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The Cognition Role to Understanding Planning and Architectural Production

Ahmed S. Al-Khafaji [1*], Nadia A. Al-Salam [2], Tuqa R. Alrobaee [1]

[1] *Faculty of Physical Planning, University of Kufa- An-Najaf, Iraq.*

[2] *Centre of Urban and Regional Planning for Post Graduate Studies, University of Baghdad, Baghdad, Iraq.*

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Abstract

This paper focuses on the concept of cognition and its clarification in the light of Islamic epistemology. Knowledge passes through two essential parts: conception and assent. Conception explains simple knowledge, while assent explains knowledge involving a judgment. The paper proceeded with the identification of the problem of relationship blurring between cognition and knowledge. The external and inner senses have explained the relationship between the stages of knowledge and cognition. The external senses receive stimuli and form primary conceptions. These conceptions transfer to the first part of the inner senses, which is common sense; it collects the sensations and transmits them to pictorial power. Secondary conceptions are formed, accompanied by feeling. Then, the estimative power role emerges in imparting meaning to be stored in memory, here knowledge is suspicion, and the perception is achieved. Finally, the images reach the thinking power to impart the specific meaning of the image, which constitutes cognition. Using the Hagia Sophia Case Study, the paper reached important indices in clarifying the cognition stages and understanding of planning and architectural production. These indices were represented by: color, scale, lighting, the harmony of the building with its surroundings, and the meanings associated with cultural, social, and civilized values.

Keywords: Attention; Sensation; Feeling; Perception; Cognition.

1. Introduction

Most of the architectural and planning studies that investigate the cognition issue focus on the results of the cognitive process, without delving into its stages and do not discuss its cognitive and conceptual origin. As the studies that dealt with cognition on the conceptual side are few due to the difficulty of explaining and clarifying mental processes. As it is possible to find these contributions in psychology research, but the contributions in the architectural and planning field are limited. The knowledge acquired about concepts and processes of cognition allows the possibility of creating high-quality urban environments through planning and design policies and procedures. This ensures that there is no conflict between planning and design as well as the performance of cognitive processes is proper [1]. This paper attempts to address the gap represented by clarity lack of the relationship between the knowledge stages and the cognition stages, assuming that knowledge stages are parallel to cognition stages, and the link between them is the external and inner senses. The aim of finding the relationship between knowledge stages and cognition stages is to help urban designers and planners to create meaningful environments related to society memory, thus allowing easy cognition and reading in a clear and unambiguous manner.

* Corresponding author: ahmeds.alkhfaji@uokufa.edu.iq

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Several recent studies have addressed cognition from different perspectives to understand and explain behavioral and psychological issues. The authors find that some studies shed light on the recipient and his behavior, other researches focused on the environment, to understand aspects of the cognitive process. Rad et al. (2021) presented a systematic review of experimental trials and studies that illustrate the emotional and cognitive impact of environments built on the human brain, with a focus on the procedures and techniques used in them. In their study, they recommend that thinking about recent lines of research in cognitive neuroscience can provide new insight to provide a better understanding of the environmental impact on humans [2]. Hollander et al. (2019) stated that context continually influences cognitive and behavioral processes. They have argued that different urban environments may influence dynamic mental states. They sought to test the principles of cognitive engineering: edges, facades/patterns, shapes, and vitality. The study found that these urban principles can stimulate important cognitive responses and positive emotional reactions. It is an important step towards understanding the relationship between human emotions and the built environment [3].

D'Acci (2019) pointed out the effect of urban forms, such as the shape of the streets, on our perception of spaces and our behavior in them, which determine the quality of our daily life and our actions. The study found that urban aesthetics influence perception and walking decision-making when a direction is not the main criterion. The study indicated that the majority of the stratified random sample prefer, assuming the rest of the variables and the continuous/readable streets are constant, to walk through winding paths instead of straight ones [4]. Talebzadeh and Nowghabi (2018) found the place's perception is achieved through the good design of the environment. Providing clarity and readability of buildings gives people a comfortable sense and safety. Also, the perception of environmental images allows people to easily identify and link to the values entrenched in their minds [5]. Taylor (2009) used perception as a tool to compare the concepts of legibility and aesthetics. The study found the aesthetics perception of the environment is a critical indicator. Legibility alone is not an important criterion for townscape quality compared to aesthetics [6].

This study differs from the previous ones in that it attempts to explain the cognitive process, images transfer from external senses to inner senses, and the transition from simple knowledge to the complex one containing meanings. These meanings are formed in the recipient's brain as a result of impressions taken from his/her environment.

2. Theoretical Approach

The theoretical part of this study includes three main items: The first item is Islamic Epistemology, which will be used to explain the relationship between knowledge and perception. The second one includes the clarification of the apparent and the inner senses, as they are the bridge between knowledge and perception. While the third one explains the stages of perception according to the architectural and planning studies.

