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Explaining and Analyzing the Relationship between Hierarchy and Sense of Presence in the Body of Islamic Architecture of Isfahan School; Case Studies: Aqa-Noor Mosque, Hakim Mosque, and Imam Mosque of Isfahan*

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ABSTRACT

A key characteristic of architecture desirable to humans is its ability to create a sense of awareness and presence in space. That allows them to feel themselves in the presence of God Almighty and see him watching over them. Factors in architecture, such as hierarchy, can be used to create this sense and help to understand the space and its design. The mosque is one of the most important buildings of the Islamic era, and it is essential in designing the space for thinking and awareness during worship. A quantitative study explains the components of hierarchy and their role in increasing the quality of space and audience presence in the four-porch mosques. This article answers the question of how hierarchy creates the presence of sense and what factor will have the most significant impact on realizing this sense. For this purpose, the theoretical model has been explained in the theoretical section by studying scientific sources and libraries. With the same typology, three mosques from the Safavid period, Aqa-Noor, Hakim, and Imam of Isfahan, were selected for testing. Then, the theoretical model was tested by surveying and questioning 105 architects. According to the SPSS statistical software analysis of data obtained from the questionnaire, the design of a hierarchy with different factors directly and positively impacts awareness and avoidance of neglect in space. Consequently, contemporary architects can use the components introduced in this study and the material structure of architecture to facilitate perception and awareness of space. The most critical component for mosque design is the hierarchy of natural light, which creates and enhances the sense of presence.

Keywords: Space Perception, Safavid Mosques of Isfahan, Natural Light Hierarchy, Sense of Unity, Sense of Time.

* This article is an excerpt from master's thesis of the first author entitled "Analysis & Design of Light Hierarchy in the Architecture of Tehran's Neighborhood Mosques (Case Study: the Isfahan School Mosques)" in the Faculty of Art and Architecture of Tarbiat Modares University and supervised by the second author and Advised by the third author have been done.

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1. INTRODUCTION

The concept of the ideal city and the neglect of its spiritual aspects has significantly gained attention in recent years, with space design specialists identifying it as one of the most critical areas of this subject. On the other hand, hierarchy is a significant theme in spatial perception and experience creation in architecture. The hierarchy is one of the prominent principles in Iranian-Islamic architecture and urban planning (Mohamadianmansoor 2007). This principle is not limited solely to architectural and urban spaces; it exists in all realms, such as the seven cities of love in Attar's poetry and the seven levels of the skies (Tabibian, Charbgoo, and Abdolahimehr 2012). This principle arises from aligning with the hierarchical system of existence beyond the material realm (Nasr 2001). Every building's architecture is designed according to a hierarchical system, defining its functional, spatial, visual, and structural dimensions (Fattahi and OmraniPour 2014). This principle has garnered significant attention, especially in the Safavid and Timurid periods (Mahboobi et al. 2018). When humans interact with architectural spaces as places for contemplation, divine remembrance, and self-awareness, they experience a sense of presence (Noghrehkar 1997; Naghizadeh 2013). The mosque space plays a crucial role as the site for the manifestation of the hierarchy principle, with perceptual aspects of space being highly significant (Ardalan and Bakhtiar 1973). Mosque architecture consciously addresses the interaction between humans and the higher realms of existence, providing a space for contemplation and spiritual engagement with the concept of the divine realm (Kahnamoui and Pashaeikamali 2001). Mosques in this land have long been the highest manifestation of sacred thoughts (Bemanian et al. 2010). Therefore, examining the hidden aspects of past mosque designs opens the way for today's architects. This research seeks to answer the question of what quantitative and qualitative relationship exists between hierarchies and creating a sense of presence in the audience in the space of past mosques. What is the most critical factor in hierarchical design in creating a sense of presence in mosques? Therefore, a research model in the architecture of Isfahan School mosques has been tested to analyze various aspects of hierarchies, emphasizing enhancing the sense of presence.

2. BACKGROUND RESEARCH

The hierarchy has always been a significant principle in the architecture of religious spaces, drawing the attention of Iranian-Islamic architects. Many researchers have extensively examined it. Table 1 presents studies and books on the subject in chronological order.

Table 1: Background Research

Subject	Title	Methodology	Conclusion
Hierarchy	Impact of Qibla's Direction on Dynamics of Movement in Mosques with the Study of Iranian-Islamic Architectural Styles	Descriptive-Analytical and Space Syntax	Utilizing a Circulation pattern can foster unity throughout the mosque and guide people toward the Qibla direction (altar) (Moosavi and Ghouchani 2021).
	The Typology of the Spatial Structure of the Contemporary Iranian Homes Relying on Confidentiality and Hierarchy Case Study: Homes between 1970's to 2000's in Tehran	Space Syntax	Houses in the 1950s and 1960s were designed with separate spaces branching off from the central hall. Subsequently, the bathrooms were separated from the main space, gaining more privacy over time (Rastjoo and Bemanian 2019).
	Typology of Spatial Configuration and Hierarchy of Entry in Iranian Houses: Concentrating the Issue of Privacy	Descriptive-Analytical	By identifying entrance spaces, a pattern is presented for preserving privacy, which is an integral part of the identity in Iranian culture and architecture (Ghafourian, Peysokhan, and Hesari 2017) .
	Exploring the Principle of Hierarchy in Islamic Architecture and Folding	Descriptive-Analytical	Examining whether the principle of hierarchy applies to Islamic architectural patterns and folding and whether it encompasses all architectural schools or is specific to a particular architecture (Zulfiqar Zadeh and Zarkesh 2017).
	Studying the Entrance Hierarchy in Shiraz Mosques	Descriptive-Analytical	The principle of hierarchy has not been observed in the entrances of some old mosques in Shiraz (Zakeri, Estejab, and Shokarane 2017).
	Recognizing the Principle of Hierarchy in the Architecture of Iranian Mosques	Descriptive-Analytical	The hierarchy is one of the architectural principles of mosques and is essential from a functional perspective and in altering the sense of space (SirosRezaei 2017).

