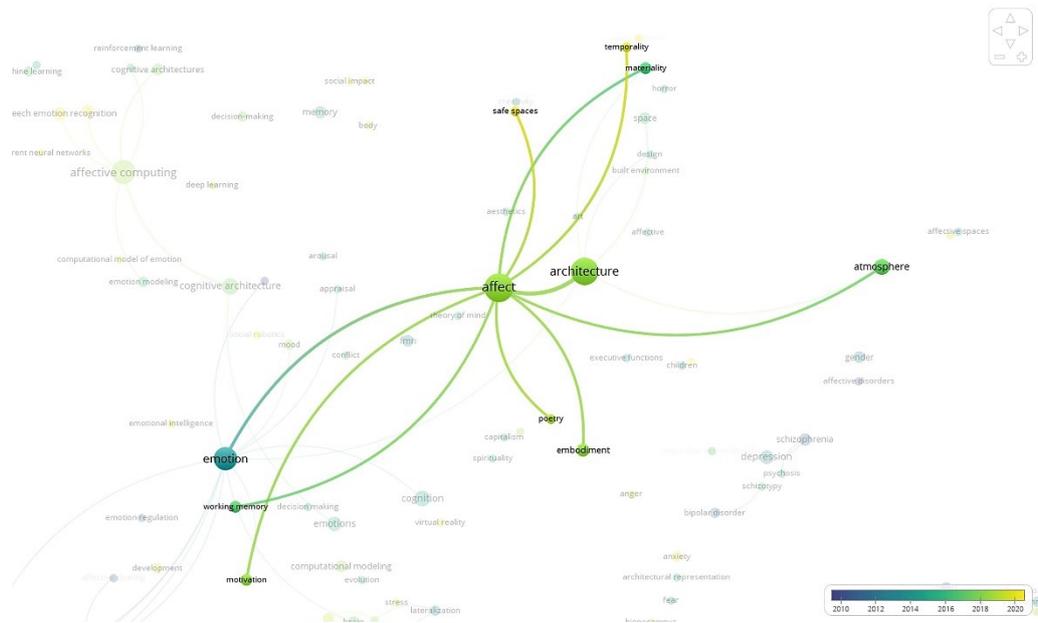


Figure 7. Strength of the lines around "Architecture" by overlay visualization according to second scanning technique in Scopus (VOSviewer).



**Figure 8.** Strength of the lines around “Affect” by overlay visualization according to second scanning technique in Scopus (VOSviewer)

Secondly, in this context, to select new concepts that can be associated with the “Affect” keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 8). According to Figure 8, the new areas associated with the “Affect” cluster can be listed as follows, from yellow to mid tone green colour: “Safe Spaces, Temporality, Architecture, Atmosphere, Motivation, Poetry, Embodiment, Materiality, Working Memory, Emotion”.

**Third scanning technique (scanned keywords “affect-architecture-water”):** Criteria were decided so that the minimum number of occurrences of a keyword is 1. After these selections, of the 1061 keywords, 1061 that met the thresholds were selected by the software. For each of the 1061 keywords, the total strength of co-occurrence links with other keywords was calculated by the software. The keywords with the greatest total link strength were selected by the software. The number of keywords to be selected was 1000.

**Table 13.** Top 10 keywords occurrences and total link strength according to third scanning technique

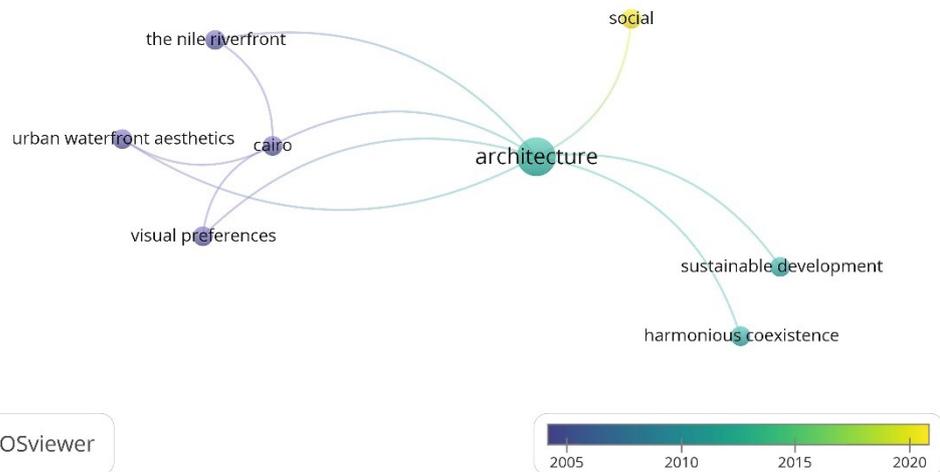
The Ranking According to The Most Occurrences			
Ranking	Selected keywords	Occurrences	Total Link Strength
1	Throughfall	10	49
2	Stemflow	9	40
3	Climate Change	7	39
4	Root Architecture	7	34
5	Eddy Covariance	5	25
6	Photosynthesis	5	24
7	Drought	5	23
8	Canopy	4	22
9	Groundwater	4	21
10	Canopy Structure	4	19

