

Analysis of Spatial Continuity in Historical Mosques based on the Space Syntax Theory; Case Study: Historical Mosques in Borujerd

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ABSTRACT

Mosques have been one of the main elements in the Islamic Iranian community. Various spatial principles have been used in mosques' spatial configuration, among which, spatial continuity is one of the substantial principles. This study investigates the spatial continuity in the historical mosques of Borujerd. The research method is descriptive-analytical by using logical reasoning. The research tool includes library and documentary studies, field observation, and analysis through space syntax software. This study first defines the study's basic concepts, including spatial continuity and its various types (structural continuity, visual continuity, and structural-visual continuity) and space syntax theory and its components (integration, connectivity, choice, and spatial depth) using library and documentary resources. And then determines the relationship between spatial continuity and space syntax theory and its components in the next phase. In the next step, the selected mosques are chosen through field technique and are evaluated and assessed in terms of spatial continuity through space syntax software to find the spatial continuity in the mosques. The study results indicate that mosques' courtyard is the most spatial element that creates spatial continuity in their spatial collection. Moreover, types of spatial continuity and their relevant methods are not completely used in historical mosques of Borujerd, so structural continuity (space continuity) and its techniques are just utilized in Emema Mosque in Borujerd, and visual continuity (transparency) and its techniques are applicable in Mosque and Jame Mosques. Structural-visual continuity is rarely used in Imam and Jame Mosques. It can be stated in terms of spatial continuity assessment through space syntax components that the highest integration, connectivity, and choice rates exist in the Emam Mosque, and the maximum spatial depth belongs to the Qaleh Mosque.

Keywords: Mosque, Spatial Continuity, Space Syntax, Borujerd.

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1. INTRODUCTION

Mosques are among the most fundamental elements of the fabric, structure, and shape of cities. The continuous presence of mosques in the city's shape has been integrated with city life since the advent of the first known cities (Mahvash and Moradpour 2017, 141). Specific attention to spatial configuration is a significant point that has been eliminated in most spaces of the mosques. Investigation of spatial configuration indicators in historical mosques confirms this topic that valuable principles have been used in the design and architecture of historical mosques, which is a key issue, so discovering these principles contributes to clearing up the confusion and knowing the architecture of past times (Varmaghani 2021, 124). Spatial continuity is one of the principles of spatial configuration. A review of the viewpoints of those scholars who studied Iranian-Islamic architecture in terms of spatial qualities would introduce various concepts that all mean spatial continuity despite their conceptual differences (Golestani, Hojat, and Saedvandi 2016). Spatial continuity in a spatial configuration means the connection and link between all spaces, which makes space a positive element only in this way (Dorri and Talischi 2017, 47). In terms of spatiality, mosque is a part of urban open spaces with a mutual interaction with them. The position of the mosque is also interpretable through analysis of spatial configuration and its effects on space activity, flow, and performance (Nizardian 2014, 97). Space syntax theory is one of the most important methods for identifying the form and indicators of spatial

configuration that was introduced by Professor Bill Hillier and Julienne Hanson in early 1980s. The space syntax theory refers to the relation between various spaces, and or interaction between spaces (Bahraiy and Taghabon 2011, 6). Borujerd can be named one of the important historical cities of Iran due to its precious historic fabric, the area about 270 hectares, and architectural elements, such as Jame Mosque with more than 1000-years history (Chegeni, Didehban, and Hessari 2021). However, few studies have been done on the identification of architectural elements, especially the mosques of this city. Thus, this study aims to assess the spatial continuity of four samples of historical mosques in Borujerd based on space syntax theory by examining these mosques. Accordingly, the research questions are as follows:

- How can one analyze the spatial continuity in the historical mosques of Borujerd based on the space syntax theory?
- What are the specifications of spatial continuity types in the historical mosques of Borujerd?

2. BACKGROUND

There are few studies and backgrounds in the field of identifying the historical mosques of Borujerd. The available studies on the identification of historical mosques in Borujerd have mainly introduced these mosques superficially. The studies conducted on historical mosques and the investigation of their spatial configuration are reviewed herein (Table 1).

