ITU A|Z • Vol 20 No 1 • March 2023 • 163-179

Minding the city: A case study on the new conceptualizations of human experience in the built environment

Tülay KARAKAŞ[1], Burcu Nimet DUMLU[2], Dilek YILDIZ ÖZKAN[3*]
[1] erenoglutu@itu.edu.tr • Ph.D Program of Architectural Design, Faculty of Architecture, Istanbul Technical University, Istanbul, Turkey
[2] dumlub@itu.edu.tr • Ph.D Program of Architectural Design Computing, Faculty of Architecture, Istanbul Technical University, Istanbul, Turkey, Department of Media Design, Keio University, Tokyo, Japan
[3] yildizd1@itu.edu.tr • Department of Architecture, Faculty of Architecture, Istanbul Technical University, Istanbul, Turkey

**Corresponding author*
Received: November 2021 • Final Acceptance: October 2022

Abstract
The study intends to mind the city by taking the information gathered through the senses and processed in the human brain as the primary concern in understanding the human experience in the built environment. This refreshing approach deals with human behavior, perception, cognition, sensation, and emotion that requires a well-defined conceptual framework. Therefore, as the study's primary objective, minding the city investigates the conceptualizations based on human evolutionary cognitive tendencies: biophilia, bilateral symmetry, mirror neurons, pareidolia, proxemics, thigmotaxis, curvilinearity and rectilinearity. The human experience is investigated, considering it as an individual human self, interpersonal human beings, and through human-built environment interactions and human-nature interactions. The paper was designed as qualitative research employing a case study strategy to develop explanatory and exploratory empirical inquiry. The conceptualizations were studied through fieldwork using observational measurements, mapping techniques, and the declaration of participants' own experiences. The fieldwork was conducted through a serial workshop entitled 'Minding the city: Bring your brain into the built environment' in İstanbul and Famagusta in 2019. As the output of the study, the visual and verbal representations of conceptualizations and urban codes were presented and discussed with the related literature. Ultimately, the acquired knowledge applied to a theory-building structure expands the theory of human experience investigated through the idea of minding the city. In sum, the study presented evolutionary aspects of human experience in a new way by identifying generalizable patterns, presented as urban codes, occurring in the daily experience of individuals and groups.

Keywords
Cognitive sciences, Human-built environment interaction, Human-nature interaction, Human evolutionary cognitive tendencies, Neuroscience.

doi: 10.5505/itujfa.2022.53179

1. Introduction

Research on the human experience in the built environment has extensive literature encompassing various disciplines. In the past several decades, human experience has played an essential role in architecture and urban studies with a particular interest in scientific perspectives and findings. The new perspectives based on neuroscience and cognitive sciences have become the most effective multi-disciplinary approach to studying human experience (Eberhard, 2007; Pallasmaa et al., 2013; Zeisel, 2006). Cognitive architecture (Hauptmann et al., 2010; Sussman & Hollander, 2015) and neuro-architecture (Edelstein, 2015; Frascari, 2012) have emerged as new study fields under these circumstances prioritizing the human response to environmental stimuli with a specified interest in the human brain, mind, and psyche. Therefore, it would be of particular interest to investigate human experience in the built environment through the lens of those emerging fields concerning it as an individual human self, interpersonal human beings, and through human-built environment interactions and human-nature interactions.

The present study intends to mind the city by taking the information gathered through the senses and processed in the human brain as the primary concern in understanding the human experience in the built environment. Minding the city considers Lynch's (1960) theory of reading the city as a pioneering study model. The empirical inquiry of individual human experience first appeared in Lynch's studies, mainly concerning the form of the city, and eventually ended up with an inspiring method and mind-opening theory of urbanism. Lynch (1960) prioritized the visual perception and the look of the cities in capturing the urban patterns and categorizing them with their features. However, minding the city concentrates on understanding the experiential use of an urban setting through the knowledge of the human brain. The insights of brain studies contribute to understanding the sensory, cognitive, emotional, and behavioral dimensions of human experience in architecture and the built environment. Additionally, they have provided valuable information for creating common grounds between the disciplines to conduct a systematic inquiry for understanding the human experience (Karakaş & Yıldız, 2020). This refreshing approach constitutes a relatively new area dealing that requires a well-defined conceptual framework. Therefore, as the study's primary objective, minding the city investigates the conceptualizations based on human evolutionary cognitive tendencies: biophilia, bilateral symmetry, mirror neurons, pareidolia, proxemics, thigmotaxis, curvilinearity and rectilinearity.

As humans, we come from a common evolutionary past shaping our tendencies and priorities that are primarily unconscious, innate, and hidden. The conceptualizations based on human evolutionary tendencies have been adapted from broad disciplinary studies covering biology, psychology, anthropology, cognitive sciences, behavioral sciences, neuroscience, and cognitive sciences. However, the literature relating the conceptualizations to architecture and the built environment is a maturing area with flourishing studies on cognitive architecture and neuro-architecture. Sussman and Hollander (2015) introduced the new conceptualizations in the built environment as a set of principles, including biophilia, bilateral symmetry, pareidolia, proxemics, thigmotaxis, and curvilinearity and rectilinearity. Morabito (2016) extended the set by adding mirror neurons and mnemonics. Hollander and Foster (2016) studied the concepts, named them cognitive architecture (CA) principles, to score an urban setting by using EEG (electroencephalography) measurements without reference to the subjective experience of participants. However, there is no adequate research that has investigated these conceptualizations through an empirical inquiry in terms of adding the insights of individuals on understanding the human experience in an urban setting. Therefore, we formulated the research question: "How would the human experience be understood through the new conceptualizations based on human evolutionary cognitive tendencies in a real urban setting?".

The present paper was designed as qualitative research employing a case study strategy to develop explanatory and exploratory empirical inquiry. Therefore, we used observational measurements, mapping techniques, and the declaration of participants' own experiences. A challenging problem arising in this domain is operationalizing the available knowledge for minding the city study because of the novelty of the study field. Thus, we developed two phases of the case study. First, we designed a preliminary stage which was the pilot study. Then, we conducted the main study. Both studies included fieldwork designed as workshops. After a brief on the pilot study identifying its contributions, the main study was presented in detail. The fieldwork of the main study developed for the Eastern Mediterranean University 9th International Design Week with the name "Minding the City / Famagusta: Bring your brain into the built environment." Throughout the workshop, comprehensive visual and verbal data was collected. The data were represented as multilayered and cognitive outputs, including videos, photographs, diagrams, sketches, architectural drawings, and notes. Finally, the collected data were analyzed and synthesized to produce visual and verbal representations of the conceptualizations and to generate the urban codes [1]. The final outputs of the study were cognitive maps, digital drawings, and generated urban codes developed separately for each conceptualization. They were presented and discussed within the related literature in the discussion part. In conclusion, an overall interpretation of the case study was developed.