Before proceeding to the concept of network mapping, the ranking according to the most occurrences of the keywords can be sorted in the interface created by the software (Table 13). The keyword that came first in this ranking was “throughfall”; the second keyword was “stemflow”; the third keyword was “climate change”; the fourth keyword was “root architecture”; the fifth keyword was “eddy covariance”; sixth keyword was “photosynthesis”; the seventh



The VOSviewer software can also show developments over time (current trends) by overlay visualization of the keywords network mapping created in Figure 9. In this way, the relationship of new keywords that have been used in publications recently can be seen in Figure 11. New study areas are expressed with yellow and light green toned small clusters in the time mapping. The keywords "Affect", "Architecture" and "Water" were compared according to developments over time. It was observed that the keyword "Affect" was expressed in light tone green colour (Figure 10). It was observed that the keyword "Architecture" was expressed in mid tone green colour (Figure 10). It was observed that the keyword "Water" was expressed in assorted colours according to the cluster it is in (Figure 10).

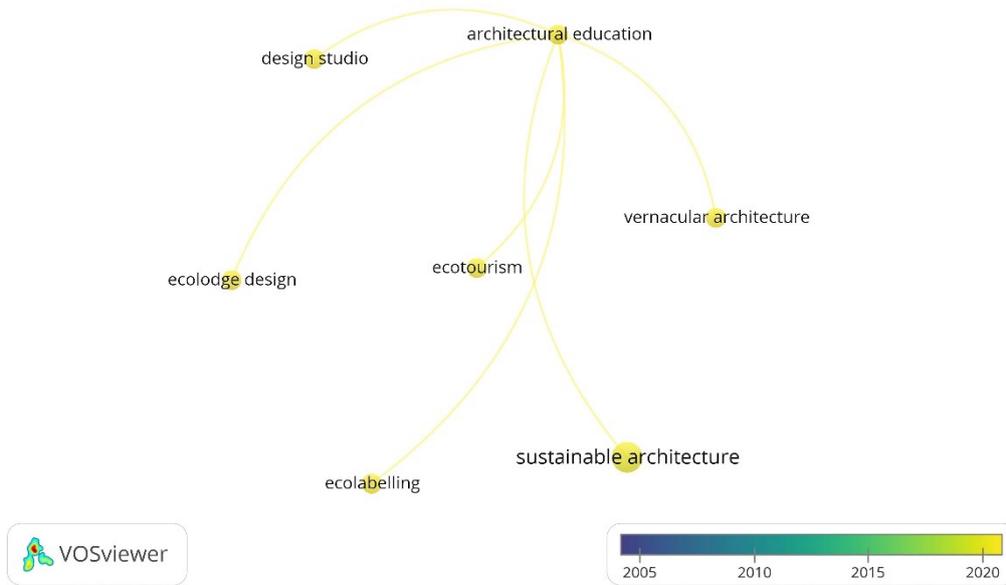
In the developments over time (current trends) by overlay visualization network map made in the VOSviewer analysis program, yellow and light green tones represent new study areas. According to Scopus data, it was determined that the field of "Affect" and "Architecture" are current fields of study. Therefore, the concepts related to the fields of "Affect" and "Architecture" have been accepted as current research gaps according to the strength of the lines around it. Since the colour of the keyword "Water" changes according to the cluster it is connected to, it has been examined one by one. In this case, "Water" has been seen that it has a yellow colour in areas that will be associated with affect and architecture.



**Figure 11.** Strength of the lines around "Architecture" by overlay visualization according to third scanning technique in Scopus (VOSviewer)

Firstly, in this context, to select new concepts that can be associated with the "Architecture" keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 11). According to Figure 11, the new areas associated with the "Architecture" cluster can be listed as follows, from yellow to mid tone green colour: "Social".