Table 1. Studies conducted on the Physical-Spatial Identification of Mosques

Row	Authors	Title	Method	Result
1	Nemati & Shahlacai (2015)	Analytic Study of Mosque Architecture In "Shabistani" And "Fouriwan" Patterns (Case Study: The Great Mosque of Isfahan)	Descriptive-Analytical and Space Syntax Software	The four-porch pattern has improved the quality of the plan in terms of spatial cohesion, function, and visual aspects compared to the Shabestan (underground space of the mosque) pattern.
2	Soltanifard & Seyedmoradi (2015)	Transformation of the Grand Mosque Position in the Islamic City Spatial Configuration-Case study: the Grand Mosque of Sabzevar City	Quantitative (Space Syntax Software)	Mosques had more transparency and legibility in the historical period rather than present, and the interactive role of mosques has been highly reduced these days.
3	Bemanian, Jelvani and Arjmandi (2016)	Spatial Configuration and the Islamic Philosophy in Isfahan Madrassah-Mosques	Field Observation and Simulation through Software	The obtained results showed the direct impact and determinant role of Islamic philosophy in the situation of all spaces of Isfahan school mosques and determining the role between spaces and the whole building of mosques.
4	Heidari, Peyvastehgar and Kiaee (2017)	The role of the yard in the spatial configuration of mosques to improve operational efficiency using spatial layout	Using Space Syntax Software	The presence of a central courtyard with rectangular geometry at the center of mosques creates the highest operational efficiency for mosques.
5	Golestani, Hojat and Saedvandi (2017)	A survey on spatial integration and the process of evolution in the Iranian mosque	Descriptive-Analytical and Software	The selected samples from various periods are examined in terms of spatial integration and continuity.

Row	Authors	Title	Method	Result
6	Mirsalami, Omranipour and Khoshbakht Bahramani (2019)	Study of spatial-social relations in the pattern of Four-Iwan Mosques in Iran	Descriptive-Analytical and Space Syntax Software	Physical divisions and structure in the mosque have a direct relationship with the expansion or limitation of spatial relations, and the layout of the courtyard's elements would increase spatial classification.
7	Mahdi Nejad, Azemati and Sadeghi Habib Abad (2020)	Investigating the Structure of Traditional, Contemporary, and Post-Islamic Revolution Mosques via the Method of Space Syntax	Space Syntax Strategy	This study examines the specifications of selected mosques using three variables of space syntax (integration, connectivity, and depth).
8	Emad et al. (2021)	Recognition of the Principles of Spatial Hierarchy in Traditional Mosques of Iran and its Analysis by Space Syntax Method (Case study: Mosques of Shiraz)	Descriptive Analytical and Space Syntax Software	Analysis of mosques indicates that those spaces with more use, such as Shabestan have desired access, and mosques have connected neighborhoods.
9	Falakian, Sadeghi and Kazemi	The Morphology of Semantic Architecture Using the Method of Space Syntax Case study: (Ali Mosque of Isfahan)	Quantitative (Space Syntax Software)	Research results show that spatial elements of the courtyard provide more transparency visual continuity, and integration rather than other spaces.

The studies conducted on the analysis of mosques based on the space syntax theory have mainly considered the physical and spatial analysis (in a limited way) of mosques' spaces, and few of them have identified those spatial principles leading to spatial utility in the mosques. Also, few studies have been done on the historical fabric of Borujerd despite the old history of Borujerd City and architectural elements such as Jame Mosque with more than 1000 years of background. Thus, researchers of this study aim to identify the spatial continuity principle, which is a criterion indicating spatial utility in the mosques in the unknown fabric and texture of Borujerd by using space syntax strategy and logical reasoning.

3. METHOD

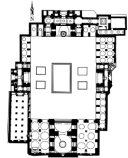


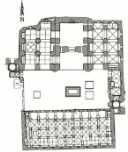


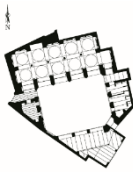


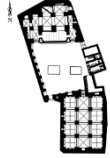


The mixed method is used in this study. The mixed method is a combination of descriptive-analytical and logical reasoning methods. Library resources, direct observation, and space syntax strategy are tools used in this research. The study is conducted in two phases. In the first phase, authentic library and documentary references are reviewed to extract the first category of theoretical foundations, including principles and rules of spatial continuity, which are visual continuity, structural continuity and structural-visual continuity, and space syntax theory and its components (integration, connectivity, depth, and choice). Further, therefore, four samples of historical mosques located in the old fabric of Borujerd City were chosen based on observation and field studies. These mosques were selected due to their location in the historical fabric of Borujerd, the monument's old history, the building's standing status, accessibility to the building, and more importantly registration of the

building in the Cultural Heritage Organization. In the second phase, a comparison is done between plans of selected mosques in terms of their spatial continuity rules, and then the plan of mosques is analyzed through space syntax software, and obtained results are expressed.