2. The new conceptualizations

2.1. Biophilia

In 1984, Edward O. Wilson defined the term biophilia as "the innate tendency to focus on life and lifelike processes" (Wilson, 1984, p.1). Followingly, the concept of biophilia, even if it was not mentioned as biophilia specifically, has been studied in diverse study fields, including philosophy, anthropology, psychology, physiology, medicine, environmental studies, architecture, and urban studies. Briefly, biophilia is an urge, a biological need, and an evolutionary tendency to be connected to nature and other organisms. In the literature, the concept of biophilia has been discussed through the savannah hypothesis (Orians, 1980, 1986), biophilia hypothesis (Stephen R. & Edward O., 1993), connectedness to nature (Zylstra et al., 2014), attention restoration theory (Kaplan, 1995), and stress recovery theory (Ulrich, 1984; Ulrich et al., 1991) which are concerned about human mental and physical health and well-being. Furthermore, in recent years, the application of biophilic patterns to design processes has gained importance regarding psychological benefits and effects on health and well-being (Ryan et al., 2014). Therefore, we applied the biophilia concept to our study to investigate the human experience as an individual human self and through human-nature interaction.

2.2. Bilateral symmetry

Bilateral symmetry is a biological term used to explain symmetry with respect to left and right or a vertical axis that divides an organism into two identical parts (Coburn et al., 2017; Moubayidin & Østergaard, 2015). As an essential gestalt principle (Koffka, 1935), symmetry is not only one of the most crucial design patterns (Alexander, 2002) and design organization schemes but also one of the most commonly used design principles that have roots in architectural history (Ching, 2007). Furthermore, according to neuroscience studies, our brain and visual system are susceptible and responsive to symmetry (Ramachandran & Hirstein, 1999), and symmetry in things significantly affects our aesthetic judgment of beauty (Jacobsen et al., 2006). Therefore, we searched for bilateral symmetry in the built environment to study the human experience through human-built environment interaction.

2.3. Mirror neurons

The concept of mirror neurons was adapted from neuroscience studies. The mirror neurons, initially discovered in macaque monkeys' brains, are a specific group of neurons that fires

both during the execution of an action and observation of the same action while performed by others (Gallese et al., 1996; Rizzolatti et al., 1996). Followingly, mirror mechanisms were discovered in the human brain (Rizzolatti & Craighero, 2004; Rizzolatti & Sinigaglia, 2008), which is a more complex issue including not only the actions of individuals but also sensations, feelings, emotions, and mental processes of individuals. According to neuroscience studies, the functional role of mirror neurons in humans might be action imitation and action understanding (Rizzolatti & Craighero, 2004). Therefore, those functionalities may contribute to understanding and repeating the behavioral responses of individuals to certain stimuli. Furthermore, they may create an understanding of a shared experience based on individuals' actions, feelings, emotions, and intentions. We applied the knowledge derived from neuroscience studies of mirror mechanisms to the built environment to create an understanding of the human experience based on interpersonal relations.

2.4. Pareidolia

Pareidolia is one of the oldest biological traits of human beings. According to the Oxford Reference (Concise Medical Dictionary, 2010, pareidolia entry), pareidolia is the "misperception of random stimuli as real things or people," a broader term including all human and non-human characteristics. For example, the tendency to seek and recognize facial expressions in things means facial pareidolia, which is the most common type of pareidolia.

Faces are so crucial for the human perception that evolutionarily, we prioritize faces and people (Sussman & Hollander, 2015), and face perception is our most highly developed skill (Haxby et al., 2000). Furthermore, as Gallese (2022) stated, 'the face is the first means used to build interpersonal relations.' So, naturally, we tend to see faces in buildings and objects. However, in the literature, few studies relate the pareidolia concept with the design disciplines and aesthetics, which establishes its relevance for design contexts (Wodehouse et al., 2018) and its effects on human affective perception (Abbas & Chalup, 2021; Chalup et al., 2010). Therefore, we applied pareidolia concepts to our study to investigate the impact of face-like forms on the human experience through human-built environment interaction.

2.5. Proxemics

Proxemics is a spatial behavior based on the regulation of distancing between both people and tactile stimuli regarding body-space relations. The term proxemics was first introduced by Hall (1959, 1969), which refers to studying spatial relations. Hall (1969) identified four measurable personal spheres referring to a distance between two people; 1) intimate distance, less than 45 cm, 2) personal distance, ranging from 45 cm to 120 cm, 3) social distance, from 120 cm to 360 cm, and 4) public distance, from 360 cm to 760 cm. Thus, those distances become a helpful tool for understanding the human experience in the built environment. As Author (2020) explained, humans regulate their proxemic distances within the environments they are immersed in and locate themselves with personal, social, or public distance according to how they intend to perceive a building element. Therefore, we studied the concept of proxemics to understand the human experience as interpersonal human beings, human built-environment interaction, and human-nature interaction regarding the regulation of inter-relational distancing.

2.6. Thigmotaxis

Thigmotaxis is a spatial strategy used by humans and animals, which "is a way an organism organizes behavior relative to tactile stimuli" (Kallai et al., 2007). In the literature, various terms are used instead of thigmotaxis as wall-hugging, wall-touching, wall-following, centrophobic behavior, and agoraphobia (Creed & Miller, 1990; Harris et al., 2009; Kallai et al., 2007; Schnörr et al., 2012; Sussman & Hollander, 2015; Walz et al., 2016). Briefly, thigmotaxis is the tendency to stay close to the boundaries of space during spatial exploration,

which is directly related to the human experience of architectural and urban space. In architecture and urban studies, Jan Gehl, one of the most critical actors in examining citizens' public life and behavioral experiences, introduced the concept of the edge effect in 1987 (Gehl, 1987). According to Gehl (2011), people move close to the boundaries of public spaces and choose physical boundaries or threshold locations where they can see the whole area clearly while standing and sitting, a tendency similar to thigmotaxis. We investigated the thigmotaxis concept to understand the human experience through human-built environment interaction and human-nature interaction concerning the boundaries of space.

2.7. Curvilinearity and rectilinearity

The influence of curvilinearity and rectilinearity have been studied from the perspectives of various disciplines over the years, such as architecture, neuroscience, psychology, aesthetics, and neuro-aesthetics. Curvilinear and rectilinear forms as physical attributes might influence the human experience regarding behavioral, emotional, and cognitive responses and the aesthetic experience of the users. In the literature, it has been investigated through diverse topics such as the potential of triggering emotional responses (Dazkir, 2009; Madani-Nejad, 2007), approach and avoidance behavior (Vartanian et al., 2013), environmental preferences (Bar & Neta, 2006; Leder et al., 2011) and beauty judgment (Coburn et al., 2017; Vartanian et al., 2013, 2019). Most studies indicated that curve lines and forms are preferred, more beautiful, pleasing, visually complex, approachable, serene, and joyful than rectilinear shapes and forms made of straight lines. Therefore, we studied the concept of curvilinearity and rectilinearity to understand the human experience through the human-built environment interaction with the contours of a space.

3. Method: Developing a case study

We conducted a case study research design to create an explanatory and exploratory empirical inquiry. The study's explanatory target is to interpret the behavioral patterns that occurred in the experiential use of an urban setting by exploring conceptualizations based on human evolutionary cognitive tendencies. The exploratory target of the study is to investigate those conceptualizations in understanding the human experience as an individual human self, interpersonal human beings, human-built environment interaction, and human-nature interaction to apply to a theory-building structure. Therefore, the case study investigated the conceptualizations in real-life contexts by applying systematic observation, self-declaration tools, and mapping techniques to reach multiple sources of evidence. The case study was developed through sequential workshops in Istanbul and Famagusta, presented as the pilot and the main study.