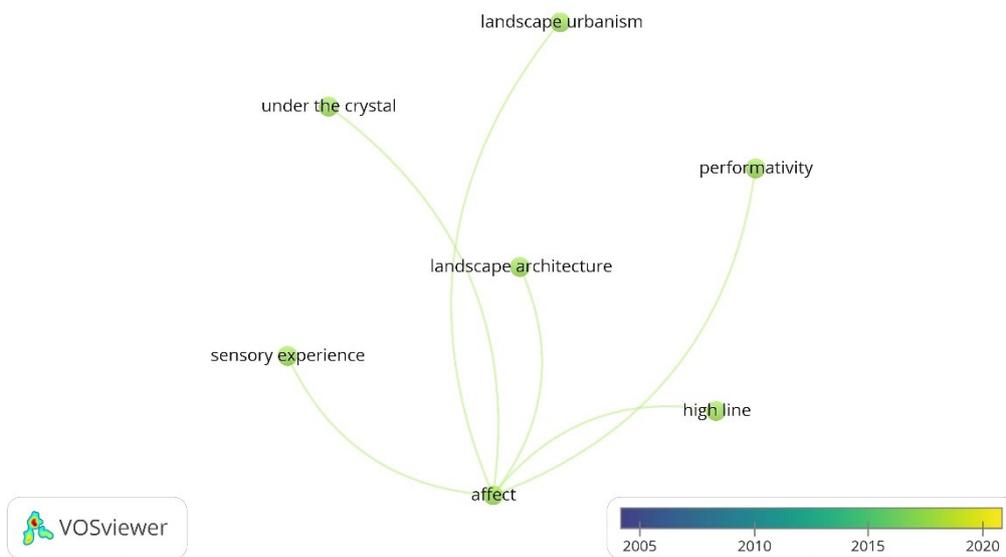
Secondly, in this context, to select new concepts that can be associated with the "Architecture" keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 12). According to Figure 12, the new areas associated with the "Architecture" cluster can be listed as follows, from yellow to mid tone green colour: "Architectural Education, Design Studio, Ecolodge Design, Ecotourism, Ecolabelling, Sustainable Architecture, Vernacular Architecture".



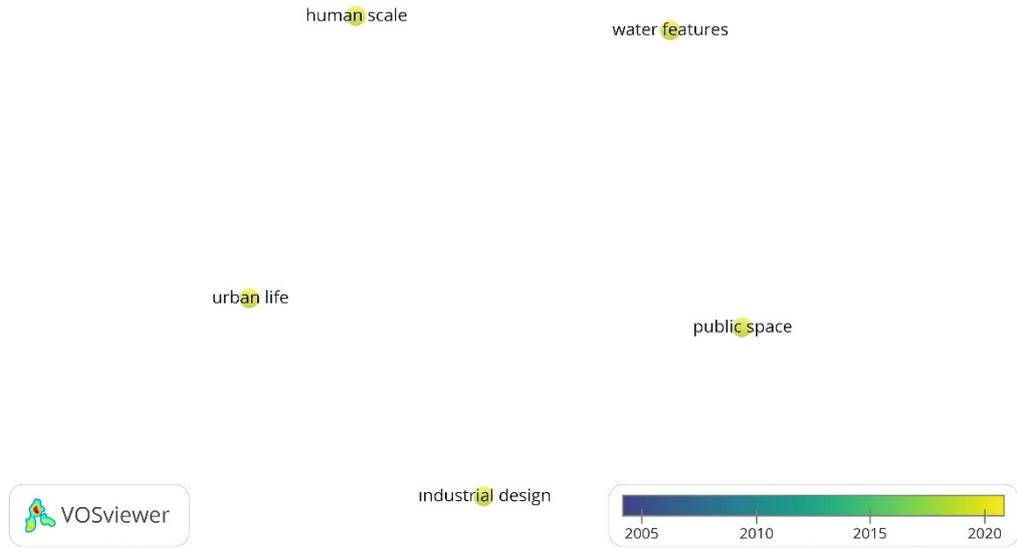
**Figure 12.** Strength of the lines around "Architecture" by overlay visualization according to third scanning technique in Scopus (VOSviewer)

Thirdly, in this context, to select new concepts that can be associated with the "Affect" keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 13). According to Figure 13, the new areas associated with the "Affect" cluster can be listed as follows, from yellow to mid tone green colour: "Sensory Experience, Landscape Architecture, High Line, Under the Crystal, Landscape Urbanism, Performativity".