4. RESEARCH PLATFORM AND INTRODUCTION TO SELECTED CASE STUDIES

Borujerd City with a cold and mountainous climate is one of the cities of Lorestan Province located at 1560m above sea level. The population of the city equals 334000 people. According to historical texts, Borujerd was politically and socially important until the late Seljuk era. The last years of the Seljuk era were the peaks of this city's development, which is confirmed by referring to some historical books, including *The Complete History Book* by Ibn al-Athir, *Rahat al-sudor* by Rawandi, *Zobdeh Al-Nasr* by Emad Al-din Kateb Isfahan, etc. (Hessari, Zandieh, and Chegeni 2021). Prince Mohammad Taghi Mirza Hesam Al-Saltaneh was the governor of Khuzestan, Lorestan, and Borujerd during the governance of Fathali Shah Qajar. This prince has chosen Borujerd as the capital of the country (Moradi, Parizadi, and Moradi 2018). Four historical mosques located in the old fabric of Borujerd City were then selected as case studies. These mosques were selected due to their location in the historical fabric of Borujerd, the monument's old history, the building's standing status, accessibility to the building, and more importantly registration of the building in the Cultural Heritage Organization (Table 2).

Table 2. Introduction to Case Studies

Row	Mosque's Name	Mosque's Plan	Mosque's Façade	Photos	Spatial Elements of the Mosque	Explanations
1	Imam (Soltani)				Dome ✓ Shabetsan ✓ Courtyard ✓ Service Space of the Mosque ✓	Spatial Organization: Central History: Safavid Area: 7000m ²
2	Jame				Dome ✓ Shabetsan ✓ Courtyard ✓ Service Space of the Mosque ✓	Spatial Organization: Linear History: Before Islam Area: 2500m ²
3	Rangineh				Dome - Shabetsan ✓ Courtyard ✓ Service Space of the Mosque ✓	Spatial Organization: Central History: Zand Dynasty Area: 700m ²
4	Qaleh				Dome - Shabetsan ✓ Courtyard ✓ Service Space of the Mosque -	Spatial Organization: Linear History: Late Zand Dynasty Area: 850m ²

5. THEORETICAL FOUNDATIONS

The concept of spatial continuity and its types are introduced and space syntax theory and its components are identified and explained to analyze the spatial continuity in the historical mosques of Borujerd city based on the space syntax theory.

5.1. Spatial Continuity

The concept of space has been always a substantial variable in architecture studies conducted in Iran. Unlike classic European architecture in which, the body is the key element, space is the key theme in Iranian architecture. Space is the key element while body is considered a restrictive variable in Iranian-Islamic architecture. Although Iranian-Islamic architectural space is multifaceted and many believe in its complexity and fundamental conflicts, its accurate identification is based on some indicators and specifications (Falihat and Shahidi 2015, 28). However, viewpoints on space in religious architecture reveal that Iranian-Islamic scholars avoid unilateral attention to the space of religious architecture and its

indicators, and always emphasize on the simultaneous role and presence of spectator in the architectural space in religious places (Soleymanzadeh, Habib, and Etesam 2019). Spatial continuity is one of the most significant indicators of religious spaces. Nader Ardalan introduces spatial continuity as one of the important concepts for perceiving the historical architecture of Iran believing that spatial continuity should direct the creation of forms (Ardalan 1973, 47). The principle of space continuity in an urban space is considered one of the spatial suitability criteria. Therefore, spatial continuity can be understood by human minds and consciousness. In general, spatial continuity is created in the building in two ways. The first way is done physically. In this case, some in-between or intermediary spaces are created between two scopes, or spatial continuity is achieved by elongating natural or artificial elements. The second case is mental in which, spatial continuity is created by creating transparency and unobstructed view by considering similar activities (Bonyani et al., 2018). Three types of spatial continuity are explained in Table 3.

Table 3. Types of Spatial Continuity

Row	Title	Definition
1	Visual Continuity (Space Transparency)	This continuity would expand the visual connection of spaces by eliminating walls through lightweight construction.
2	Structural Continuity (Space Continuity)	This continuity is obtained through articulations and passages preventing from dealing with space disconnection.
3	Structural-Visual Continuity (Space Opening)	This continuity is obtained through wall retraction and the formation of a new space around a central core on one hand and integrating and overlapping two spaces on the other hand.