2.1. The Islamic Epistemology

The study in the knowledge roots requires a set of mental processes done by the human brain, especially cognition. This mental process is the core of epistemology. With it, the truth of things can be known and discovered. The brain plays an essential role in this process [7]. Cognition is the psychological process that contributes to reaching the meanings, connotations of things, and situations. The person deals with this process by organizing, interpreting, and formulating the sensory stimuli related to it in meaningful, holistic forms [8]. It is defined as "the image occurrence in the human brain, or the representation of the thing reality without a judgment against it called a conception, and with the judgment on it is called an assent [9]. Knowledge is mainly divided into two parts, one of which is "Conception", which is simple knowledge, and the other is "Assent", which is complex knowledge involving judgment. The conception is like our understanding of the meaning of heat, light, or sound, while assent is like our belief that heat is energy imported from the sun [10] (See Figure 1).

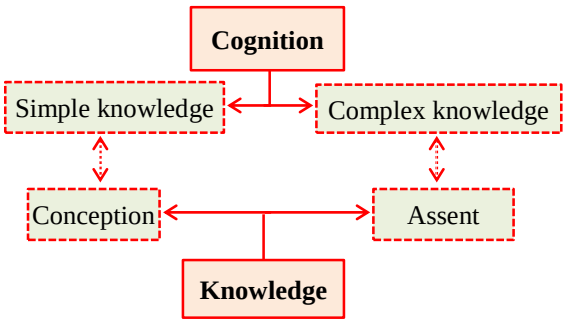

Figure 1. Relationship between knowledge and cognition

This paper adopts the Islamic theory in its interpretation of conception and assent. Conceptions are divided into two main parts: primary and secondary. "Primary conceptions" are the conceptual basis of the human brain; these conceptions are generated directly from receiving things by senses. It is the reason for the conception and presence of ideas in the human brain [11]. Primary conception can be considered a base for every conception in the human brain,

but this stage is only an introductory stage that has no role in creating concepts and ideas. Another stage is known as the "Secondary conceptions," which takes from elementary meanings the primary basis for conception. It begins with the role of innovation, creation, generating, and extracting new concepts. This is what the Islamic epistemology theory calls "Dispossession" [7]. Assent is a mental act that expresses truthfulness to the one who said it, and the opposite is denial. Assent has degrees; if there is a possibility of its opposite, it is called "suspicion"; otherwise, it is a "certainty" [12] (Figure 2).

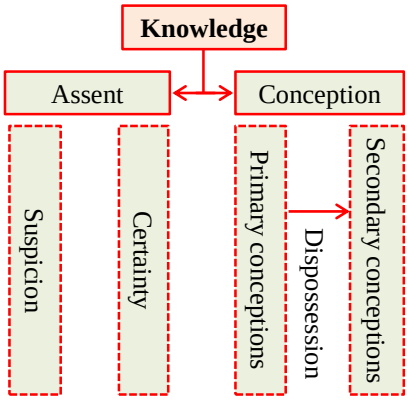

Figure 2. Stages knowledge

From the above, the authors find that knowledge is achieved starting from the primary conception. It is moving to the secondary conception, then to suspicion, and ending with certainty. In these stages, knowledge is manifested; within them, the stages of cognition are realized. This study clarifies the relationship between cognition and knowledge, assuming that the cognition stages coincide with knowledge stages explained by Islamic epistemology. Therefore, the research will use the external and the inner senses to explain this relationship.

2.2. The External and Inner Senses

The acquisition of knowledge comes from the close relationship between the senses and the brain. It is a process of cognition that brings them together. Cognition is divided into two parts: external perception related to the five external senses and inner cognition related to the brain [13]. As the human brain can use, encode and interpret spatial information [14]. To prove the relationship between cognition stages and knowledge stages, Al-Farabi's theory will be used to clarify the role of the external and inner senses in the process of cognition and knowledge acquisition, according to the following stages:

- External senses get excited as a result of the external stimuli presence they receive [15]. It perceives substance and its suffixes as they exist without abstraction. It perceives images of objects only when they are present but cannot evoke them in their absence, unlike the inner senses, which do not require the presence of the image of the substance. After that, it leads to the first part of the inner senses, which is a common sense [16].
- Common sense: It is the center of the senses and sensation; it is considered a "common force for all the senses" [17]. This sense aims to accept the images perceived by the five external senses and collect them together, then transform them to the other force, which is pictorial power to preserve them [18].
- Pictorial power: It is the force that abstracts substance but preserves its suffixes, such as preserving the color. It is a servant power to estimative power [19]. Pictorial power has the function of innovation and creativity. It forms the stored images derived from common sense into new forms that were not previously recognized by the sense. It superimposes them with each other and separates them from each other according to the choice [20]. If it is adequately adapted, a pleasant feeling occurs; when it is conflicting, a painful feeling occurs [21].
- Estimative power: It is the force that abstracts substance more abstractly than the pictorial and realizes the meanings such as good and bad for a specific subject. It preserves a part of the suffixes of substance, such as the sheep's perception of wolf enmity. Estimative power is the source of all judgments and beliefs that the brain cannot confirm their validity. The brain may accept the validity of these judgments by way of illusion and imagination. The judgments of illusion may be truthful, and the brain will testify to their validity later [22].
- Memory power: It stores the perceived meanings from estimative power [21]. This power's function relates to the extent of a person's ability to remember, his ability to preserve and retrieve meaningful objects when requested [20].
- Thinker or imaginary power: This power controls the images and meanings stored in the two forces: pictorial and memory. It meets and combines them or divides and separates them. It is called a "Thinker" if the image in pictorial power matches with meaning in memory power to reason it. This power is called "Imaginary" if the image does not match the meaning, leading to estimative and unreasonable [21] (See Figure 3).