Subject	Title	Methodology	Conclusion
Hierarchy	The Place of Credo in the Formation of Mosque Hierarchy, Case Study: Imam Mosque in Isfahan	Descriptive-Analytical	The hierarchy in the Imam Mosque is a unique example that ranges from the seeker's quest to the human's ascension and their connection to the divine presence (Bighami 2015).
	Comparative Comparison of the Hierarchies of the Religious Spaces, Case Study: (Firozabad Fire Place, Yazd Jame Mosque, First Unitarian Church of Rochester by Louis Kahn) (Zardtashti, Christian, Islamic)	Descriptive-Analytical	All spaces within different religious complexes are influenced by the central position of worship and follow a relatively similar hierarchy (Bahmani Kazerooni, Hamzavi, and Namazi 2016).
	Investigating Sustainable Elements of Iranian Architecture in Fire Temples and Mosques	Descriptive-Analytical	Examining the evolution of fire temples and mosques before and after Islam and analyzing features such as hierarchy, scale, proportion, spatial contrast (contradiction), etc. (Yousefi and Shaker 2015)
	Introduction to Islamic Identity in Architecture	Descriptive-Analytical	Hierarchy classification can be categorized into three forms: spatial hierarchy, physical hierarchy, and ornamentation hierarchy (Noghrekar, Hamzenejad, and Ranjbar-Kermani 2009).
	Privacy Hierarchy in Iranian Mosques	Descriptive-Analytical	Utilizing the principle of hierarchy in mosques leads to an increased sense of being in a sacred space. (Mohamadianmansoor 2007).
	The Spatial System of Iranian Architecture and its Structure	Descriptive	Explanation of the Hierarchy Principle (Taghvaei 2007)
	Access and Hierarchy of Urban Spaces	Descriptive	Hierarchy in architecture is discussed in two parts: the subject within a context (the significance of finding hierarchy in the subject is mentioned in terms of size, shape, composition, and spatial sanctity) and the space itself, which will have hierarchies influenced by function, access, privacy, stability, and light-shadow (Okhovvat 1996).
Sense of Presence	The Sense of Presence: the Most Desirable Situation for Mankind's Relationship with Existence	Descriptive-Analytical	Examining the concepts of "remembrance" and "sense of presence" as the most desirable state for humans and the superior feature of the environment (Naghizadeh 2013)

The background research indicates that many studies have examined the hierarchy. Research has focused on identifying concepts and definitions, primarily through qualitative and intuitive approaches, studying these concepts in the architecture of Iran. Quantitative research has also been conducted on residential spaces. However, various aspects and indicators of research variables in architecture have not been quantitatively and operationally investigated regarding their impact on the user in mosque spaces.

3. RESEARCH METHODOLOGY

This research falls within the domain of applied studies and, in terms of its objective, is descriptive-explanatory, employing an empirical research method. A theoretical framework is initially developed by studying scientific documents and then tested using a survey method. The statistical population includes 105 architects, and the population of buildings consists of Four-Iwan mosques in Isfahan.

Experts examined the indicators to assess the validity of the questionnaire, and after they confirmed the indicators and the questionnaire, they were tested. Finally, the data were analyzed in SPSS to confirm the research hypothesis (Fig. 1).

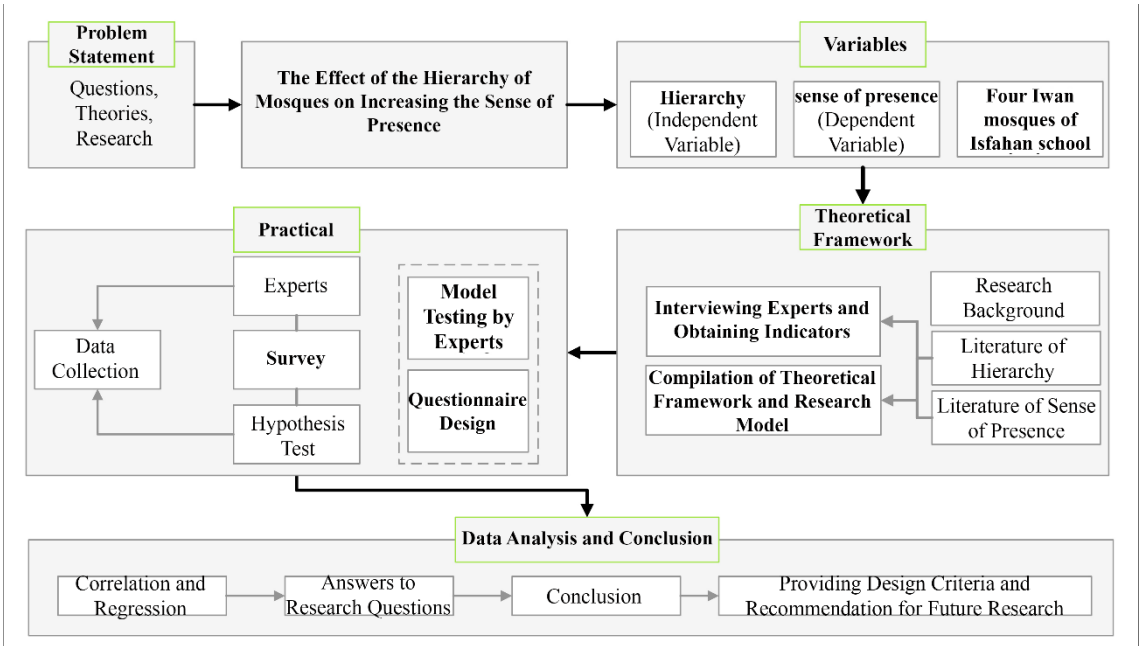


Fig. 1. Research Methodology

4. THEORETICAL FRAMEWORK OF RESEARCH

4.1. Hierarchy

For Muslims, the process of ascending levels and readiness for arrival has always been significant. Hierarchy is one of the fundamental principles in architecture that determines the role, position, and value of elements. The principle of organizing spaces and elements based on their physical-functional characteristics creates a hierarchical approach to using and placing elements. Therefore, the principle of hierarchy can be seen as leading to spatial realms with functional diversity (Seyfiyan and Mahmoodi 2007) (Fig. 2).

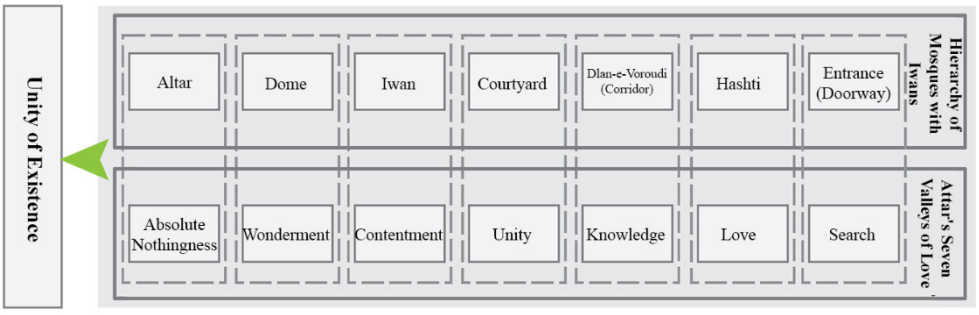


Fig. 2. Hierarchical Relationship in the Mosques with Four Iwans and Attar's Seven Valleys of Love, aiming to Achieve the Unity of Existence

4.2. Sense of Presence

The Iranian culture defines monotheism, awareness, and its branches as the most suitable state for humans. The sense of presence, faith, time, security, and place are essential conditions for human life that can lead to distancing from negligence and reminding of beautiful concepts and subjects (Fig. 3). God has entrusted these concepts to the nature of humans, and these conditions are the highest conditions of human life (Naghizadeh 2013, 2010).