3.1. Participants

We recruited workshop participants with an open call for senior architecture students. The participants of the pilot and main study have a joint team. We designed the pilot study as a workshop for architecture students studying at the University on 4-6 April 2019. The application requirements included 1) taking a photo from an urban environment representing a particular organizational scheme parallel to the ground surface and 2) writing a short essay explaining the selected vantage point. We aimed to recruit fully immersed students. Five students, three of them were 4th year, and two were master's students, were chosen. We trained the students in the course of the pilot study.

For the main study, we attended the 9th International Design Week held at Eastern Mediterranean University in Cyprus on 8-10 May 2019 with the trained students. Additionally, we recruited five new participants who applied through design week to join the study team. The newcomers were trained through the presentations and the pilot study findings. We coupled the trained students with the new participants to increase the awareness and attention levels of the study groups. It was crucial for the study's success that

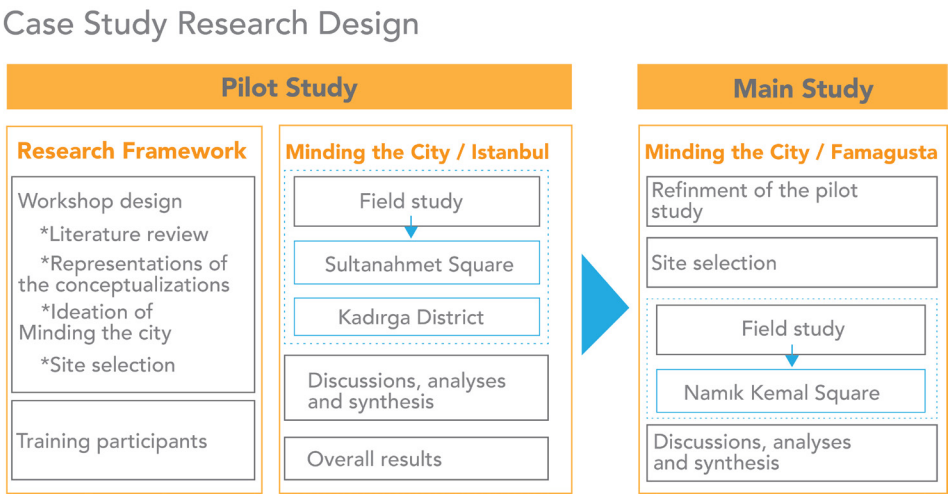

Figure 1. *The case study research design.*

the participants would be prepared for what to observe and how to make their observations and experiences explicit. Then, we assigned the concepts to each group to make them employ the arrangements in the field.

3.2. The case study research design

We designed the pilot study as a preliminary study for the main study, including the field studies and necessary preparations for future studies. The content of the whole case study research design is shown in Figure 1.

Within the pilot study, we developed a detailed study covering the requirements of the research framework and the field studies; 1) workshop design and the preparation of the workshop materials, including literature review, representations of the conceptualizations developed by the research team, ideation of minding the city, and site selection 2) training the participants. The fieldwork of the pilot study was conducted with the Minding the City / Istanbul: Bring your brain into the built environment workshop, while 'Minding the City/Famagusta: Bring your brain into the built environment workshop was led for the main study.

The workshop design has a generic three-day flow applied to both studies. The research pattern of the workshop included individual and collective processes considering both in-studio and on-site examinations. As the workshop leaders, we were next to the participants to clarify the obscurities in all the phases. However, during the data collection on the site, we had the recognized outsider position aiming not to create research bias and to observe the participants' study experiences.

On the first day of flow, the workshop starts with the presentations that include three topics; 1) What does 'Minding the City Mean?', 2) How to observe?, and 3) Conceptualizing the built environment. First, we introduce the idea of minding the city, which refers to an alternative way of reading the city. Then, we trained the students on the systematic observation and mapping techniques, the defined conceptualizations, and the production techniques of the final output. After the training sessions, we introduce the study fields' context to the participants. Followingly, the on-site process starts with the individual observations of the participants as secret outsiders and full participant positions. Next, the participants observe the user's environmental behaviors and the physical traces on the site left behind. They used mapping, counting, tracing, photographing, and sketching tools to collect the data. They searched for biophilia, bilateral symmetry, mirror neurons, pareidolia, proxemics, thigmotaxis, curvilinearity and rectilinearity, and mnemonics concepts. However, the concept of mnemonics was excluded in the course of the pilot study. The concept of mnemonics could not be studied in the flow of a three-day workshop conducted in such dense urban settings due to the mnemonics' strong refer-

ences to space's historical and narrative characteristics. Participants recorded their observations and experiences as annotated diagrams, photographs, drawings, sketches, and notes for each concept.

The second day is planned as an in-studio examination. First, the participants individually analyze their on-site observations and experiences to refine and classify the collected data. Then, the participants create digital drawings of their analyses, including the data reproduction and their insights. Next, we asked them to express their experiences as written statements identifying the conceptualizations. Finally, in the second half of the second day, joint discussion sessions are made to sync up all work done so far with the contributions of all participants.

The last day is planned as a collective work. Firstly, we revised the digital drawings produced by the participants to produce the final version of visual and verbal representations of the synthesized data. Then, we held a round-table discussion to finalize the written statements as the urban codes. First, the statements written by each participant were examined and compared one by one. Then, the non-repetitive and singular experiences were eliminated. Ultimately, the written statements based on the shared experiences were generated as urban codes framing the human experience in the built environment through human evolutionary cognitive tendencies.

3.3. The pilot study

Conducting a pilot study was required for many reasons. Firstly, studying a novel topic in the design disciplines demands more attention; for this reason, examining it in an existing environment reveals the knowledge for implementing it in practice. Secondly, developing a pilot study allows adding the participants' perspectives on the existing literature, enriching the study field for future studies. Thirdly, we practiced our research design's efficiency to maximize the main study's accuracy. Finally, it created the opportunity to work with experienced participants.

In the scope of the pilot study, we organized two field studies in Istanbul with different qualifications; 1) A linear route ending with a small-scale urban park, Kadırga District (Pier Loti Street and Kadırga Square), 2) A large-scale touristic square, Sultanahmet Square. The aim of selecting two sites is to compare the pros and cons for efficiently examining the conceptualizations. In addition, the participants marked the locations where they had experienced and observed the conceptualizations on the sites to gather location-based data. According to the results of the two study fields, we would be able to plan well-organized fieldwork for the main study.

We applied the three-day workshop flow to the Minding the City / Istanbul: Bring your brain into the built environment workshop. First, we introduced the study fields to the participants. The upper image of Figure 2 shows the locations of the sites. Kadırga District is a residential area with a port used for galleys and has a strong neighborhood culture. Sultanahmet Square is a tourist area including significantly important historical landmarks such as Blue Mosque and Hagia Sophia and a large hippodrome area. Sultanahmet Square is also named "Hippodrome of Constantinople," referring to its usage during the Byzantine.

The fieldwork was continued according to the workshop flow. The participants attended all individual and collective processes, both in-studio and on-site. As a final output of the study, the participants produced visual and verbal representations of the conceptualizations and the generated urban codes for two study fields. The final session, which was the overall discussion, contributed to the main study;

- Creating focused groups for each concept would be more beneficial to increase the quality of the outputs.
- Linear routes have many distractions, such as cars and bicycles, which change and affect the human experience.
- The users of a residential district are so familiar with the site that it causes an unheeding relationship with the built environment.
- Touristic squares supply more data

because of the number of users and the liveliness of the space. Additionally, the users of touristic squares generally stay in place to experience the whole space and create precise interactions with the site that make touristic urban squares more efficient for examining conceptualizations.