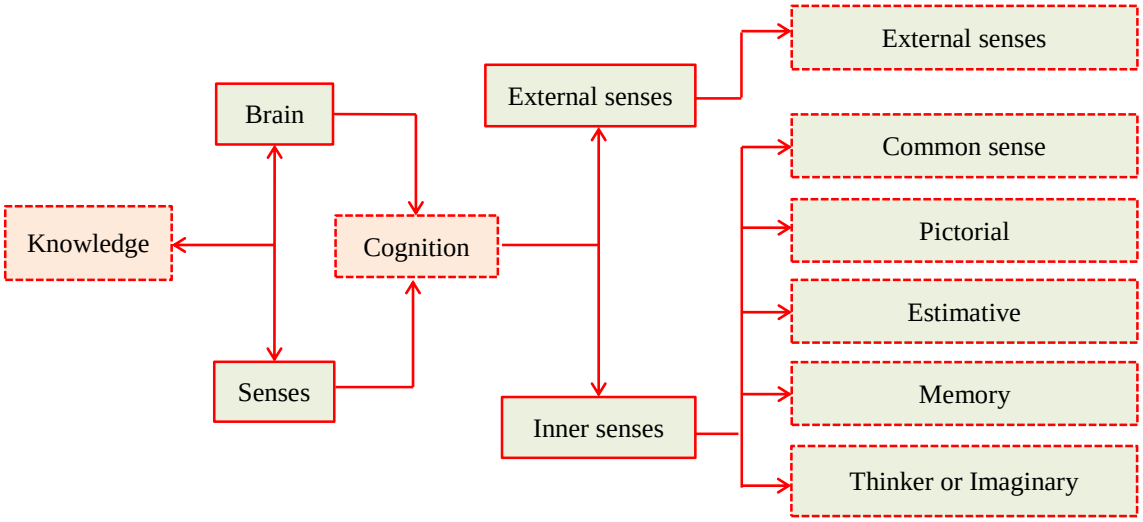

Figure 3. The senses mediate between knowledge and cognition

In the next section, the paper will move on to explaining architectural and planning studies of cognition to find the relationships between the stages of cognition and knowledge.

2.3. Cognition Stages in Architectural and Planning Studies

Lynch (1960) was the first author to focus his work on cognition concepts of the urban environment. He described two important things in explaining his theory in the book "Image of the City": the first is the physical elements of the urban environment, the second is the psychological and mental image of the city. He also identified four critical elements in a mental image of the urban environment: legibility, building the image, identity, and image-ability [23].

Several studies dealt with the cognition stages. Some studies have classified it into four stages, starting with attention, sensation, perception, and ending with cognition [24]. Some studies have confirmed that the cognition process consists of five stages: attention, sensation, feeling, perception, and cognition [25]. The authors note from what previously mentioned that the last division is the most comprehensive one so that it will be adopted in this paper.

- ***Attention***: It is the first condition for achieving environmental knowledge. It is intended to focus the senses towards an object [26]. Attention is obtained by the stimulus presentation, which is an external factor that stimulates the activity of the human or the activity of one of the sense organs [27]. Several factors contribute to achieving attention, such as scale, size, color, texture, and lighting [28]. It can be said that several issues may attract attention, such as marked difference, variation and change, pattern and constancy, and kinetic succession [29].

- ***Sensation***: It is the first threshold for initial perception of the topics we feel when stimuli arouse the various sense organs. It is referred to as the essential instantaneous experience generated by physical stimuli and their direct connection with human receptors [30]. It is also known as receiving physical stimulation and encoding input into the nervous system [31].

- ***Feeling***: It is a conscious experience characterized by mental activity. It is accompanied by a specific degree of pleasure or suffering. The emotion is often overlapped with the psychological state and mood. This stage can be considered the link between sensation and perception [32]. Strong evidence has been presented that emotions play a crucial role in perception [33]. Emotion is also closely related to proper judgment. Many researchers have argued that emotions are the source of our intuitive proper judgments [34].

- ***Perception***: It is the organization and interpretation of sensory information using our experience. In this stage, the sensory impressions of the stimuli are translated into mental images that produce meanings [35]. These meanings are not necessarily straightforward and specific [36].