Space has various meanings from different perspectives. For Muslims, space holds sacred value due to God's presence. The fact that "the world is the abode of God" resonates well in Iranian architectural space, emphasizing reminders and recollections and dispelling negligence

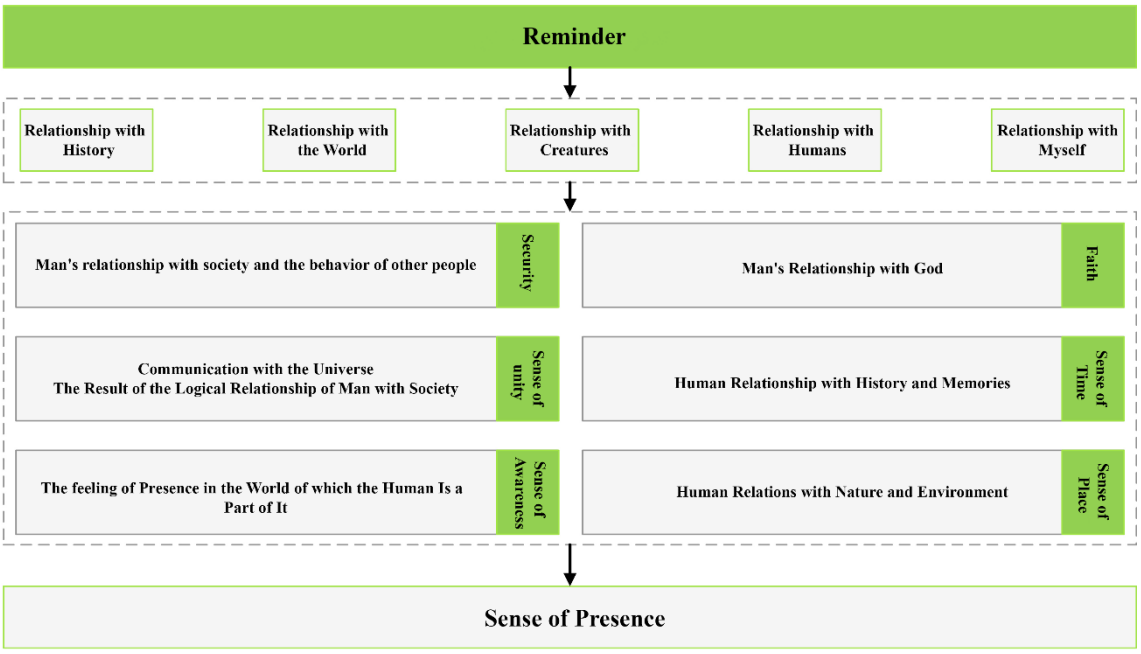


Fig. 3. Elucidation the Sense of Presence Concept
(Adapted from Naghizadeh 2013)

4.3. The Role of Sense of Place in the Sense of Presence

The most important term associated with place is the sense of place (Mousaei jo, Majedi, and Zabihi 2021). This concept encompasses a broad spectrum of the relationship between humans and place, (Raymond et al. 2016) which includes the meaning of place and belongingness to place. (Stedman 2003; Smaldone, Harris, and Sanyal 2005) much research has emphasized the social construction of sense of place and neglect the potentially important contributions of the physical environment to place meanings and attachment. This article presents research that tests several models that integrate. According to Lynch, space must have a perceptible and memorable identity in order to evoke a sense of place. (Karami, Ghafary, and Fakhrayee 2014). This sensation may be accompanied by a sense of belongingness (Lynch 1984). In essence, it is the mental perception of the environment and relatively conscious feelings about it, where the user's emotions become intertwined and integrated with the environment (Rajala, Sorice, and Thomas 2020). According to Schultz, the sense of place resides in a location characterized by distinct personality, tangible materials, structure, and color. (Norberg-Schulz 2000) However, the users within the Iranian-Islamic society, by being in the mosque, is placed at a higher level than the sense of place. For them, place does not require a specific body or personality. In fact, they strive for "presence" more in the place and perceive emotions beyond the sense of place. This presence is related to awareness, existence, and God. The relationship that humans have with existence can be classified into various levels, such as the relationship between humans and themselves and God, history, sense of awareness, etc., and the sum of these senses is the "sense of presence". (Naghizadeh 2013).

5. CONCEPTUAL AND OPERATIONAL DEFINITION OF VARIABLES

To assess the research's concepts and variables, they must first be conceptually defined, and then their operational definitions must be provided for measurability. Based on the discussions in the theoretical foundations section, conceptual definitions are as follows:

Hierarchy: Organizing space and elements and establishing order and ranking to prepare for arriving at the destination

Sense of presence: It is the realm of the divine, and this feeling refers to awareness and the sense of actual presence in the space.

Operational definition: In one's mind, a person can ascend to the station of divinity through successive physical and spiritual levels. The spatial structure of mosques is prepared with various hierarchies and classifications, ultimately guiding humans toward the mihrab, the symbol of divinity (SatariRaouf and Azimi 2010). Throughout history, there has been a belief that in the arrangement of spaces leading to the destination space, understanding and feeling undergo a continuous process to prepare for reaching the space (Shayan and Qaripour 2008).

As a hierarchy, the religious way guides humans towards the truth (God). In mosque architecture, reaching the truth means attaining the highest level of awareness and connection with God, conveyed to humans through their presence in a specific place. This path is embodied through ascending levels and readiness in spatial design, forming a hierarchy. Through various stages in connecting, transferring, and arriving spaces, this hierarchy is created by changing design elements such as light, color, and height. A conceptual research model has been proposed based on the content above and interviews with experts in this field (Fig. 4).

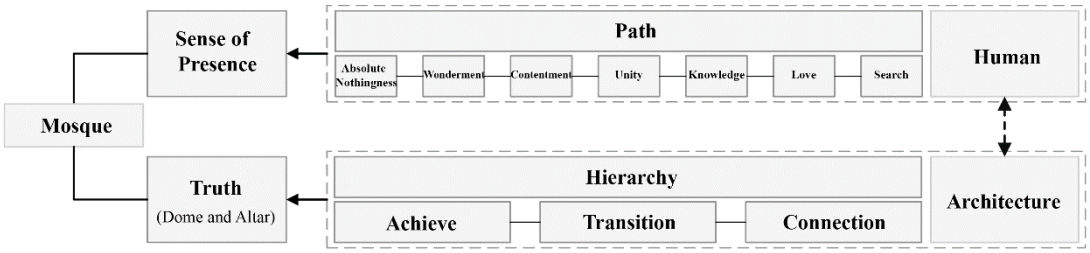


Fig. 4. Research Conceptual Model

The indicators in Table 2 have been proposed as variable measurement factors based on interviews and experts' opinions. By changing the hierarchy factors, the hierarchical design is measured, and the existence of the sense of presence factors shows an increase in this variable. By changing the hierarchical factors, the hierarchical design is assessed, and the sense of presence factors signifies the degree of increase in this variable.