(Golestani, Hojat, and Saedvandi 2016)

5.2. Space Syntax Theory

Space syntax is a collection of methods and theories that studies spatial structure at the architectural and urban scale to find the mutual effect of space configuration structure, social organization, and social behaviors (Hamedani Golshan, Motallebi, and Behzadfar, 2020). Depth Map is the most important tool used for analyzing spatial structure based on the space syntax method. This software was prepared by Turner and colleagues in the London Academy of Sciences, allowing authors to analyze space at all micro and macro scales with higher accuracy and more indicators (Turner and Pinedo 2010, 16). The most significant components of space syntax technique are explained herein for analyzing spatial configuration.

Integration: integration of each space with a spatial complex indicates the continuity rate of that space or separation of that space from other spaces available in that spatial complex. A space has an acceptable integration and continuity that is more integrated with other spaces (Hillier, Hanson, and Peponis 1984).

Connectivity: connectivity of spaces means the number of connections between each space and other spaces available in that structure. It means that connectivity between spaces means more usability of considered space, desired spatial circulation, and higher functional efficiency (Hillier 2007, 202).

There is a linear relationship between integration and connectivity. It means that the number of connections

between spaces would increase the integration and continuity of space. These two factors (integration and connectivity) can be used to measure the spatial integrity rate in the spaces of a spatial complex (Oswald 2011, 739).

Spatial depth: the component of spatial depth has a reverse relation with space continuity. The spatial depth in a spatial complex can be evaluated through the concept of observable space. The observable space or any level that can be viewed from each point is a part of space syntax theory that measures the users' view in the space and is a substantial tool helps to find how individuals perceive and act in a spatial complex (Beatrix Emo 2015, 4). The higher the component of spatial depth in a general environment, the fewer the indicators of environment quality, accessibility, and attendance in that place will be (Hessari and Chegeni 2021, 53).

Choice: this component has a direct relation with spatial continuity. If there is a greater number of choices of a space in a spatial complex, that space will be converted to a distributive space. It means that spatial circulation will be increased, and the link between spaces and subsequently the spatial continuity will be increased when spaces are arranged around a central space (Jun and John 1998, 153).

According to the mentioned explanations, the relation between components of space syntax and spatial continuity concepts is expressed in brief (Fig. 1).

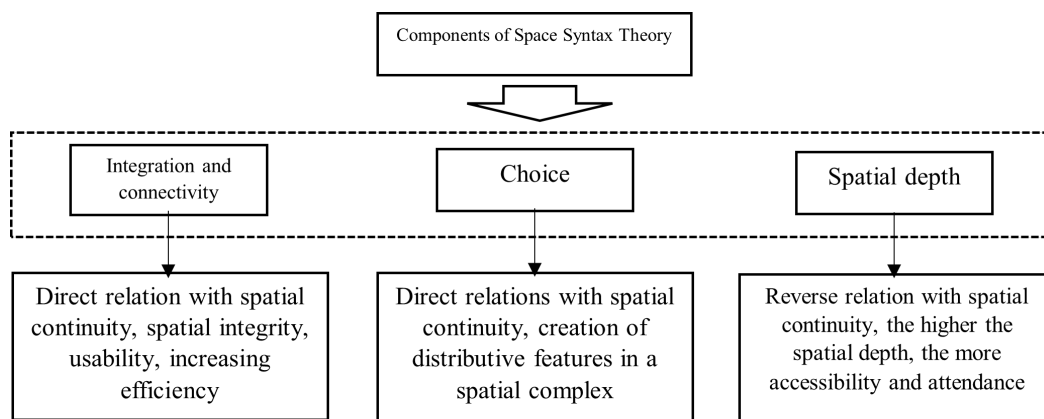


Fig. 1. The Relation between Components of Space Syntax and Spatial Continuity

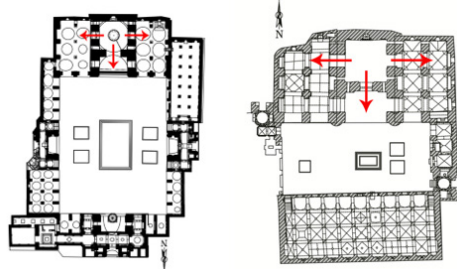
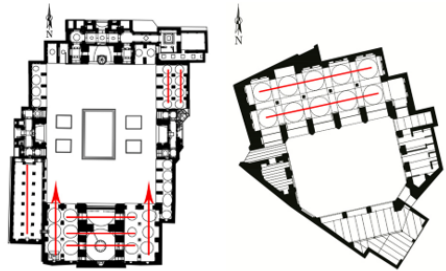
6. ANALYSIS AND INTERPRETATION

After expressing the literature review and finding the studied area and case studies, the spatial patterns of the selected mosques are compared with the concepts of spatial continuity in this section. The second section quantifies the concepts related to spatial continuity through Space Syntax Software, assesses the selected mosques' spatial organization, and then expresses their specifications. In this step, the types of spatial continuity and techniques of each type are firstly expressed, and then are compared with selected case studies.