- ***Cognition***: It is how the person begins to impart meaning to the primary senses' stimuli. The person draws on his experiences and his individual and collective culture [37]. In addition to the context in which he receives these influences. This stage reduces the influences that a person received from his surrounding environment. The influences which the brain can interpret and link them to a cultural, social, political, or civilized value remain. The influences that are not related to meaning be disappeared [30] (See Figure 4).

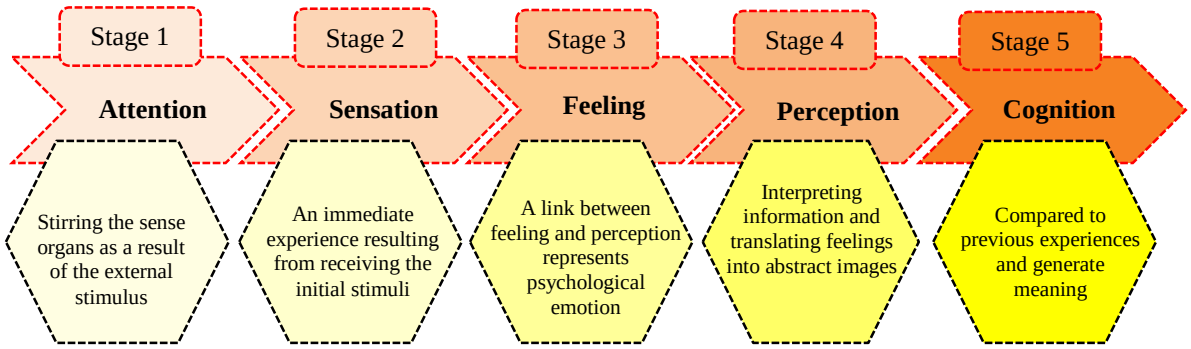

Figure 4. Cognition stages

The external and inner senses have explained the relationship between the stages of knowledge and cognition. The external senses receive stimuli and form primary conceptions. These conceptions transfer to the first part of the inner senses, which is common sense; it collects the sensations and transmits them to pictorial power. Secondary conceptions are formed, accompanied by feeling. Then, the estimative power role emerges in imparting meaning to be stored in memory, here knowledge is suspicion, and the perception is achieved. Finally, the images reach the thinking power to impart the specific meaning of the image, which constitutes cognition. Figure 5 summarizes the external senses' role and the inner senses in clarifying the relationship between knowledge and cognition.

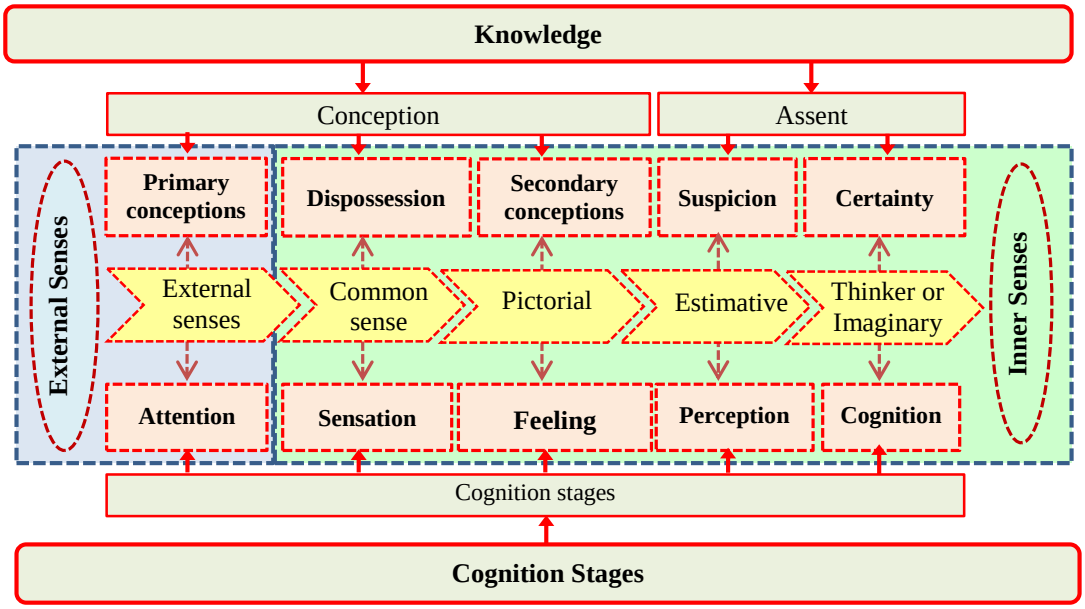

Figure 5. Cognition coincide with knowledge

3. Research Methodology

The authors relied on philosophical parallels and approaches to find the relationship between knowledge and cognition. The research relied on the role and function of the external and internal senses in clarifying the stages of cognition and used an analytical method in application to the Hagia Sophia building.