- Touristic squares are surrounded by designed architectural and urban features that contribute to understanding the human experience concerning the artificial features of the built environment.
- The scale of the square affects the quality of the final output. Sultanahmet Square has so many attributes that make it unable to handle the data causing a shift in the focus of the study.

3.4. The main study

The main study was designed based on the feedback obtained from the pilot study. Within the knowledge gathered from the pilot study, we decided to study an urban square in Famagusta for the main study, which is touristic but smaller than Sultanahmet Square; Namık Kemal Square matched our criteria.

The refinements of the pilot study include the elaboration of the research framework. The novelty of the concepts to the participants and the architecture discipline created some challenges. The participants recognized biophilia and pareidolia concepts because they were easy to picture in their minds. Bilateral symmetry, curvilinearity and rectilinearity were well understood because of their familiarity with design disciplines; however, mirror neurons and thigmotaxis required extended literature research concerning the relational studies with architecture. Unexpectedly, finding the proxemics concept in the built environment and classifying the collected data caused some conflicts as it was hard to measure precise distances between moving individuals and groups. Therefore, we developed standards for the interpretations of the data regarding the visualization through draft drawings. In the training session, we informed the participants about defined arrangements, including the type of experience, what the question should be in mind, and the sub-components based on the characteristics of the experience. Table 1. shows the detailed arrangements for each conceptualization. Eventually, we conducted the fieldwork as defined in the workshop flow.

Figure 2. *The maps showing the pilot and the main study fields.*

3.5. The location and context

Namık Kemal Square is located in the old town area of Famagusta, shown in the bottom image of Figure 2. There are historical places such as Lala Mustafa Pasha Mosque around the square. Lala Mustafa Pasha Mosque is a significant historical landmark mainly built as a catholic cathedral; then converted into a mosque in Ottoman times. This gothic-style building frames the square. The modern-style small buildings are also located around the square. One of the entrances of the square has an arched stone gate.

Namık Kemal square is located in the center of the old town. The roads leading to the square are mainly occupied by commercial and public buildings that make the square significantly crucial for tourists and locals. Additionally, the roads are pedestrianized to leave spaces for public events that create more livable environments. Thus,

Table 1. *The detailed arrangements for the conceptualizations.*

CONCEPTUALIZATIONS	HUMAN EXPERIENCE	THE QUESTION (what to look for?)	SUB-COMPONENT
BIOPHILIA	Human-nature interaction Individual human self	How do people behave around natural elements?	Sun effect Greenery effect Water effect Animal effect
BILATERAL SYMMETRY	Human-built environment interaction	How do people perceive symmetrical designes, patterns and organization schemes?	Symmetry axis Spatial symmetry Object-based symmetry
MIRROR NEURONS	Interpersonal human beings	How do people behave around other people?	Individual behavior Group behavior
PAREIDOLIA	Human-built environment interaction	How do people perceive the face-like forms?	Architectural elements-based face perception Object-based face perception
PROXEMICS	Interpersonal human beings Human-built environment interaction Human-nature interaction	How do people regulate inter-relational distancing?	Intimate distance Personal distance Social distance Public distance
THIGMOTAXIS	Human-built environment interaction Human-nature interaction	How do people move/behave around the boundaries of space?	Floor covering effect Border effect Edge effect-vertical Edge effect-horizontal
CURVILINEARITY AND RECTILINEARITY	Human-built environment interaction	How do people interact with the contours of space?	Curved edge effect Sharpen edge effect

the square's potential users and characteristics are appropriate for conducting fieldwork concerning the human experience.

3.6. Fieldwork and the final outputs

For the fieldwork, we applied the three-day workshop flow. First, the grouped participants visited Namık Kemal Square for fieldwork. They observed the human behaviors and the physical traces around the square. Additionally, they followed their own experiences to understand how they reacted to the built environment according to the defined arrangements.

They documented their insights about other people and their environmental features, behaviors, reactions, and current situations. Their routes were crossed from time to time, and they were also aware of their reactions to each other. The site observations took five hours. During that time, they mainly conducted individual and subgroup work. Recognizing the users' behavioral responses as defined in human evolutionary cognitive tendencies amazed the students. Additionally, they realized that they were experiencing the site the same way, consciously or unconsciously. They enjoyed going deep into their daily experiences and observing others' experiences through the eyes of their evolutionary past. Finally, each group cataloged the collected data with the name of the assigned concept and documented their data as written statements. On the second and third days, in-studio sessions were held to develop an analysis of and synthesize the collected data. Additionally, we met separately with each group to discuss the participants' insights on the assigned conceptualizations. Consequently, they transformed their observations and experiences into meaningful statements to generate urban codes of Namık Kemal Square.

The final output of the study included the production of the visual and verbal representations of the conceptualization and the urban codes for Namık Kemal Square. First, the participants developed both a general site map and individual maps for each concept to mark their observations and experiences in a location-based manner. Then, the groups reproduced the collected data as digital drawings representing the situation that occurred at each location. Finally, they generated the urban codes as written statements for each situation. The final product was prepared as posters representing cognitive maps, digital drawings, urban codes, and a video film showing fragments from the workshop. The final outputs were presented at the closing ceremony of the EMU 9th International Design Week (Karakaş & Dumlu, 2019).

3.7. Results and discussion

In this section, the results of the case study were illustrated for each conceptualization through the final outputs of the main study. However, the concept of bilateral symmetry was better studied at Sultanahmet Square than in other fields due to the size of the square. In addition, Sultanahmet Square provided enlarged vistas and longer symmetry axes to follow reaching a place, accompanied mainly by well-designed landscape features that enhance the symmetry perception.

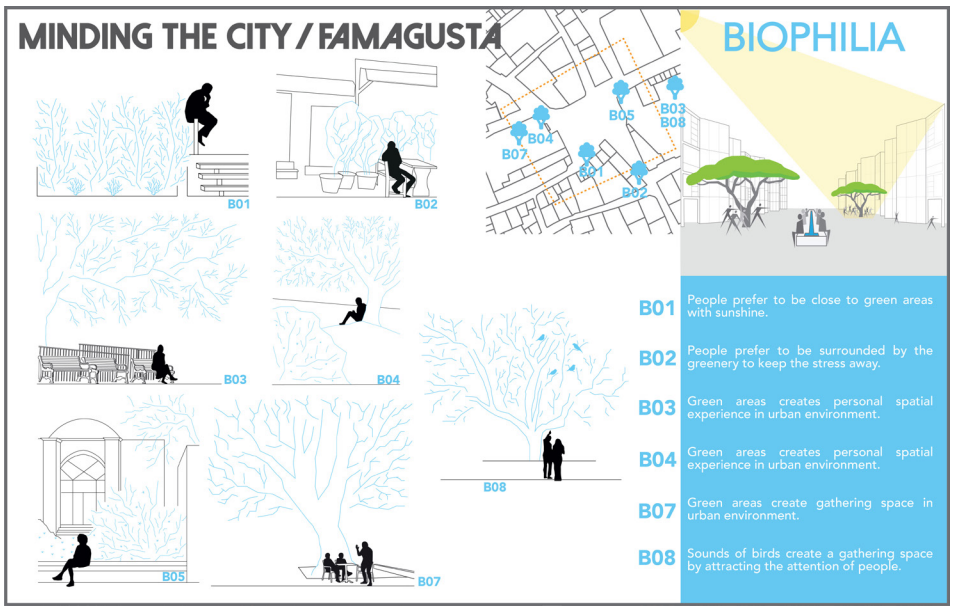

Figure 3. *The biophilia concept.*

Therefore, the pilot study's findings concerning bilateral symmetry were added to the discussion. Finally, the key findings were summarized, and the results were interpreted within the related literature.