Table 2: Explanation of Hierarchical Indicators and Sense of Presence

Variable	Indicators	Explanations
Hierarchy	Elevation	Adjusting the floor level
	Color, Materials	Altering the color and texture of the space and materials
	Decorations	Utilizing techniques such as tiling, brickwork, knotting, moqrans, karbandi, etc.
	Proportions	Modifying the proportions of height-to-length within the space and length-to-width
	View and Landscape	Adjusting frames, visual sequences, and various vistas transitioning from the internal space to its surroundings
	Symbolism	Incorporating cultural and religious symbols
	Thermal Comfort	Modifying atmospheric conditions including humidity, temperature, precipitation, radiation, and wind
	Light and Illumination	Manipulating natural lighting and its intensity within the space
	Sound	Utilizing sound phenomena such as resonance, echo, etc., to alter auditory experiences
	Shape and Form	Adjusting the geometric layout of plans, sections, and morphological forms
Sense of Presence	Sense of Unity	Ensuring components adhere to unified principles and goals, and coordinating their relationships within the whole
	Security	Cultivating a sense of assurance within the environment, fostering mastery over the geographical area, and promoting harmony with the community
	Sense of Time	Experiencing a timeless sensation, as if time has paused, or reflecting on the passage of time and reminiscing memories
	Reflection and Contemplation	Engaging in reasoning and contemplation to deepen connections with the inner self and understand profound meanings through all senses

Variable	Indicators	Explanations
Sense of Presence	Sense of Equilibrium	Embracing equality in engagement with the environment, avoiding extremes, and promoting harmony in components, such as symmetry and rhythm
	Transcendence and Spirituality	Enhancing understanding of the divine by drawing closer to it and seeking communication beyond religious confines, leading to fortified spiritual dimensions in life, comfort, hope, and inner tranquility
	Manifestation	Observing the manifestation of the divine within the essence, attributes, and actions of the created world
	Territoriality	Concentrating on self-discovery and progression towards self-actualization

Variables and their indicators have been introduced based on the research objectives, and a theoretical model is presented for testing (Fig. 5).

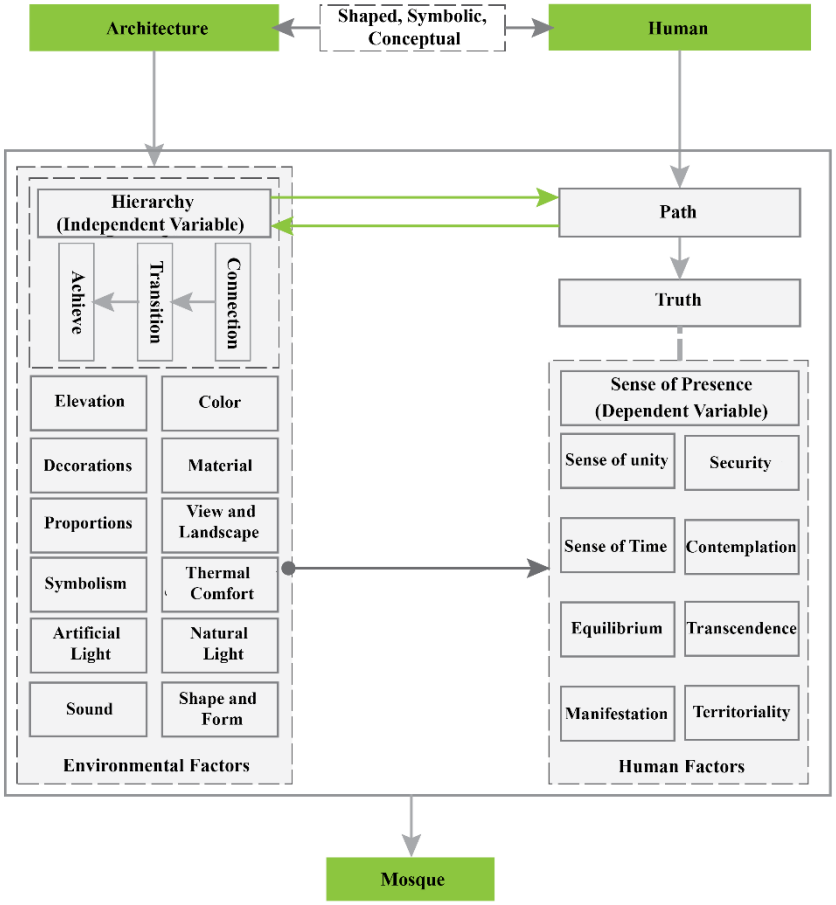


Fig. 5. Research Theoretical Model

6. CASE STUDIES

With the emergence of the Safavid government and the establishment of the Isfahan School, mosques came to be recognized as symbols and manifestations of Shia ideals (Nourian, Elahizadeh, and Abdulahi Sabet 2014). The Isfahan School of Philosophy is a skillful synthesis of Sohravardi's Wisdom of Love and Mulla Sadra's Transcendental Philosophy. The design of mosques in this school is an attempt to manifest a hidden geometry rooted in the profound significance of this philosophical tradition. In Safavid-era mosques, a hierarchical access and spatial orientation have been observed (Sarmi, Khodabakhshi, and Khallaghdoost 2015). The spatial design in these mosques is conceptual, compelling the visitor to contemplate and reflect before allowing entry into the space of worship and transcendence (Ansari, Okhovat, and Molaee 2008). The finest examples of

such mosques can be found in Isfahan. Therefore, for the uniform typology, all four Iwan mosques from the Safavid period were initially identified, followed by examining the Abbasi Great Mosque, Hakim, and Aghanur on three different urban scales.

6.1. Abbasi Great Mosque

The Abbasi Great Mosque is one of the mosques situated in Naqsh-e Jahan Square in Isfahan and boasts a distinctive architectural innovation through the rotation of its entrance iwan. In the portal and forecourt, the art of tilework has reached its pinnacle, with intricately designed tiles and various Islamic motifs adorning the entrance facade beautifully. This mosque, with its structural integrity, serves as a symbol of steadfastness and the serene expression of the essence of Islam (Sarmi, Khodabakhshi, and Khallaghdoost 2015; Pope 1994; Dabbagh and Rahbar 2016).

6.2. Hakim Mosque

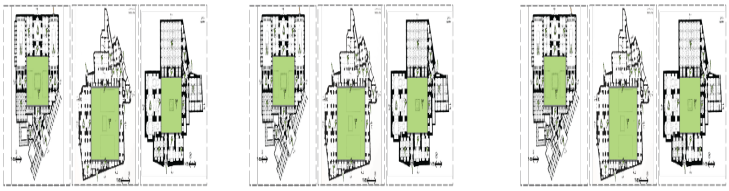
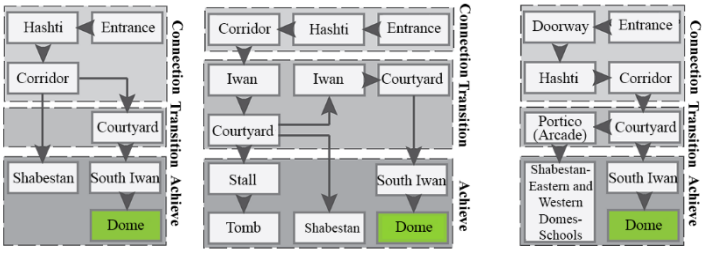
The Hakim Mosque is located amidst the ruins of an old mosque from the Dailamites' rule at the end of the Rangarzan Bazaar. It was constructed during the reign of Shah Abbas II. Despite the absence of a grand dome and minaret, due to its large-scale four-iwan layout, brickwork, tilework, and especially its architectural design, it holds significant value among the monuments of that period (Hillenbrand 1994; Maher-al-Naqsh 1997; Kayani 1997; Pope 1994).