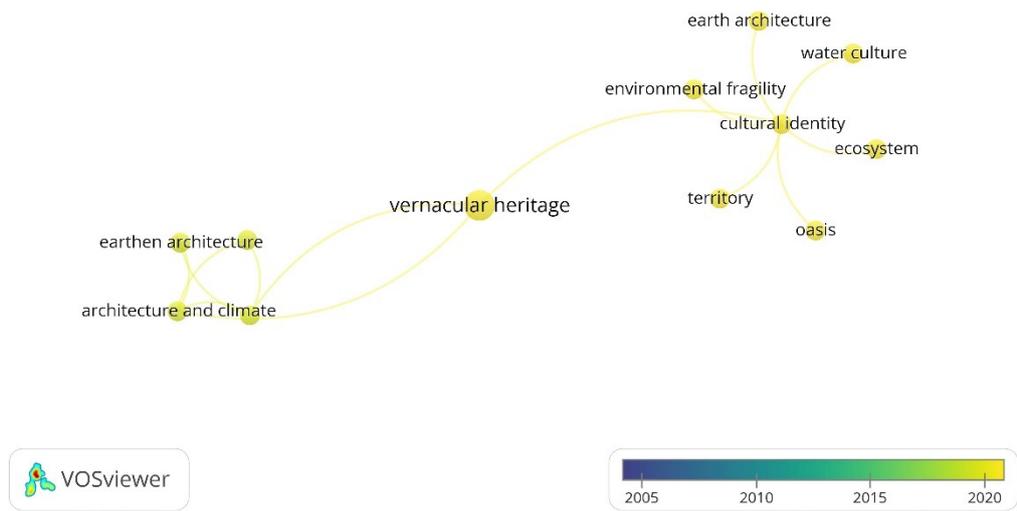
Fourthly, in this context, to select new concepts that can be associated with the "Water" keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 14). According to Figure 14, the new areas near with the "Water" cluster can be listed as follows, from yellow to mid tone green colour: "Human Scale, Urban Life, Industrial Design, Public Space".



**Figure 13.** Strength of the lines around "Affect" by overlay visualization according to third scanning technique in Scopus (VOSviewer)



**Figure 14.** Strength of the lines around "Water" by overlay visualization according to third scanning technique in Scopus (VOSviewer)



**Figure 15.** Strength of the lines around "Water" by overlay visualization according to third scanning technique in Scopus (VOSviewer)

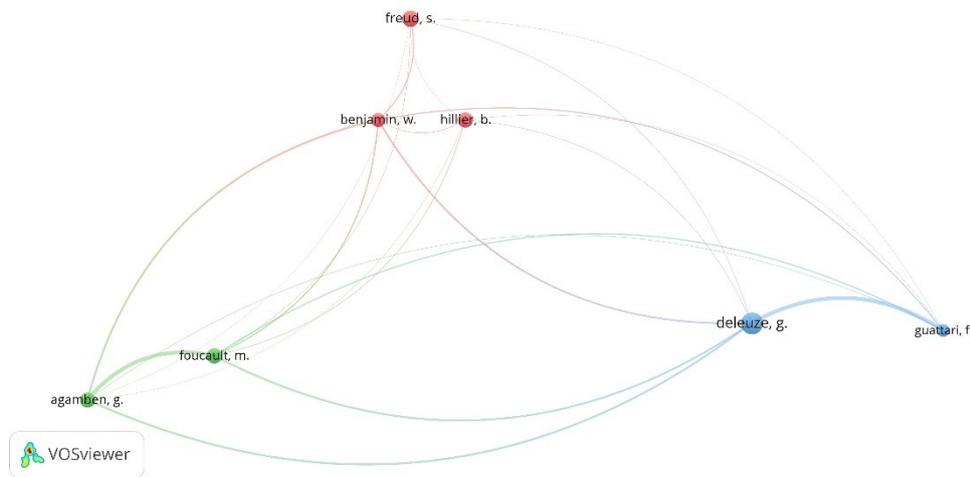
Fifthly, in this context, to select new concepts that can be associated with the "Water" keyword, small clusters networked with in yellow and light green tones close to the cluster they belong to were considered (Figure 15). According to Figure 15, the new areas near with the "Water" cluster can be listed as follows, from yellow to mid tone green colour: "Water Culture, Earth Architecture, Environmental Fragility, Cultural Identity, Ecosystem, Oasis, Territory, Vernacular Heritage, Earthen Architecture, Architecture and Climate".

### Mapping based on "Co-citation" data by the "Cited Authors"

Co-citation analysis is a provider method to study the speciality structure of science in the specified field (Small, 1973, p. 265). In addition, co-citation analysis is one of the techniques that devised to identify documents likely to be closely related (Smith, 1981, p. 85). Cited authors co-citation analysis is used in understanding intellectual structure and can produce empirical maps of prominent authors in various areas at science (White & Griffith, 1981; McCain, 1990). Co-citations to the third document in two independent documents are

examined through authors cited together. In this analysis, the clusters and the sizes of the clusters represent the cited authors' frequency. The links between the clusters express the cooperation between the cited authors. The thickness of the line of networks increases according to the total link strength between the cited authors.