3.7.1. Biophilia

The findings of the biophilia concepts showed that it has an appreciable impact on the human experience as human-nature interactions and an individual human self. The research on human-nature interaction has a long tradition in many areas of science. For example, Joye (2007) stated that although there are various perspectives based on the areas of psychoevolutionary, geography, or paleoanthropology in the study of human-nature interactions, these perspectives suggest a common theory on evolutionary processes of human cognitive tendencies toward nature. The theory briefly is that humans have positive affiliations with a specific set of natural elements. Additionally, Ulrich (1991) explained the positive effect of natural elements on stress reduction as restoration. He identified the green areas, sunshine, and water elements as preferable for the personal spatial experience. Figure 3 shows the findings of the present study.

In line with previous studies, it is revealed that humans prefer to be close to natural elements such as greenery, sunlight, water, and animals for sitting, resting, and gathering individually and in groups. Additionally, the multisensorial dimensions of human experience are highlighted based on the sounds of birds, the smell of flowers, and the tactility of plant tissues. Going beyond the previous studies, we obtained the capability of the biophilic features from the findings to create a personal spatial experience in the urban environment. This experience offered individuals the opportunity to turn inward for self-reflection and thus provided an individual experience of the human self.

3.7.2. Bilateral symmetry

Bilateral symmetry was mainly studied through the artificial features of the study fields to examine symmetry perception based on symmetrical designs, patterns, and organization schemes. Spatial and object-based symmetry were detected at different scales ranging from a portal to a massive historic building. Figure 4 shows the bilateral symmetry found in Famagusta and Istanbul.

In the study of bilateral symmetry, the urban squares provided an excellent context where the key findings emerged. In the literature, the importance of being distant to perceived symmetry was stated by Salingaros (2020) that symmetry perception increases when experiencing from a

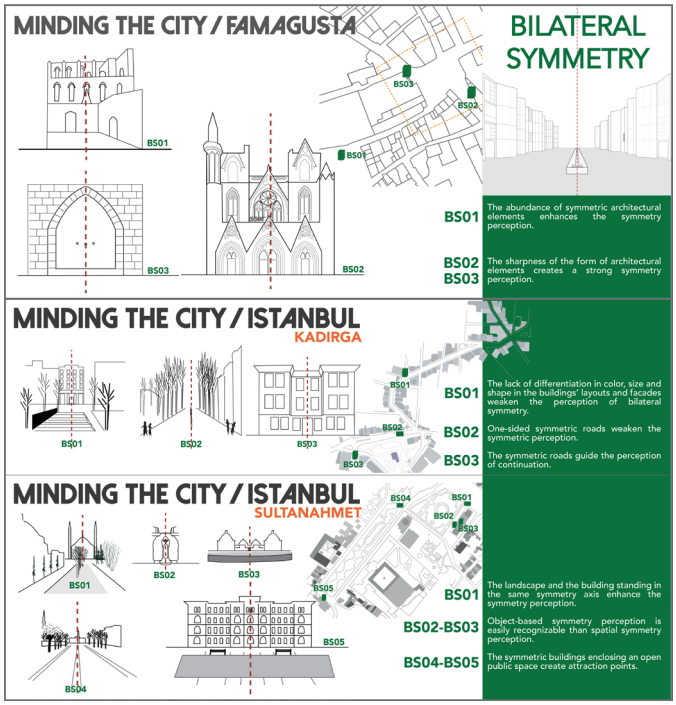

Figure 4. *The bilateral symmetry concept.*

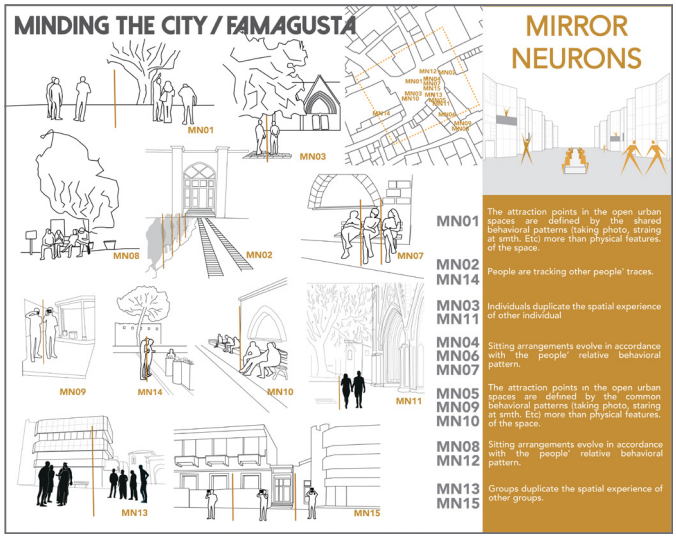

Figure 5. *The mirror neurons concept.*

distance, even if the strength of the perceived image decreases. Additionally, Salingaros (2006; 2010;2020) and Salingaros and Sussman (2020) mentioned the importance of using a coherent pattern, contrast, complexity, engagement, emphasized vertical axis, and multiple sub-symmetries based on the knowledge of our evolutionary past, biological origins and the neural circuits of our brains. In line with those studies, one of our findings supports and furthers that perceiving a building from a distance surrounded by a symmetrically ordered urban landscape using the same symmetry axis enhances symmetry perception. Another promising finding of our study showed that the lack of differentiation in color, size, and shape in the buildings' layouts and facades weakens the perception of bilateral symmetry by creating an endless repetition.

On the other hand, even in the absence of complete symmetry, the repetition of horizontal and vertical sub-symmetries creates a kind of symmetry perception. Additionally, it was revealed that the sharpness of architectural elements might enhance the symmetry perception. Lastly, it was found that the symmetrical building enclosing a public space becomes an attraction point.

3.7.3. Mirror neurons

Even though mirror neurons are a controversial topic in neuroscience studies regarding how the mechanisms develop in the brain, it is evident that mirror mechanisms can be observed through behaviors. Therefore, the present paper focused on evaluating the observational traces of action imitation and action understanding in the built environment (Rizzolatti & Craighero, 2004). Concerning the mirror neurons concept, human experience was searched through the acts of interpersonal human beings. The individual and group experiences were documented as relative and shared, as shown in Figure 5.

The findings revealed that humans tend to duplicate the behavior displayed by other humans in the built environment even if they do not know the logic behind the behavior. They imitate actions like taking photographs, stopping and staring at something, or standing at a spot by following the other's actions individually or in groups. Especially if there is an architectural landmark on the site, shared behavioral patterns occur around them instinctively. Additionally, people orient their actions by understanding others' actions and intentions, like following the physical traces left behind and tracking other peoples' traces.