6.3. Aqa-Noor Mosque

The Aqa-Noor Mosque is located in the historical district of Dardasht. Its construction began during the reign of Shah Abbas I and was completed during the rule of Shah Safi. The mosque's founder was Nur al-Din Mohammad Isfahani. Its Shabestaan (prayer hall), adorned with stone columns and a dome covered with a dome fountain, was added during the Qajar period, utilizing marble stone to enhance illumination (Bemanian, Jelvani, and Arjmandi 2016; Haji-Qassemi 1996).

Table 3: Comparative Study of Mosques Features

Mosque Name		Aqa-Noor Mosque		Hakim Mosque		Abbasi Great Mosque (Imam Mosque)	
Construction Period (Year of Initiation)		Safavid Era		Safavid Era		Safavid and Qajar Era	
Urban Scale		Center of the Neighborhoods		Around the Main Structure of the City		Urban Scale (Jame Mosque)	
Location of the Entrance		Courtyard Corner		Courtyard Corner		Both Sides of the North Iwan	
Entranc Location	Alley - Market	*		*		*	
	Square	-		-		*	
Entrance Retreat		-		-		*	
Dome	Quantity	*	1	*	1	*	3
Minaret	Quantity	-	-	-	-	*	4
Goldaste	Location	*	South West	*	North East	*	North West
Courtyard Form		Square		Square		Rectangular (in the Qibla Direction)	
Pool Form		Rectangular (in the Qibla Direction)		Rectangle (Against the Direction of Qibla)		Rectangle (Against the Direction of Qibla)	
Altar Decorations		Muqarnas		Muqarnas		Karbandi	
Adjacency Neighborhood		Residential		Residential- Religious- Market		Market- Square	
Land Area		4000 Square meters		8000 Square meters		17000 Square meters	
Lattice Windows		*		*		*	
Wide Window		*		-		-	
Lattice Window above the Altar		*		*		*	

Mosque Name	Aqa-Noor Mosque	Hakim Mosque	Abbasi Great Mosque (Imam Mosque)
Materials and Decorations	Brick (Karbandi and Muqarnas)	Brick (Karbandi and Muqarnas)	Kashi Haft Rang (Seven-Colored Tiles) (Muqarnas)
Light Entry from Courtyard	*	*	*
Spatial Diagram			
Circulation Diagram Spatial			

According to Table 3, all three mosques have a four-iwan plan and feature one minaret, although the location of the minaret varies in each mosque. Imam Mosque has three domes, while Aghanur and Hakim mosques have one dome. All three mosques have a southern iwan leading to the dome chamber and mihrab. Due to its accessibility, vastness, and scale, the Imam Mosque features four minarets, a front hall, and a grand dome, serving as critical urban symbols

7. FINDINGS AND DISCUSSION

This study used the Likert scale to evaluate the indicators of a sense of place and hierarchy in the Four Iwan mosques of the Isfahan School of Architecture. It is worth noting that sound and form indicators in the hierarchy were not assessable via the questionnaire and, thus, were not included in the survey. Cronbach's alpha coefficient was used for reliability and consistency of the scale, demonstrating excellent internal reliability of the questionnaire ($\alpha = 0.94$). The spatial variables of sense of place and hierarchy were examined in three sampled mosques, with background variables first followed by the main variables of the study.

7.1. Descriptive Analysis of Background Variables

The statistical results indicate that out of 105 respondents, 45 individuals have solely traveled to Isfahan, with 37.1% being residents for more than ten years and 20% residing in Isfahan for less than ten years. 62.9% of the respondents are male, while 37.1% are female, and 15 individuals have visited Aqa-Noor Mosque, 21 individuals have visited Hakim Mosque, and 36 individuals have visited Masjid Imam in Isfahan; in addition to their visiting experience, they also engaged in religious activities (prayer).

According to the respondents, the most attractive space in the Aqa-Noor Mosque is the Shabestan, while the Hakim Mosque and Abbasi Great Mosque are the domes. Visitors spent the most time in the Shabestan and courtyard of Aqa-Noor Mosque, the Shabestan, the dome of Hakim Mosque, and the dome of Abbasi Great Mosque.

7.2. Descriptive Analysis of Main Variables

Based on Figure 6, the Abbasi Great Mosque excels in all hierarchical and sense of presence indicators. Due to its construction goals and proximity to Naghsh-e Jahan Square, this mosque has achieved the highest score in all components. With its visible domes and minarets from Naghsh-e Jahan Square, Abbasi Great Mosque has created greater vertical connection and grandeur, leading to significant differences in elevation, visibility, and symbolic elements compared to the other two mosques. However, all three mosques follow a similar pattern, and except for elevation, Hakim Mosque has a higher score than Aqa-Noor Mosque in all indicators.

There is little difference between the three mosques regarding the sense of presence indicator. That indicates that all three mosques promote awareness, avoidance of negligence, and a sense of divine presence in their spaces similarly, and with movement within their spaces, perception occurs moment by

moment. However, in Abbasi Great Mosque, some features are more prominent; the sense of presence responses show that the sense of unity and the sense of time have obtained the highest score, and despite the diverse experiences of individuals, ultimately, all lead to a sense of presence