4. Case Study

Hagia Sophia was initially built as a Byzantine-style church, which is a two-storey building for holding the monastic rites. It is one of the largest and most luxurious buildings within a complex that includes many buildings. This complex was largely protected by being located outside the city to be safe from the Seljuk and Georgian raids during the thirteenth century. It was established on a high stone hill to be overlooking the Black Sea. This location has given her great importance [38]. The building can be summarized into four periods:

- The first period back to the fourth and fifth centuries AD, when the Bfirst Church was consecrated during the reign of Constantius II. In 360 AD it was built in a close area to the present site of Hagia Sophia, but in 404 AD, the building was burned and completely destroyed [39].
- The second period refers to the fifth and sixth centuries AD when Theodosius II built the Bsecond church in 415. The building was destroyed by a fire during the Nika revolt against Emperor Justinian I in 532 [39].

- The third stage covers a long period from the sixth century to the fourteenth century AD. When Emperor Justinian I began construction of a new building. It was constructed by the architect Isidore and the physicist Anthemius, it was opened in 537, then, two earthquakes caused cracks that led to the collapse of the dome in 553 and 557. Later, reconstruction work was assigned to Isidore the Younger, who chose materials lighter than previously used. The dome was changed to give the building its current appearance. The works were completed in 562. During the following centuries, the building suffered other severe damage, a great fire broke out in 859, an earthquake in 869, while in 1346, the collapse of some structural elements caused the building to close until 1354 [40].
- The last stage refers to the fifteenth and nineteenth centuries AD, after the conquest of Constantinople in 1453. Mohamed II (the Conqueror Sultan Mohamed) converted the Hagia Sophia into a mosque. Additions were made to it, most notably the Ottoman-style minarets when the modern republic of Turkey in 1934, the building was converted into a museum by Mustafa Kemal Ataturk. In the following centuries, Hagia Sophia underwent many restorations, rebuilding, and amalgamation works [41]. Finally, in the year 2020, it was converted again into a mosque by a court ruling [42].

There are many discussions about Hagia Sophia, whether it is a church or a mosque. Because it lasted 1500 years and witnessed two different religions (Christian and Islamic) and different societies, then it became a museum by gaining religious and cultural value [43]. To clarifying the relationship between the stages of knowledge and cognition in a practical way, the paper will use this building.

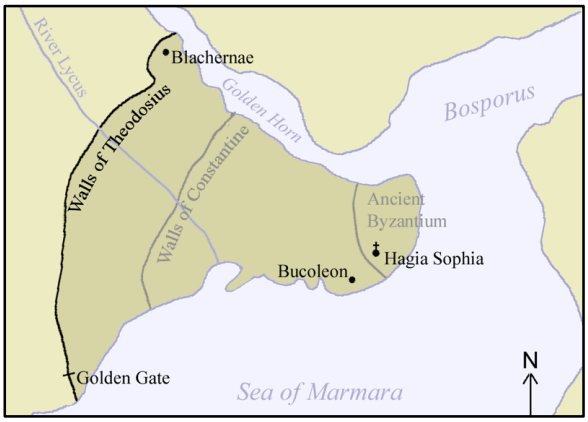

Figure 6. Site of Hagia Sophia

5. Results and Discussion

5.1. First Stage: Attention – External Sense – Primary Conception

In the attention stage and the acquisition of primary conception, the authors find that scale of the building and the lighting have guided the sense of sight and generated attention towards it without other buildings adjacent to it. The external senses received stimuli from the external environment due to color, scale, and light. The primary conception of knowledge was generated. It represents the basic rule and the first initiation point of cognition (See Figure 7).

Figure 7. Dominant scale and lighting in the Hagia Sophia

It was found that the main indices of this stage were Scale, size, luminance, color, texture that produced the primary conceptions. Table 1.

Table 1. Conceptual indices of the first stage

Attention	External senses	Primary conceptions
Scale, size, luminance, colour, texture	The five senses (sight, smell, hearing, etc.)	Simple primary perception at the boundaries, shape, and size of a building

5.2. Second Stage: Sensation and Feeling-Common Sense and Pictorial-Dispossession and Secondary Conceptions

The Hagia Sophia is designed with its surroundings through the harmony of color, formation, relationship to green areas, fountains, and the sea view. The sensations generated from these elements are combined by common sense, then transferred to a mental stage in which another mental activity begins. This activity creates and stores composite images of innovative new forms, builds, and saving secondary conceptions. A feeling of relief and joy accompany this activity. This stage represents the end of simple perceptions of the building's elevated level (Figure 8).

Figure 8. Harmony between the building and its surrounding

It was found that the main indices of this stage were formal harmony, color harmony, and effects of roaring water and green areas that produced the secondary conceptions. Table 2. It should be noted that the sensation stage and the feeling stage are intertwined, therefore it was found that some planning and architectural studies consider them one stage.