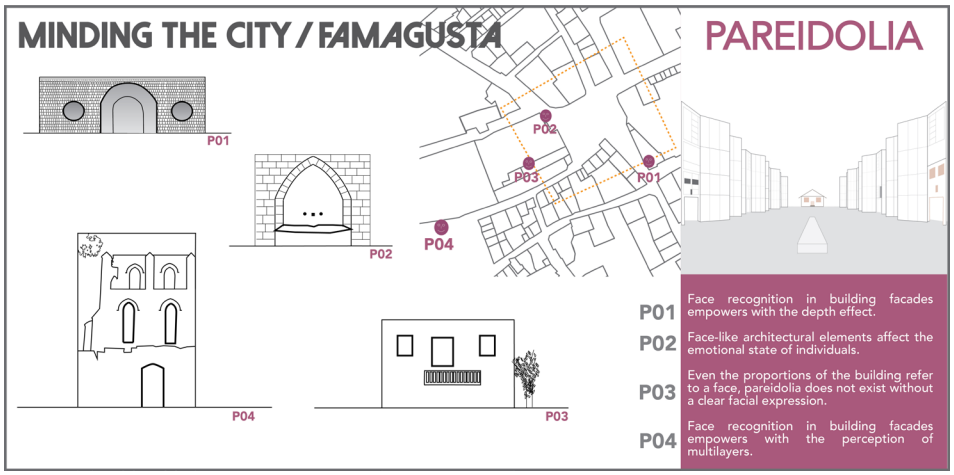

Figure 6. *The pareidolia concept.*

3.7.4. Pareidolia

The pareidolia concept was investigated through human-built environment interactions seeking to find the pareidolia effect in architectural elements and urban artifacts. We followed the hypothesis of Chalup, Hong, and Ostwald (2010), explaining the perceptibility capacity of abstract face-like forms in architectural elements and their potential to evoke emotions from observers. It was inferred from the study that face-like architectural elements are highly recognizable, including shape and emotion recognition. The findings are presented in Figure 6.

One significant result of the study is that the participants look for not only facial features but also facial expressions, which impact their emotional experiences. Furthermore, the illusion of seeing face-like features around the built environment becomes a game-like experience, so looking for pareidolic features in urban space creates a positive environmental experience that triggers certain emotions in people. Additionally, the identification of pareidolic elements only appears in the case of perceiving a clear facial expression, even the proportions of the building proper. Finally, it was revealed that the multilayered elements of building facades enhance the pareidolia effect.

3.7.5. Proxemics

Carmichael & Lockhart (2012) and Hall (1963) defined proxemics through the investigation of the action of increasing or decreasing, basically regulating, the interpersonal distance and the distance between humans and their surroundings. We studied proxemic behavior by accepting their definitions and following Hall's distance categorization: intimate, personal, social, and public. Figure 7 indicates the variety of distancing options found on the site.

The results revealed that the arrangement of urban furniture, the size of the space, the topographic features of the space, the presence of attraction and vantage points, and the greenery affect the proxemic behavior of human beings. The form and the arrangements of the benches change the personal distance. At the same time, the size of the square may demand more intimate relations between the groups, altering social and public distancing. Additionally, it was observed and experienced

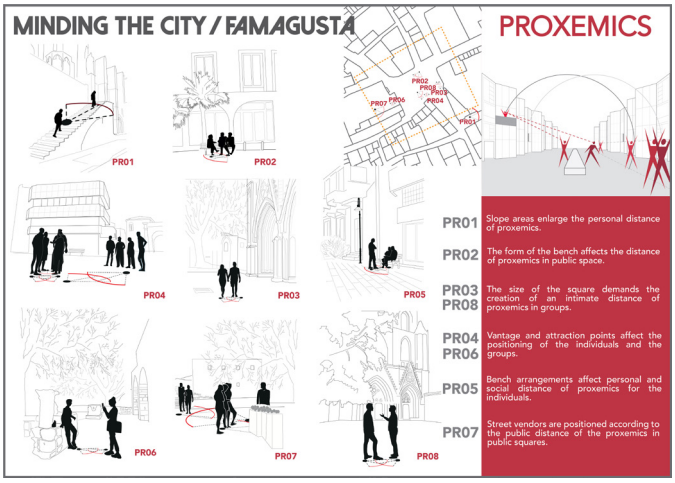

Figure 7. *The proxemics concept.*

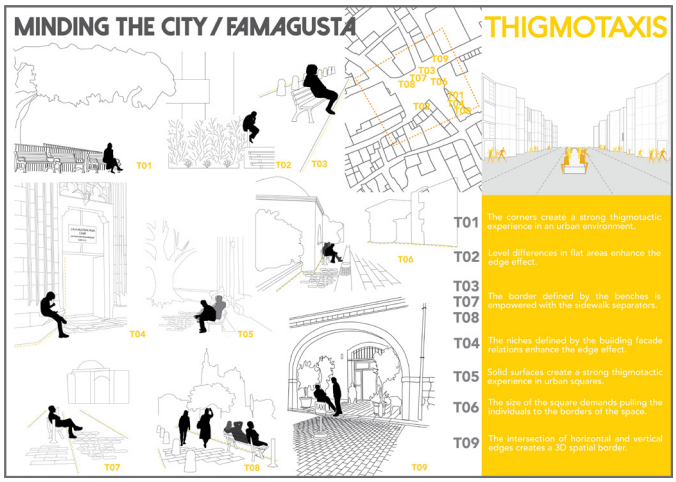

Figure 8. *The thigmotaxis concept.*

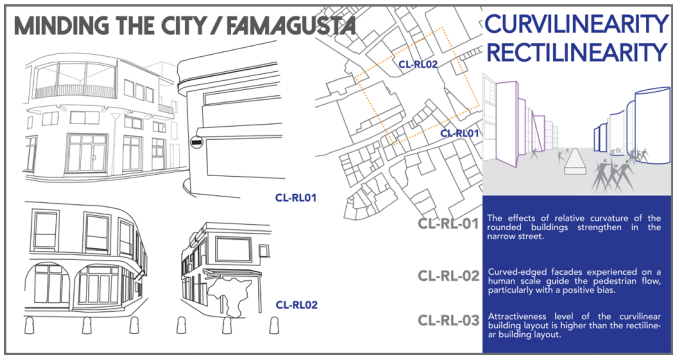

Figure 9. *The curvilinearity and rectilinearity concepts.*

that walking in the slope areas requires larger personal distancing. The presence of attraction and vantage points and the trees have the most significant impact on the human experience as distancing by creating gathering points.

3.7.6. Thigmotaxis

The boundaries of a space significantly influence human preferences for the experiential use of space. Kallai et al. (2007) identified thigmotaxis as an essential element of spatial cognition and emotionally guided, safety-seeking behavior, while Walz, Mühlberger, & Pauli (2016) associated thigmotactic behavior with agoraphobia, a pathologic fear of open spaces, and anxiety sensitivity. In architecture and urban studies, the edge effect, which has similar references to thigmotaxis, is identified as a preference for the use of urban space (Gehl, 2011). We studied the concept by examining the floor coverings, borders, and vertical and horizontal edges of an urban setting. Figure 8 shows the thigmotaxis experiences of users in Namık Kemal Square.

The elements of space creating a thigmotactic experience vary from a niche on the building facades to the line on the street and the level and material differences on the floor and facades. The surface's solidness or transparency significantly impacts the thigmotactic experience. It was revealed that people prefer to sit and watch the square next to solid surfaces. In addition, coupling the thigmotactic elements of space, such as using intersected vertical and horizontal edges and repetitive bench arrangements with the sidewalk separators, intensifies the thigmotactic experience. Lastly, the size of the space stimulates people towards tactile stimuli, as proxemics tend to do. Therefore, it demands pulling individuals to the border of space.