Visual continuity (transparency): this type of spatial continuity looks for transparency. Transparency literary means expressing the physical quality of materials, and its academic meanings indicates the

quality of spatial organization (Kunnawar 2010, 3). In other words, the literal meaning of transparency refers to the quality of materials through which light transmits, and its practical meaning describes the perceptual perception that allows the mind to distinguish various spatial concepts (Ascher 2003, 3). This type of spatial continuity results in visual expansion of walls and is done through the elimination of walls based on lightweight construction, which is done in two ways: removal of in-between space between some and Shabestan and expanding the Shabestan nave using arch and a lintel (Hojat, Golestani, and Saedvandi 2015). Table 4 indicates this type of spatial continuity and its relevant technique in the historical mosques of Borujerd.

Table 4. Visual Continuity (Transparency) in Historical Mosques of Borujerd

Type of Spatial Continuity	Images	Explanations
Removal of in-between Space between Dome and Shabestan		This type of spatial continuity only occurs in mosques that have domes. In this type, the classic framework of the dome is kept and it is tried to create more expansion in the surrounding fronts. This type of spatial continuity has been only created in Emam and Jame mosques.
Expanded Opening of Shabestan by using an Arch and a Lintel		Expanding Shabestan's opening, by using an arch and a lintel in mosques is achieved based on the creative perception of lateral forces and scientific progress. This important case appeared in almost all mosques for spatial opening and better perception of the surrounding environment by the audience.

Structural continuity (space continuity): when human perceives various distinctive spaces and consider them as continuous spaces through a route, it can be stated that space continuity exists in that spatial complex. In such space, audience movement is done smoothly without interruption inside the spaces (Golestani 2107, 59). Demarcation of spaces is soft and gradual not hard and immediate in Iranian architecture. Therefore, individuals never face space disconnection (Tabibian, Charbgoon, and Abdolahimehr 2012). Structural continuity or space continuity looks for gradual and continuous conversion of a space to another one and lack of facing space disconnection using articulations and passages. This type of spatial continuity results in connection and integration between various elements of the mosque (Saremi, Khodabakhshi, and Khalaghdoost 2015). This kind of spatial continuity is obtained through three techniques:

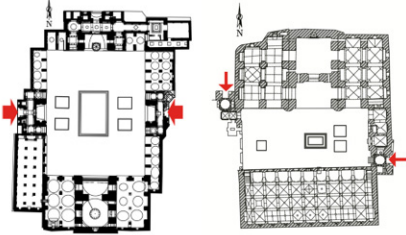
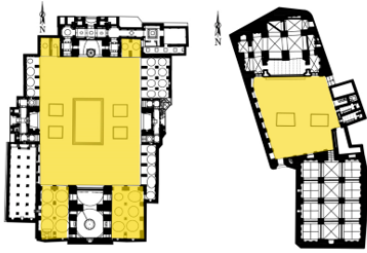
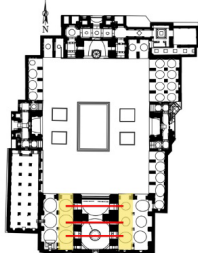
City and mosque coexistence: entrance into the mosque's building is done through hierarchy, which is called the entrance system. The entrance system includes a collection of consecutive articulations. This entrance system is applied when a more spatial distance between the space of the mosque and other buildings is considered.

Courtyard and Shabestan coexistence: this technique of spatial continuity is shaped through surrounding porches and stoops that connect the open space of the courtyard to the open space of Shabestan.

Dome and side Shabestan coexistence: this technique of spatial continuity is obtained through a corridor. Instead of thick walls that separate two adjacent spaces, a spatial space in the form of a corridor links two spaces smoothly. In the space of a corridor, the space is separated from the outside and connected to the inside (Golestani, Hojat, and Saedvandi 2016).

Table 5 indicates 5 types of structural continuity and their relevant techniques in the historical mosques of Borujerd.