**First scanning technique (scanned keywords "affect-architecture"):** Criteria were decided so that the minimum number of citations of an author is 50. After these selections, of the 60766 authors, 10 that met the thresholds were selected by the software. For each of the 10 authors, the total strength of co-citation links with other authors was calculated by the software. The authors with the greatest total link strength were selected by the software. The number of authors to be selected was 10.

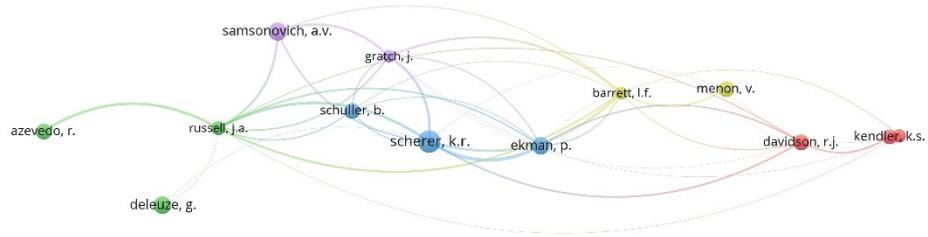


**Figure 16.** Mapping based on "Co-citation" data according to the "Cited Authors" data according to first scanning technique in Scopus (VOSviewer)

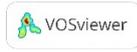
When proceeding with mapping in Scopus data, the VOSviewer software warned that some of the 10 items in your network are not connected to each other and the larger set of connected items consists of 7 items. Asked by the software, "Do you want to show this set of items instead of all items?", the mapping in Figure 16. was created by answering the question "yes". According to this mapping, the first author was, with 127 co-citations, "Deleuze"; the second author was, with 80 co-citations, "Freud"; the third author was, with 71 co-citations, "Agamben"; the fourth author was, with 71 co-citations, "Foucault"; the fifth author was, with 67 co-citations, "Hillier"; the sixth author was, with 61 co-citations, "Benjamin"; the seventh author was, with 59 co-citations, "Davidson"; the eighth author was, with 55 co-citations, "Steg"; the ninth author was, with 54 co-citations, "Guattari"; the tenth author was, with 59 co-citations, "Damasio" (Figure 16).

**Second scanning technique (scanned keywords "affective-architecture"):** Criteria were decided so that the minimum number of citations of an author is 40. After these selections, of the 26567 authors, 13 that met the thresholds were selected by the software. For each of the 13 authors, the total strength of co-citation links with other authors was calculated by the software. The authors with the greatest total link strength were selected by the software. The number of authors to be selected was 13.

When proceeding with mapping in Scopus data, the mapping process has been completed without any warning by the software when proceeding for the mapping (Figure 17). According to this mapping, the first author was,



**Figure 17.** Mapping based on "Co-citation" data according to the "Cited Authors" data according to second scanning technique in Scopus (VOSviewer)

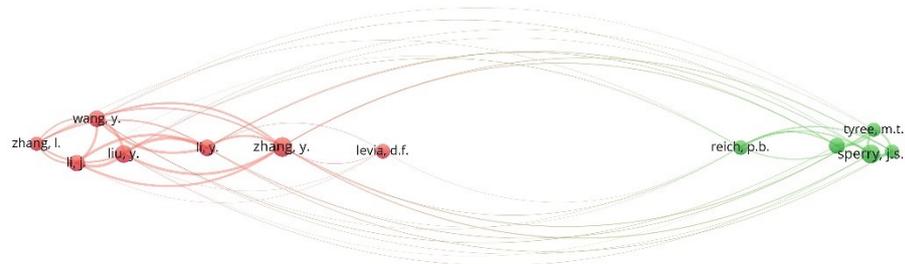


with 100 co-citations, "Scherer"; the second author was, with 71 co-citations, "Samsonovich"; the third author was, with 69 co-citations, "Ekman"; the fourth author was, with 66 co-citations, "Deleuze"; the fifth author was, with 58 co-citations, "Azevedo"; the sixth author was, with 57 co-citations, "Davidson"; the seventh author was, with 56 co-citations, "Schuller"; the eighth author was, with 56 co-citations, "Menon"; the ninth author was, with 51 co-citations, "Kendler"; the tenth author was, with 45 co-citations, "Russell"; the eleventh author was, with 43 co-citations, "Kupfer"; the twelfth author was, with 41 co-citations, "Barrett"; the thirteenth author was, with 40 co-citations, "Gratch" (Figure 17).