Table 2. Conceptual indices of the second stage

Sensation - Feeling	Common sense - Pictorial	Dispossession - Secondary conceptions
A sense of the formal harmony between the building and its surroundings, colour harmony between the building and its surroundings, and effects of roaring water and green areas around the building, creating a joy and relief feeling.	Collecting the various sensations that the five senses received in the previous stage, bringing them together in common sense power, and storing them in pictorial power.	Producing new forms of composite images to preserve them and create an integrated Conception of the building as a whole with its surroundings

5.3. Third Stage: Perception – Estimative - Suspicion

When looking at the Hagia Sophia building carefully, it was found that the building was built as a church in a Byzantine style. Minarets were added to it later to turn it into a mosque; after that, it turned into a museum then returned to become a mosque. These transformations affected the brain's estimative power, as they worked to abstract the building shape and generated meaning through the issuance of primary judgments.

These judgments depend on the formal characteristics of the building and drew on experiences stored in memory. However, it could not generate a clear and specific meaning, which caused suspicion about the building knowledge, whether it was a church, mosque, or museum (See Figure 9).

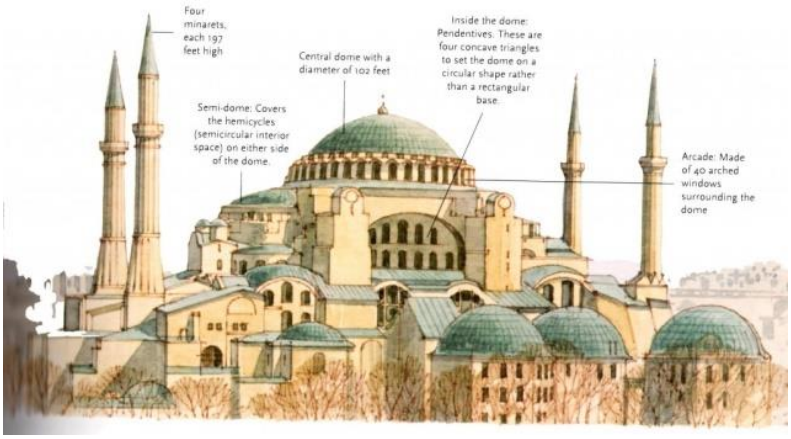

Figure 9. Byzantine style and Ottoman-style for element building

It was found that the main index of this stage was a difference between the building parts that produced a lack of meaning clarity of the building and generated suspicion (Table 3).

Table 3. Conceptual indices of the third stage

Perception	Estimative	Suspicion
A difference between the building parts as a result of adding the Ottoman minarets to the Byzantine building	It stripped the building shape and generated elementary meanings and judgments	Suspicion and uncertainty in the judgment release for not generating a clear and specific meaning about the knowledge of the building, whether it is a church, museum, or mosque

5.4. Fourth stage: Cognition – Thinker - Certainty

Because of the changes that occurred in Hagia Sophia in form, function, and two religions (Christian and Islamic) punished it. In addition to the difference in society over time, it has become a museum for its human values acquisition. In this regard, we cannot disagree about the building's meaning linked to cultural, social, political, and urban values. Those values that the brain could explain according to the stored meanings, so its brain became certain because of the correspondence between image and meaning of the building. These values have been added to the building to be an icon and important landmark in Istanbul. This is what made it a museum expressing the culture and history of society (Figure 10).

Figure 10. Hagia Sophia as a landmark

It was found that the main index of this stage was the different functions of the building across the different eras, which produced certain civilizational and cultural values (Table 4).

Table 4. Conceptual indices of the fourth stage

Cognition	Thinker	Certainty
Explaining the difference in form and function due to the succession of different political and social systems.	The cultural, social, and civilizational values of the building matched the meanings stored in the brain.	Final judgment as a result of the building's image congruence with its cultural and social meaning, which made it an important landmark in Istanbul.

6. Conclusions

Cognition of the urban environment is a goal for architects and urban designers. They strive to make environments clear and understandable to the recipient. Therefore, this paper explains the stages that cognition goes through to reach knowledge and generate meanings about a place. The relationship between knowledge and cognition is explained by the external and the inner senses. Stimuli are the essential part of the cognitive process, as it is the main outlet in the cognitive

process. As the brain deals with the images, it passes out and ignores the others. Cognition in the first stage is not limited to the sense of sight in receiving formal stimuli. Instead, it goes beyond that to include olfactory stimuli such as odors, auditory such as roaring water or noise, and touch-like roughness or smoothness of surfaces, as well as taste stimuli. Common sense can combine it with trying to abstract the material and obtain the overall meanings.

The harmony of color, shape and geometric proportions plays an important role in generating good impressions of places, as they introvert the perception. If the impression is good, positive perception and a feeling of comfort and pleasure are generated. This feeling makes places acceptable and increases attachment to them. Cultural storage and experiences also have an essential influence in generating and retaining meanings. The meanings and perceptions that do not find an explanation in the brain are not preserved. The meanings of cultural and social value remain; this is the cognitive process's goal and purpose.