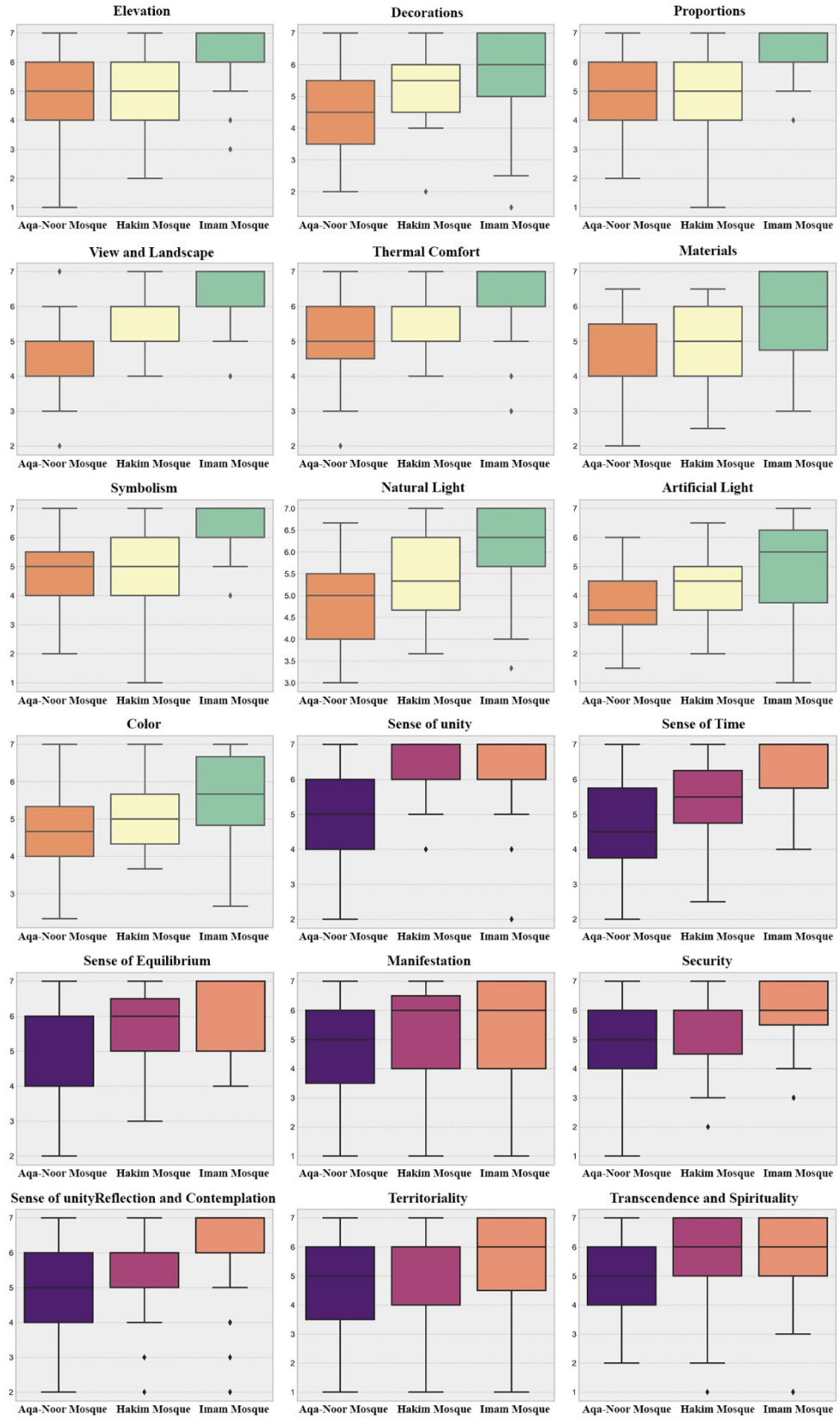


Fig. 6. Box Plots of the Hierarchical and Sense of Presence Indicators in the Case Studies

In comparing the hierarchical indicators among the three mosques, the Imam Mosque exhibits minor variations in thermal comfort, proportions, view and landscape, and elevation. However, due to the excessive use of tiles and colors, this mosque has somewhat obscured the hierarchy of materials and decorations for respondents. However, it is still recognized as one of the masterpieces of Iranian architecture.

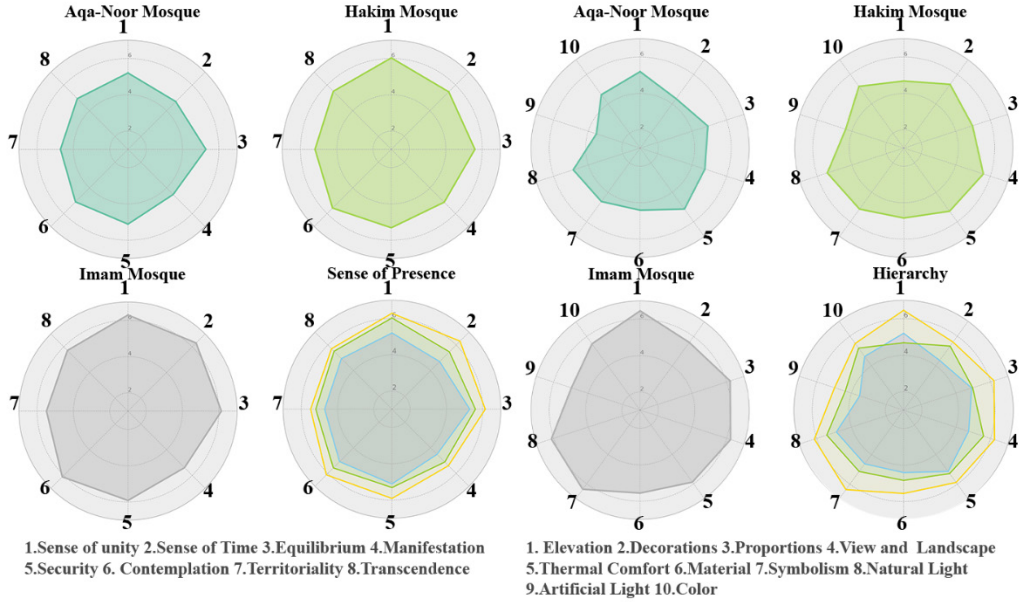


Fig. 7. Comparison of Indicators of Two Variables, Hierarchy and Sense of Presence, in the Case Studies

According to Figure 7, in the variable of sense of presence, the indicators of sense of time and unity have obtained the highest scores in Imam Mosque, sense of unity in Hakim Mosque, and sense of equilibrium in Aqa-Noor Mosque. However, the lowest score in the sense of presence variable in all three mosques belongs to the manifestation. On the other hand, the indicator of elevation change in the hierarchy of Aqa-Noor Mosque has received the highest score. In contrast, the elevation change and symbolism indicators have gained higher scores in the Hakim Mosque, the indicator of change in view, and the Abbasi Great Mosque.

7.3. Correlation Analysis

The correlation analysis in this study indicates that all variables have a positive and direct relationship.