**Third scanning technique (scanned keywords "affect-architecture-water"):**

Criteria were decided so that the minimum number of citations of an author is 40. After these selections, of the 28972 authors, 12 that met the thresholds were selected by the software. For each of the 12 authors, the total strength of co-citation links with other authors was calculated by the software. The authors with the greatest total link strength were selected by the software. The number of authors to be selected was 12.

When proceeding with mapping in Scopus data, the VOSviewer software warned that some of the 20 items in your network are not connected to each other and the larger set of connected items consists of 13 items. Asked by the software, "Do you want to show this set of items instead of all items?", the mapping in Figure 18. was created by answering the question "yes". According to this mapping, the first author was, with 66 co-citations, "Zhang, Y."; the second author was, with 65 co-citations, "Sperry"; the third author was, with 56 co-citations, "Liu"; the fourth author was, with 52 co-citations, "Li, J."; the fifth author was, with



**Figure 18.** Mapping based on "Co-citation" data according to the "Cited Authors" data according to third scanning technique in Scopus (VOSviewer)



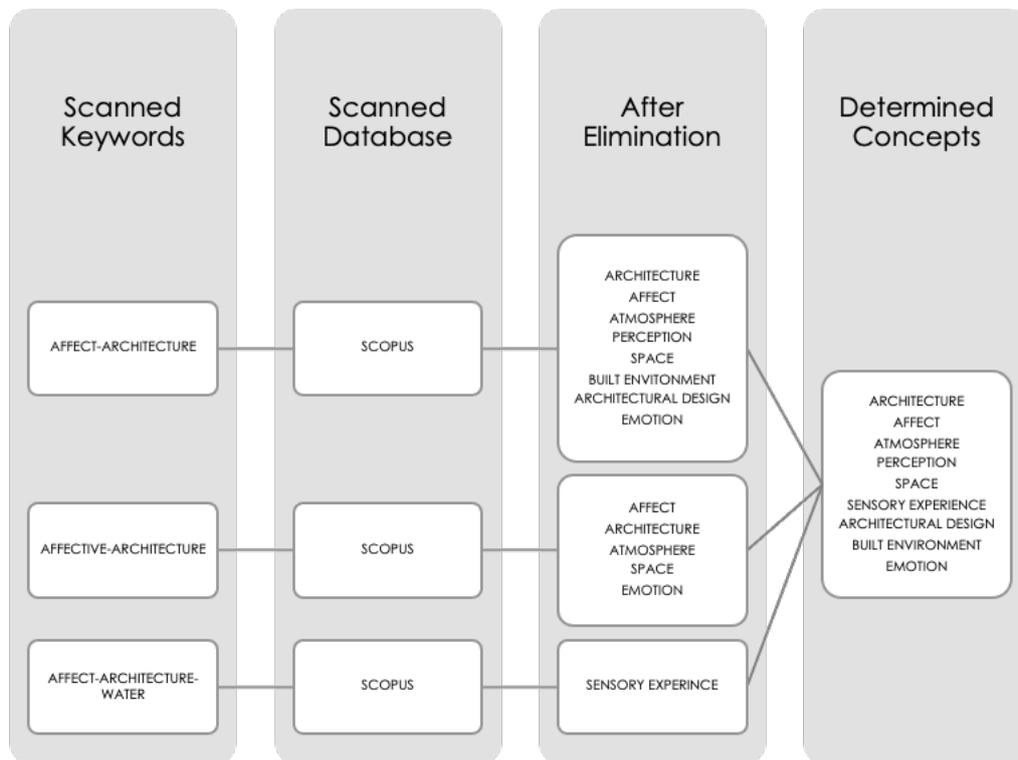
50 co-citations, “Li, Y.”; the sixth author was, with 50 co-citations, “Wang”; the seventh author was, with 47 co-citations, “Mainzer”; the eighth author was, with 42 co-citations, “Reich”; the ninth author was, with 42 co-citations, “Levia”; the tenth author was, with 40 co-citations, “Hacke”; the eleventh author was, with 40 co-citations, “Tyree”; the twelfth author was, with 40 co-citations, “Zhang, I.” (Figure 18).

## CONCLUSION

In this study, scientific documents about the “Affect, Affective, Architecture and Water” were examined by bibliometric data collected from Scopus database according to some criteria in selected scientific disciplines which are Arts and Humanities or Psychology or Environmental Science. In order to understand these concepts, the search was detailed by creating three different combinations with the selected keywords. These combinations were “Affect” and “Architecture”; “Affective” and “Architecture”; “Affect”, “Architecture” and “Water”. In this context, document types, publication years, top countries, top subject areas, top sources, top affiliations, top funding sponsors, author keywords and co-occurrences, co-citations of cited authors were evaluated based on the bibliometric data of 1557 documents in total conducted since 1921.