7. Declarations

7.1. Author Contributions

Conceptualization, A.S.A., N.A.A., and T.R.A.; writing—original draft preparation, A.S.A., N.A.A., and T.R.A.; writing—review and editing, A.S.A., N.A.A., and T.R.A. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

Data sharing is not applicable to this article.

7.3. Funding

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7.5. Conflicts of Interest

The authors declare no conflict of interest.

8. References

[1] Gärling, Tommy, and Reginald G. Golledge. "Environmental Perception and Cognition." Advance in Environment, Behavior, and Design (1989): 203–236. doi:10.1007/978-1-4613-0717-4_7.

[2] Rad, Parastou Naghibi, Farzaneh Behzadi, Abbas Yazdanfar, Hessam Ghamari, Erfan Zabeh, and Reza Lashgari. "Cognitive and Perceptual Influences of Architectural and Urban Environments with an Emphasis on the Experimental Procedures and Techniques" (January 18, 2021). doi:10.31234/osf.io/d2h4m.

[3] Hollander, Justin B., Alexandra Purdy, Andrew Wiley, Veronica Foster, Robert J.K. Jacob, Holly A. Taylor, and Tad T. Brunyé. "Seeing the City: Using Eye-Tracking Technology to Explore Cognitive Responses to the Built Environment." Journal of Urbanism: International Research on Placemaking and Urban Sustainability 12, no. 2 (October 22, 2018): 156–171. doi:10.1080/17549175.2018.1531908.

[4] D'Acci, Luca. "Aesthetical Cognitive Perceptions of Urban Street Form. Pedestrian Preferences Towards Straight or Curvy Route Shapes." Journal of Urban Design 24, no. 6 (January 15, 2019): 896–912. doi:10.1080/13574809.2018.1554994.

[5] Talebzadeh, Adeleh, and Azadeh Sharifi Nowghabi. "The Visual Effects of Store's Signage Displays in Urban Landscape." Civil Engineering Journal 5, no. 1 (2019): 191-199. doi:10.28991/cej-2019-03091237.

[6] Taylor, Nigel. "Legibility and Aesthetics in Urban Design." Journal of Urban Design 14, no. 2 (May 2009): 189–202. doi:10.1080/13574800802670929.

[7] Al-Ṣadr, Muḥammad Bāqir. Our philosophy. Translated by Shams Constantine Inati. London. (1987).

[8] Benflis, Khadija. "Patterns of Sovereignty of the Brain, Visual Perception and Memory, a Comparative Study of Students with Learning Difficulties in Writing and Mathematics." Doctoral, University of the Mentouri Brothers – Constantine (2008).

[9] Al-Jarjani, Ali. The Book of Definitions. 1st Edition ed. Beirut: Lebanon Library, (1990).

[10] Parıldar, Sümeyye. "Intentionality as Immateriality and Mullā Ṣadrā on the Soul." Studies in the History of Philosophy of Mind (2020): 21–43. doi:10.1007/978-3-030-39884-2_2.

[11] Al-Kamali, Mohammed. Lectures in Islamic Philosophy, Theory of Knowledge in a New Dress. 1st Edition e.d.: Al-Faw Institution for Publishing, Distribution and Advertising (1991).

[12] López-Farjeat, Luis Xavier. al-Farabi's Psychology and Epistemology. In Stanford Encyclopedia of Philosophy (2016).

[13] Tavana, Mohammad Ali, Hamid Nassaj, and Morteza Bahrani. "Reconstruction of the Sociopolitical Hierarchy in Farabi's Virtuous City based on Type of Knowledge and Function." Cosmos and History: The Journal of Natural and Social Philosophy 14, no. 3 (2018): 297-320.

[14] Bratman, Gregory N., Gretchen C. Daily, Benjamin J. Levy, and James J. Gross. "The Benefits of Nature Experience: Improved Affect and Cognition." Landscape and Urban Planning 138 (June 2015): 41–50. doi:10.1016/j.landurbplan.2015.02.005.

[15] Reid, Thomas. "Of the Powers We Have by Means of Our External Senses." Essays on the Intellectual Powers of Man (2010).

[16] Komaromi, A. L. Peter Olivi on Perception, Attention, Cognition and Free Will. Philosophy Models (2021).

[17] Rauf, Muhammad, Mushtaq Ahmad, and Zafar Iqbal. "Al-Farabi's philosophy of education." Educational Research International 1, no. 2 (2013): 85-94.

[18] Nasr, Seyyed Hossein, and Oliver Leaman, eds. "History of Islamic Philosophy" (March 7, 2013). doi: 10.4324/9780203824597.

[19] Najati, Muhammad Othman. Perception of Ibn Sina- Research in Psychology amidst the Arabs. Third Edition ed: Al-Shorouk. (1980).