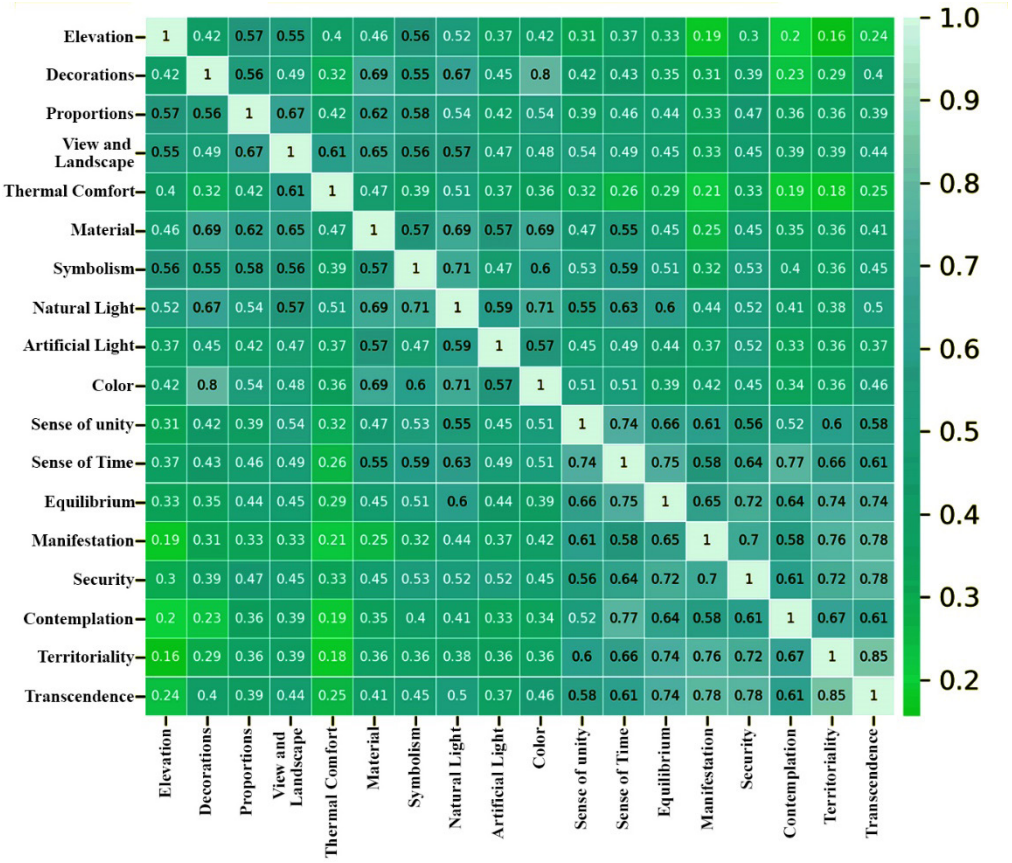


Fig. 8. Correlation Matrix between Indicators of Research

Based on the data presented in Figure 8, the correlation coefficients of the hierarchy components are situated in the range [0.8,0.16].

Most correlation coefficients are above 0.5, indicating strong relationships between the indicators. However, the lowest positive coefficients are respectively related to [Elevation-Reflection and Contemplation−0.2], [Elevation- ManifestationSensation- 0.19], [ThermalComfort- Reflection and Contemplation- 0.19], [ThermalComfort- Territoriality- 0.18], and [Elevation- Territoriality- 0.16].

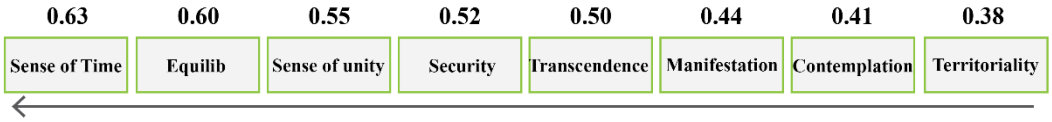


Fig. 9. The Correlation between Natural Light Hierarchy and the Sense of Presence Indicators

The correlation coefficients between the sense of presence and the hierarchy of natural light range from [0..38– 0.63], indicating a direct effect of the natural light change indicator on increasing the sense of presence. Specifically, the highest and lowest coefficients are associated with the indicators of the sense of time and territoriality (Fig. 9).

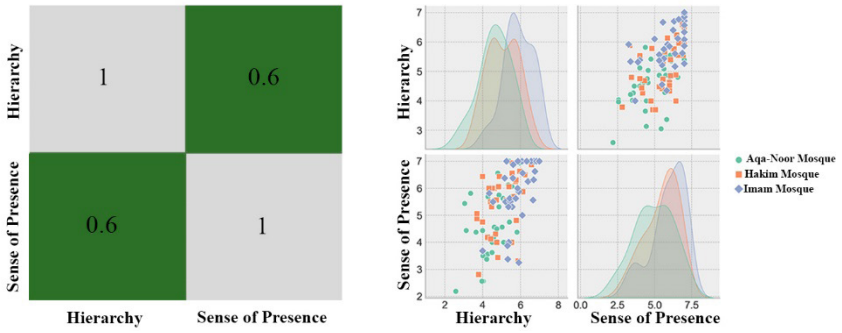


Fig. 10. The Correlation Matrix between The Research Variables

Figure 10 shows that the Pearson correlation coefficient between the research variables is 0.6, indicating a direct relationship between them.

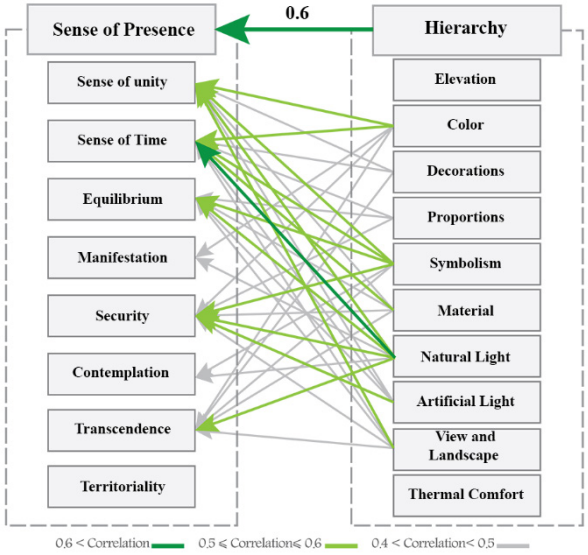


Fig. 11. The Theoretical Model Test

Figure 8 depicts the correlation between the indicators; the view and the hierarchy of natural light have the most significant effect, while thermal comfort has the most negligible impact on the sense of presence. In Figure 11, indicators with a stronger relationship with each other are identified; for example, changes in symbolism and artificial and natural light have a significant effect on increasing security, which is perceptible due to the enhanced readability of the city with symbolism and the use of light during day and night.

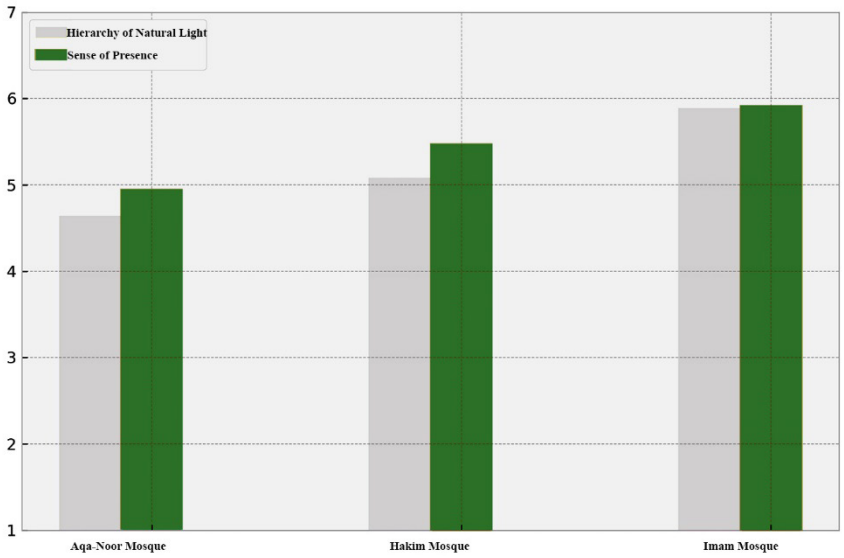


Fig. 12. Comparison of the Hierarchy of Natural Light and the Sense of Presence in the Case Studies

According to Figure 12, in the case studies, the design of the Imam Mosque manipulates natural light the most, resulting in the highest sense of presence compared to the other three mosques.

7.4. Regression Analysis

Regression analysis demonstrates to the researcher how much the dependent variable changes with an increase of one unit in the independent variable. The research hypothesis suggests a positive relationship between hierarchy and sense of presence. This explanatory claim has been investigated by determining the correlation coefficient between the independent variable (hierarchy) and the dependent variable (sense of presence) in the case studies of the four-iwan mosques of the Isfahan School of Architecture.