3.7.7. Curvilinearity and rectilinearity

The quality of the contours of space affects the experiential use of an urban setting. In the present paper, interaction with the contours of space is studied with a specific interest in the curvilinearity and rectilinearity concepts. Bar and Neta (2007) found that people prefer everyday objects with curved contours over sharp-angled objects. Additionally, Nanda et al. (2013) explored the impact of contours on emotions through the neuro-architecture paradigm with a particular interest in curves vs. sharp angles. After reviewing many studies concerning the impact of visual stimuli on the human brain, they proposed hypotheses on the impact of curvature as a visual property evoking emotional responses in the limbic system and affecting the individuals' emotional experiences. The people's interactions with the curved and sharp contours of space are shown in Figure 9.

The curvilinearity and rectilinearity of space affect the users' movement and emotional states and the attractiveness level of that space. It was found that the curved elements of building facades experienced at a human scale significantly affect pedestrian preferences with a positive impact. Furthermore,

the attractiveness level of curvilinear forms is higher than that of rectilinear ones. Additionally, the effect of curved shapes changes according to the relative distance. For example, it increases in the narrow streets.

4. Conclusion and future work

The present paper investigated the human experience in multiple urban settings by using the knowledge of the human brain to mind the city through new conceptualizations based on human evolutionary cognitive tendencies; biophilia, bilateral symmetry, mirror neurons, pareidolia, proxemics, thigmotaxis, curvilinearity, and rectilinearity. The insights of individuals on the conceptualizations concerning the experiential use of urban settings were presented through an empirical inquiry. Therefore, the case study research design was developed and applied.

In this particular study, the knowledge derived from various disciplines was applied to the architectural and built environment studies to develop an experiential case investigating human experience as the individual human self, interpersonal human being, human-built environment interactions, and human-nature interactions. The shared behavioral patterns were explained and exhibited as statements converted into urban codes, which provide fundamental material for an enriched human experience in the built environment. The urban codes were presented as the final output of the fieldwork. Ultimately, the acquired knowledge applied to a theory-building structure expands the theory of human experience investigated through the idea of minding the city.

Our findings indicated that the human experience is mainly shaped by the shared behavioral patterns identified by the human evolutionary cognitive tendencies, whether consciously or unconsciously. It briefly means that people experience an urban setting by keeping the other people and the environmental features in mind and regulating their responses to them through the defined conceptualizations. Additionally, the awareness of the concepts creates an enriched and conscious experience that provides more immersed interaction with the urban phenomenon and results in higher recognition of the human experience. The impact of some concepts is more potent than others and easy to recognize. However, some concepts can only be perceived through the eyes of an outsider or through retrospective investigation of self-experience. For example, the biophilic tendencies of human beings are more apparent than all the other concepts, so the relationship with the natural elements is observed and experienced with full awareness.

Similarly, the concept of thigmotaxis has a strong influence on human beings. Participants both found and defined their interactions with the borders of space with clarity. Additionally, bilateral symmetry, curvilinearity, and rectilinearity concepts are easily perceived due to their clear visual cues and evaluated by their significant impact. However, recognizing the pareidolia concept increases with the raised awareness of participants; the more carefully they look around, the more faces they find in the built environment. On the other hand, the proxemic experience of individuals and groups is recognized both at the time of the experience and retrospectively. Observing and defining proxemic tendencies in public space is complicated due to the possibility of creating biases in the interactions of familiar and unfamiliar individuals and groups. Finally, the concept of mirror neurons is mainly perceived by the retrospective investigation due to its highest abstractness level. The participants identified precise behavioral relations based on the imitation and the understanding of the behavioral patterns of individuals and groups. However, they had difficulty making sense of the data and expressing them as written statements. The discussions concerning this peculiar occasion suggested that empathizing with others and adapting to a specific environment might occur even before we intend to do.

In conclusion, minding the city improved the available knowledge of the human experience through the urban

codes. It provided valuable insight into the investigation of the new conceptualizations that emerged in the neuro-architecture and cognitive architecture studies. Additionally, the study presented the evolutionary aspects of human experience in a new way by referring to generalizable patterns in the experiential use of urban settings through the human perceptual, cognitive, sensational, and emotional responses.

The idea of minding the city suggests an alternative way of reading the city through the knowledge of the human brain, which is still in its very early stages requiring lots of future work. Future studies should consider focusing on a single concept to study more deeply. However, developing a holistic view of human evolutionary cognitive tendencies in experiential and experimental studies should be a concern. Furthermore, the concept of mnemonics, which we mentioned in the pilot study but has not been studied yet, should also be investigated. Lastly, future studies should be developed with more trained participants through varied fieldwork.

Endnotes

[1] The term 'urban code' was first used by Mikoleit and Pürckhauer (2011) in the book Urban Code: 100 Lessons for Understanding the City, a set of written statements on the experiential use of an urban setting.

Acknowledgement

We would like to thank you for the contributions and hard work of our Minding the City/Famagusta workshop participants who are Ebrar Karagül (FSMVU, Arch., Undergraduate), Lütfiye Karaaslan (FSMVU, Arch., Graduate), Melek Sena Nayir (FSMVU, Arch., Undergraduate), Mustafa Celalettin Kilinc (FSMVU, Arch., Graduate), Serra Kizmaz (FSMVU, Arch., Master Student), Odai Abdelqader (EMU, Undergraduate), Akif Emre Taşdemir (FSMVU, Undergraduate), Sunanur Işık (FSMVU, Undergraduate), Gizem Yapa (FSMVU, Undergraduate), Yusuf Arık (FSMVU, Undergraduate). Additionally, we would like to appreciate the support of EMU academic staff especially Sanaz Nezhadmasoum for the operational issues.

References

Abbas, A., & Chalup, S. (2021). Affective analysis of visual scenes using face pareidolia and scene-context. *Neurocomputing*, *437*, 72–83.

Alexander, C. (2002). *The Nature of Order: The phenomenon of life*. Center for Environmental Structure. Berkeley, California: Center for Environmental Structure.

Bar, M., & Neta, M. (2006). Humans Prefer Curved Visual Objects. *Psychological Science 17* (8): 645–648.

Chalup, S., Hong, K., & Ostwald, M. J. (2010). Simulating Pareidolia of Faces for Architectural Image Analysis. *International Journal of Computer Information Systems and Industrial Management Applications*, *2*, 262–278.

Ching, F. D. K. (2007). *Architecture: form, space, & order (4th edition)*. New Jersey: John Wiley & Sons.

Coburn, A., Vartanian, O., & Chatterjee, A. (2017). Buildings, Beauty, and the Brain: A Neuroscience of Architectural Experience. *Journal of Cognitive Neuroscience*, *29*(9), 1521–1531.

Creed, R. P., & Miller, J. R. (1990). Interpreting animal wall-following behavior. *Experientia*, *46*(7), 758–761.

Dazkir, S. S. (2009). Emotional effect of curvilinear vs. rectilinear forms of furniture in interior settings. Oregon State University. Corvallis, USA

Eberhard, J. P. (2007). *Architecture and the brain : a new knowledge base from neuroscience*. Greenway Communications/Östberg

Edelstein, E. (2015). *The Routledge Companion for Architecture Design and Practice*. New York: Routledge.

Frascari, M. (2012). De Beata Architectura: Places for Thinking. In *The Cultural Role of Architecture Contemporary and Historical Perspectives* (pp. 107–116). Routledge.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain 119*, 593–609.