Bibliometric analysis with science mapping techniques methods was applied to the data downloaded by scanning with the keywords “Affect, Affective, Architecture and Water” in Scopus database. The concepts related to the “Affect, Affective, Architecture and Water” clusters and the developments over time (new trends) by overlay visualization for the concepts were determined by “co-occurrences mapping”. The cited authors related to the “Affect, Affective, Architecture and Water” clusters were determined by “co-citation mapping”.

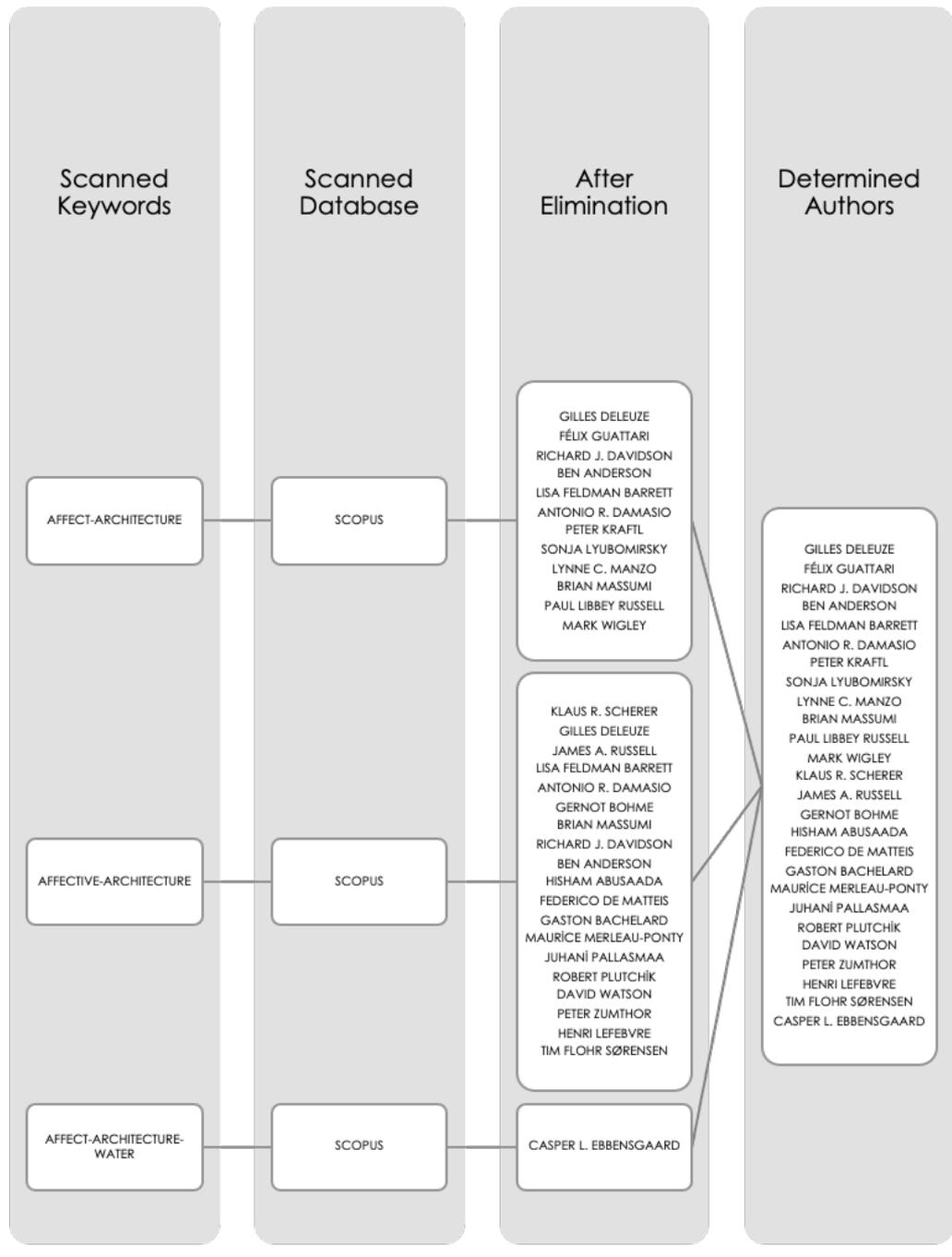
As a result of co-occurrences of author keywords mapping, related concepts in the current research gaps were determined according to the findings (Table 14). In the database selected for three scanning techniques, the nine concepts