[20] Alrobaee, Tuqa Raad, and Ibrahim Jawad Kadhim. "The Schematic Thought of Cities beyond the Hermann Theory." The iraqi journal of architecture and planning 14, no. 2 (2018): 232-246.

[21] Ati, Ibrahim. The Human in Islamic Philosophy - Al-Farabi Model. Egypt: The Egyptian General Authority for Books (1993).

[22] Ivry, Alfred. Arabic and Islamic psychology and philosophy of mind. In Stanford Encyclopedia of Philosophy (2008).

[23] Lynch, Kevin. The image of the city. Vol. 11: MIT press (1960).

[24] Ibrahim, Dhabia Farouk. "The Planning Dimensions of Place Communication in Urban Environment." Higher Institution of the Urban and Regional Planning, University of Baghdad, Iraq, (2007).

[25] Qassab, Ahmad Saeed, and Sabah Mwafaq AlHalabia. "Architecture between sensation and perception."Tishreen University Journal for Research and Scientific Studies -Engineering Sciences Series (2018).

[26] Saliba, Jamil. Philosophical Lexicon in Arabic, French and Latin terms. Lebanon: Lebanese Book, (1973).

[27] White, Holly, and Priti Shah. "Focus: Attention Science: Attention in Urban and Natural Environments." The Yale journal of biology and medicine 92, no. 1 (2019): 115.

[28] Isaac, Alan Reginald George. Approach to architectural design. Butterworth, (1971).

[29] Rapoport, Amos. Human aspects of urban form: towards a man—environment approach to urban form and design: 2016.

[30] Al-Alwan, Huda. "The Articulation of the Architectural Environment: A Psychophysical Study of the Mental Representation of Complex Environments." Ph.D., Department of Architecture, University of Baghdad, Iraq (2001).

[31] Selst, Van. Introductory Psychology Chapter 4: Sensation & Perception. In Sensation and Perception Chapter 4 of Feist & Rosenberg Psychology: Perspectives & Connections. USA: The California State University (2014).

[32] Al-Jasmani, Abd Ali. Psychology and its Educational and Social Applications. Baghdad: A Eternity (1984).

[33] Liu, Ye, QiuFang Fu, and XiaoLan Fu. "The Interaction between Cognition and Emotion." Chinese Science Bulletin 54, no. 22 (November 2009): 4102–4116. doi:10.1007/s11434-009-0632-2.

[34] Greene, Joshua D, R Brian Sommerville, Leigh E Nystrom, John M Darley, and Jonathan D Cohen. "An fMRI investigation of emotional engagement in moral judgment." Science 293, no. 5537 (September 14, 2001): 2105–2108. doi: 10.1126/science.1062872.

[35] Qiong, O. U. "A brief introduction to perception." Studies in Literature and Language 15, no. 4 (2017): 18-28. doi: 10.3968/10055.

[36] Aouf, Ahmed Mohamed. Introduction in Urban Design. United Arab Emirates: Zayed Center for History and Heritage (2002).

[37] Bostancı, Seda, and Suzan Girginkaya Akdağ. "Understanding Aesthetic Experiences of Architectural Students in Vertical and Horizontal Campuses: A Comprehensive Approach." Journal of Contemporary Urban Affairs 4, no. 2 (2020): 13-26.

[38] Eastmond, Antony. Art and identity in thirteenth-century Byzantium: Hagia Sophia and the empire of Trebizond. Routledge, (2017).

[39] Necipoğlu, Gülru. "The life of an imperial monument: Hagia Sophia after Byzantium." (1992).

[40] Taranto, Mirco, Luis Barba, Jorge Blancas, Andrea Bloise, Marco Cappa, Francesco Chiaravalloti, Gino Mirocle Crisci, et al. "The Bricks of Hagia Sophia (Istanbul, Turkey): a New Hypothesis to Explain Their Compositional Difference." Journal of Cultural Heritage 38 (July 2019): 136–146. doi:10.1016/j.culher.2019.02.009.

[41] Miriello, Domenico, Luis Barba, Jorge Blancas, Andrea Bloise, Marco Cappa, Murat Cura, Daniela De Angelis, et al. "New Compositional Data on Ancient Mortars from Hagia Sophia (Istanbul, Turkey)." Archaeological and Anthropological Sciences 9, no. 4 (August 26, 2016): 499–514. doi:10.1007/s12520-016-0375-3.

[42] Coruhlu, Yakup Emre, Bayram Uzun, and Okan Yildiz. "Conflict over the Use of Hagia Sophia: The Legal Case." Land 9, no. 10 (September 24, 2020): 350. doi:10.3390/land9100350.

[43] Nur, Yüksel Burçin, and Yasemen Say Ozer. "Temporality and Memory in Architecture: Hagia Sophia." Iconarp International J. of Architecture and Planning 5, no. Special Issue (December 18, 2017): 60–76. doi:10.15320/iconarp.2017.26.