Gehl, J. (1987). *Life between buildings : using public space*. New York: Van Nostrand Reinhold.

Gehl, J. (2011). *Life between build-*

ings : using public space (6th ed.). Washington: Island Press.

Hall, E. T. (1959). *The silent language*. New York: Doubleday & Company.

Hall, E. T. (1969). *The Hidden Dimension*. New York: Anchor Books; Doubleday & Company, Inc

Harris, A. P., D'Eath, R. B., & Healy, S. D. (2009). Environmental enrichment enhances spatial cognition in rats by reducing thigmotaxis (wall hugging) during testing. *Animal Behaviour, 77*(6), 1459–1464.

Hauptmann, D., Neidich, W., & Angelidakis, A. (2010). *Cognitive architecture : from bio-politics to noo-politics ; architecture & mind in the age of communication and information*. Rotterdam: 010 Publishers.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences, 4*(6), 223–233.

Hollander, J., & Foster, V. (2016). Brain responses to architecture and planning: a preliminary neuro-assessment of the pedestrian experience in Boston, Massachusetts. *Architectural Science Review, 59*(6), 474–481.

Jacobsen, T., Schubotz, R. I., Höfel, L., & Cramon, D. (2006). Brain correlates of aesthetic judgment of beauty. *NeuroImage, 29*(1), 276–285.

Joye, Y. (2007). Architectural Lessons From Environmental Psychology: The Case of Biophilic Architecture. *Review of General Psychology, 11*(4), 305–328.

Kallai, J., Makany, T., Csatho, A., Karadi, K., Horvath, D., Kovacs-Labadi, B., Jarai, R., Nadel, L., & Jacobs, J. W. (2007). Cognitive and affective aspects of thigmotaxis strategy in humans. *Behavioral neuroscience*, *121*(1), 21–30.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182.

Karakaş, T., & Dumlu, B. N. (2019). Minding the City / Famagusta on Vimeo. https://vimeo.com/335675094

Karakas, T., & Yildiz, D. (2020). Exploring the influence of the built environment on human experience through a neuroscience approach: A systematic review. *Frontiers of Architectural Research*, 9(1), 236–247

Koffka, K. (1935). *Principles of Gestalt psychology*. Routledge & Kegan paulltd

Leder, H., Tinio, P. P. L., & Bar, M. (2011). Emotional valence modulates the preference for curved objects. *Perception*, *40*(6), 649–655.

Lynch, K. (1960). *The image of the city*. Cambridge: MIT Press.

Madani-Nejad, K. (2007). Curvilinearity in architecture: emotional effect of curvilinear forms in interior design, Texas A&M University,TX,USA https://oaktrust.library.tamu.edu/handle/1969.1/5750

McCall, C. (2015). Mapping Social Interactions: The Science of Proxemics. In *Social Behavior from Rodents to Humans*. Springer, Cham.

Mikoleit, A., & Pürckhauer, M. (2011). *Urban code : 100 lessons for understanding the city*. Cambridge: MIT Press.

Morabito, G. V. (2016). Architecture and Neuroscience: Designing for How the Brain Responds to the Built Environment. University of Cincinnati, OH, USA http://rave.ohiolink.edu/etdc/view?acc_num=ucin1460729866

Moubayidin, L., & Østergaard, L. (2015). Symmetry matters. *The New Phytologist, 207*(4), 985–990.

Nanda, U., Debajyoti, P., Hessam, G., and Robyn, B. (2013). Lessons from Neuroscience: Form Follows Function, Emotions Follow Form. *Intelligent Buildings International 5* (sup1):61–78.

Orians, G. H. (1980). Habitat selection : General theory and applications to human behavior. *The evolution of human social behavior*. Elsevier.

Orians, G. H. (1986). An ecological and evolutionary approach to landscape aesthetics. *Landscape meanings and values* (pp. 3-25). Routledge.

Pallasmaa, J., Mallgrave, H. F., & Arbib, M. (2013). *Architecture and Neuroscience*. Tapio Wirkkala-Rut Bryk Foundation.

PAREIDOLIA | meaning in the Cambridge English Dictionary. (2021). https://dictionary.cambridge.org/dictionary/english/pareidolia

Ramachandran, V. S., & Hirstein,

W. (1999). The science of art: A neurological theory of aesthetic experience. *Journal of Consciousness Studies, 6*(6–7), 15–51.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169–192.

Rizzolatti, G., Fadiga, L., Gallese, V., & Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research, 3*(2), 131–141.

Rizzolatti, G., & Sinigaglia, C. (2008). *Mirrors in the Brain: How Our Minds Share Actions and Emotions*. Oxford University Press, USA

Ryan, C. O., Browning, W. D., Clancy, J. O., Andrews, S. L., & Kallianpurkar, N. B. (2014). Biophilic Design Patterns: Emerging Nature-Based Parameters for Health and Well-Being in the Built Environment. *Archnet-IJAR: International Journal of Architectural Research, 8(*2), 62–76.

Salingaros, N. A., & Sussman, A. (2020). Biometric Pilot-Studies Reveal the Arrangement and Shape of Windows on a Traditional Façade to Be Implicitly 'Engaging', Whereas Contemporary Façades Are Not. *Urban Science, 4* (2), 26

Salingaros, N. A. (2020). Symmetry Gives Meaning to Architecture. *Symmetry: Culture and Science 31* (3): 231–260.

Schnörr, S. J., Steenbergen, P. J., Richardson, M. K., & Champagne, D. L. (2012). Measuring thigmotaxis in larval zebrafish. *Behavioural Brain Research, 228*(2), 367–374.

Stephen R., K., & Edward O., W. (1993). *The Biophilia Hypothesis*. Washington: Island Press.

Sussman, A., & Hollander, J. B. (2015). *Cognitive Architecture : Designing for How We Respond to the Built Environment*. Routledge.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science 224*(4647), 420–421.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11*(3), 201–230.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Leder, H., Modroño, C., Nadal, M., Rostrup, N., & Skov, M. (2013). Impact of contour on aesthetic judgments and approach-avoidance decisions in architecture. *Proceedings of the National Academy of Sciences of the United States of America, 110*(2), 10446–10453.

Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L. B., Leder, H., Modroño, C., Rostrup, N., Skov, M., Corradi, G., & Nadal, M. (2019). Preference for curvilinear contour in interior architectural spaces: Evidence from experts and nonexperts. *Psychology of Aesthetics, Creativity, and the Arts, 13*(1), 110–116.

Walz, N., Mühlberger, A., & Pauli, P. (2016). A Human Open Field Test Reveals Thigmotaxis Related to Agoraphobic Fear. *Biological Psychiatry, 80*(5), 390–397.

Wilson, E. O. (1984). *Biophilia*. Harvard University Press.

Wodehouse, A., Brisco, R., Broussard, E., & Duffy, A. (2018). Pareidolia: Characterising facial anthropomorphism and its implications for product design. *Journal of Design Research, 16*(2), 83–98.

Zeisel, J. (2006). *Inquiry by Design: Environment/ Behavior / Neuroscience in Architecture, Interiors, Landscape, and Planning*. W.W. Norton & Company.

Zylstra, M. J., Knight, A. T., Esler, K. J., & Le Grange, L. L. L. (2014). Connectedness as a Core Conservation Concern: An Interdisciplinary Review of Theory and a Call for Practice. *Springer Science Reviews, 2*(1), 119–143.