Table 4 presents the regression analysis between the research variables. According to the data in this table, the correlation coefficient between hierarchy and sense of presence is equivalent to 0.598. The proportion of shared variance between hierarchy and sense of presence is 0.358.

Table 4: Coefficients of Regression Showing the Influence of the Independent Variable (Hierarchy) on the Dependent Variable (Sense of Presence)

Variables	b	Constant	Sig	Beta	R^2	R
Hierarchy and Sense of Presence	0.780	1.387	0.012	0.598	0.358	0.598

According to the regression analysis, the relationship between the independent and dependent variables is as follows:

(Hierarchy) Independent Variable = 0.78 (Sense of Presence) + 1.387

The regression coefficient indicates that with the positive coefficient of the relationship, as the independent variable increases, the predicted value of the dependent variable also increases, thus confirming the research hypothesis (Fig. 13).

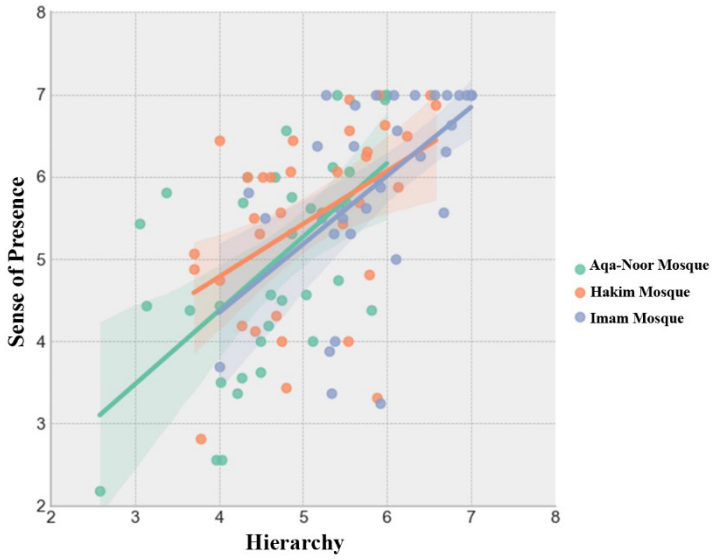


Fig. 13. Multiple Regression

8. CONCLUSION

This study analyzed the sense of presence indicators and hierarchy indicators and the relationship between them. The analysis of the questionnaire data indicates that the research hypothesis is confirmed based on the positive regression coefficient. Furthermore, considering the positive correlation between indicators and descriptive analyses from previous studies regarding the observance of hierarchy in design, it is concluded that enhancing the hierarchy contributes to spatial spirituality as one of the factors affecting the sense of presence.

- The Isfahan School Mosques prepare individuals for traversing hierarchies and creating awareness in every scale and spatial location, especially in urban-scale mosques. The sense of unity is perceived more than other indicators, and the most appealing space for the user in these mosques is one where they spend more time, such as the Shabistan space in the Agha-Noor Mosque and the dome space in the Hakim Mosque and Imam Mosque.
- Based on the research findings, architects' designs that incorporate hierarchical factors contribute to increased awareness and avoidance of negligence in space, particularly in cultivating a sense of time and unity. That is because users' preparation unfolds over time, and the principle of hierarchy inherently embodies unity in multiplicity. For instance, provisions such as creating differences in levels, textures, colors, materials, decorations, lighting, etc., besides distinguishing between two spaces and establishing hierarchies, facilitate perception and awareness in space. Table 5 demonstrates the significant impact of the essential hierarchical design factors, with correlations exceeding 0.4, on the indicators of the sense of presence.
- Among the factors contributing to the creation of hierarchies, natural light is the most essential and decisive element for design in mosque spaces, as it has the strongest correlation with the sense of time, unity, equilibrium, security, and transcendence.
- One noteworthy finding in the correlation results between natural light and sense of presence indicators is the significance of the manifestation sense. In descriptive studies, light has been introduced as the primary element in mosque design to manifest. According to the results of data analysis, alongside natural lighting in mosques, color is an essential factor in design for divine manifestation. Through quantitative analysis of Iranian mosque architecture, the unity of light and color is demonstrated, indicating that light contributes more to enhancing the territoriality domain and contemplation than manifestation.
- Symbolism, views, materials, and artificial lighting are among the most critical factors in hierarchical design after natural light, aiming to enhance mosques' spatial awareness (sense of presence). Changes in thermal comfort are less significant than other parameters. The lower score of this component, considering the type of research sample, i.e., mosques, is understandable, and generally, its impact on spatial awareness is direct and positive. For example, thermal changes are essential in balancing the comfort of different bathroom spaces.
- Artificial lighting receives a low score in mosques because it is predominantly used during the day and for visits. It should be noted that, according to the theoretical model test, lighting, especially artificial lighting at night, significantly impacts the sense of security, emphasizing the importance of designing hierarchical artificial lighting in mosques.

The respondents to the questions in this research are architects, and the number of individuals among the respondents who have experience in religious activities in these mosques is limited. Nowadays, the most common use of these mosques is for visits. One of the suggestions for future research is to clarify the questionnaire for citizens so that the responses of these two groups can be compared and evaluated.

Table 5: Practical Solutions for Hierarchical Design to Increase the Users' Awareness in a Four-Iwan Mosque (Coefficients above 0.4)

Hierarchy Indicators	Designing	Example in Mosques	Sense of Presence Indicators							
			Sense of Unity	Sense of Time	Equilibrium	Manifestation	Security	Contemplation	Transcendence	Territoriality
Natural Light	Grading and lighting changes and awareness of day changes	Corridor, Lattice Windows of Dome and Altar	*	*	*	*	*	*	*	*
View and Landscape	Movement changes cause vision changes (Sequence)	Corridor Rotation	*	*	*		*		*	
Symbolism	Use a variety of symbols	Dome and Minaret on the Way to the Altar	*	*	*		*	*	*	
Color	Color changes in surfaces	Surfaces of Space	*	*		*	*		*	
Material	Material changes	Bricks and Tiles	*	*	*		*		*	
Artificial Light	Changes in artificial lighting	-	*	*			*			
Decorations	Change decorations and variety in details	Altar decorations more than other Surfaces, Decorations of Iwans and Domes	*	*					*	
Proportions	Change in dimensions on the way to the altar	The Small Hallway (Corridor) to the Large Courtyard and then the Space of the Dome		*	*		*			

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

MORAL APPROVAL

The authors commit to observe all the ethical principles of the publication of the scientific work based on the ethical principles of COPE. In case of any violation of the ethical principles, even after the publication of the article, they give the journal the right to delete the article and follow up on the matter.

PARTICIPATION PERCENTAGE

The authors declare that they have actively participated directly in the stages of conducting the research and writing the article.
The first author contributed 50% (writing the article, collecting and analyzing data, and drawing conclusions).
The second author contributed 30% (writing the article and methodology).
The third author contributed 20% (writing the article and methodology).

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