**Table 14.** From the keywords to the new research related gaps “Concepts”

determined by the scanned keywords are Architecture, Affect, Atmosphere, Perception, Space, Sensory Experience, Architectural Design, Built Environment, Emotion (Table 14). While determining these gaps, new concepts that may be related and networked to "Affect, Architecture and Water" were emphasized. As a result of co-citation mapping, authors were determined according to the findings (Table 15). After the names of the authors were determined in the co-citation mapping, back to the references and screened according to the related texts. Other authors who were not in the priority rank in the co-citation mapping by the selected criteria were determined according to the references related to the subject. In this case, in the database selected for three scanning techniques, the 26 authors who can be examined as reference sources determined by the scanned keywords are Gilles Deleuze, Félix Guattari, Richard J. Davidson, Ben Anderson, Lisa Feldman Barrett, Antonio R. Damasio, Peter Krafft, Sonja Lyubomirsky, Lynne C. Manzo, Brian Massumi, Paul Libbey

**Table 15.** From the keywords to the "Authors"



Russell, Mark Wigley, Klaus R. Scherer, James A. Russell, Gernot Böhme, Hisham Abusaada, Federico De Matteis, Gaston Bachelard, Maurice Merleau-Ponty, Juhani Pallasmaa, Robert Plutchik, David Watson, Peter Zumthor, Henri Lefebvre, Tim Flohr Sørensen and Casper Laing Ebbensgaard (Table 15). While determining these authors, mainly cited references that may be related and networked to "Affect, Architecture" were emphasized. In spite of, primary author could not be reached according to "Affect, Architecture and Water" keywords combination according to some criteria in selected scientific disciplines, only one author determined by backing to the articles (Table 15).

It has been illustrated that the keywords "affect-architecture-water" were not found together at the same time in the findings obtained as a result of the analyses from the Scopus data in with the criterias determined by the third scanning combination and the selected disciplines. On the other hand, it has been proved that the keywords "affect-architecture" and "affective-architecture" were found together at the same time in the findings obtained as a result of the analyses from the Scopus data in with the criterias determined by the combination of the first and second screening and the selected disciplines. To conclude, it was pointed out that a new network could be established with "water" for the relationship between "affect-architecture" and "affective-architecture". Moreover, the concepts determined in these research areas have just started to be studied and have a growing tendency. In addition to this situation, in the approach to the relationship between space and water in architecture; "affect" with the other keywords around it have been found to be actual and open to development.

## ACKNOWLEDGEMENT

This study is produced from an ongoing master thesis of Damla Katuk under the supervision of Emine Koseoglu, titled "Biyofilik Yaklaşım ile Suyun Mekânda Algısal ve Duygulanımsal Boyutları: Çağdaş Mimarlık Örnekleri" (Perceptual and Affective Aspects of Water in Architectural Space by A Biophilic Approach: Examples of Contemporary Architecture) which was accepted in the Master of Architecture Program at Fatih Sultan Mehmet Vakıf University Institute of Graduate Studies since 9 July 2021.

This study is an output of the research project entitled "Biyofilik Yaklaşım ile Suyun Mekânda Algısal ve Duygulanımsal Boyutları: Çağdaş Mimarlık Örnekleri" which has been supported by Fatih Sultan Mehmet Vakıf University Research Projects Coordination Unit under grant number "2022B1Ç05D".

This study is an output of the research project entitled "Çağdaş Mimarlık Örneklerinde Biyofilik Öğe Olarak Suyun Algısal ve Duygulanımsal Yönlerinin İncelenmesi" which has been supported by 1002-B Emergency Support Module of The Scientific and Technological Research Council of Türkiye (TÜBİTAK) under grant number "222K102".

## Conflict of Interest

No conflict of interest was declared by the authors.

## Authors' Contributions

The authors contributed equally to the study.

## Financial Disclosure

**Funding:** BAP Coordination Unit of Fatih Sultan Mehmet Vakıf University (FSMVU) [grant number, 2022B1Ç05D]

**Funding:** 1002-B Emergency Support Module of The Scientific and Technological Research Council of Türkiye (TÜBİTAK) [grant number, 222K102].

### **Ethics Committee Approval**

Ethics committee approval was not required for this article.

### **Legal Public/Private Permissions**

In this research, the necessary permissions were obtained from the relevant participants (individuals, institutions, and organizations) during the survey and in-depth interviews

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ISSN:2822-4175