Table 5. Structural Continuity (Space Continuity) in Historical Mosques of Borujerd

Type of Spatial Continuity	Images	Explanations
Creating Coexistence between the Space of the Mosque and the City		This type of spatial continuity is obtained by defining the entrance system in the mosques that have Shabestan and dome. The definition of entrance systems creates coordination between the building of the mosque and surrounding buildings. The entrance system has been defined only in the historical mosques of Emama and Jame.
Coexistence between the Courtyard and Shabestan		Coexistence between the courtyard and Shabestan is obtained through the porch and stoops. This type of spatial continuity in the mosques is seen in the connection of open space to closed space through semi-open space. As seen, this type of spatial continuity does not exist in all historical mosques. For instance, coexistence between the courtyard and Shabestam has appeared in Emam Mosque but this type of spatial continuity is not created in Qaleh Mosque due to the lack of porches and stoops.
Coexistence between Domes and Side Shabestan		This type of spatial continuity is created through corridors in the mosques. Corridor or communication routes play the role of articulation in this type of spatial continuity. This technique of spatial continuity is seen only in the Emam Mosque of Borujerd.

Visual-structural continuity (space expansion): this type of spatial continuity means the formation of a new space around a central core by retracting walls and expanding the space geometrically (Golestani, Hojat, and Saedvandi 2016). Visual-structural continuity in the spatial organization of mosques is created through two forms opening the space of the courtyard and expanding the space of the dome.

Expansion of courtyard space occurs by adding a balcony or semi-floor and opening of dome space plan is done to cover other spaces and diminish the spatial borders (Hojat, Golestani, and Saedvandi 2015). Table 6 reports six types of visual-structural continuity and their relevant techniques in the historical mosques of Borujerd.

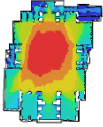
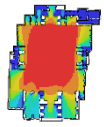
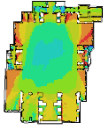


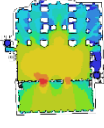
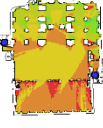

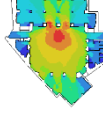
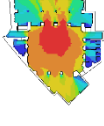


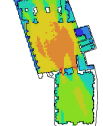
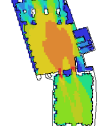


Table 6. Structural-Visual Continuity in Historical Mosques of Borujerd

Type of Spatial Continuity	Images	Explanations
Opening the Space of the Courtyard		This type of structural-visual continuity appears in mosques that have porches or spatial elements of balconies. This technique of structural-visual continuity is observed in the Emam and Jame Mosques of Borujerd.
Opening the Space of the Dome	-	This type of visual-structural continuity looks for spatial expansion of the dome's plan. This technique is not seen in the historical mosques of Borujerd.

After comparing the spatial continuity patterns of the historical mosques of Borujerd in the second phase of the study, the selected case studies are assessed and evaluated through Space Syntax Software. This study

has been done based on the Visibility Graph Analysis (VGA) through Space Syntax Software. The mean value of the space syntax method has been considered for more accurate measurement (Table 7).

Table 7. Assessment of Spatial Continuity based on Space Syntax Technique in Historical Mosques of Borujerd

Name of Mosque	Integration	Connectivity	Choice	Spatial Depth
Emam				
Jame				
Rangineh				
Qaleh				

Space syntax theory models and analyzes the arrangement of spaces next to each other and their impacts on the activities and displacement of individuals based on the syntax technique and showing

connected graphs (Table 8) (Molazadeh, Baranipiesian, and Khosrowzadeh 2013). After analyzing the graph of variables for selected buildings, they are analyzed quantitatively (Table 8).

Table 8. Quantitative Analysis of Space Syntax Variables in Historical Mosques of Borujerd

Name of Mosque	Integration	Connectivity	Choice	Spatial Depth
Emam	2.11	3059	1.78	1.60
Jame	1.58	2570	1.23	1.77
Rangineh	1.98	2800	1.57	1.58
Qaleh	1.16	974	1.09	2.01

6.1. Spatial Integration

Spatial integration indicates the rate of spatial continuity of spaces in a spatial complex. The turning point of spatial continuity in mosques having central organization and four porches is the courtyard of these mosques. Regarding the direct relation between the integration component and the spatial continuity

concept, it is concluded that spatial continuity is more in the mosques with central patterns. This topic is completely clear in research analyses. Spatial continuity in Emam and Rangineh mosques is highly different from the two mosques of Jame and Qaleh. Fig. 2 depicts the rate of spatial continuity in spaces of historical mosques in Borujerd.

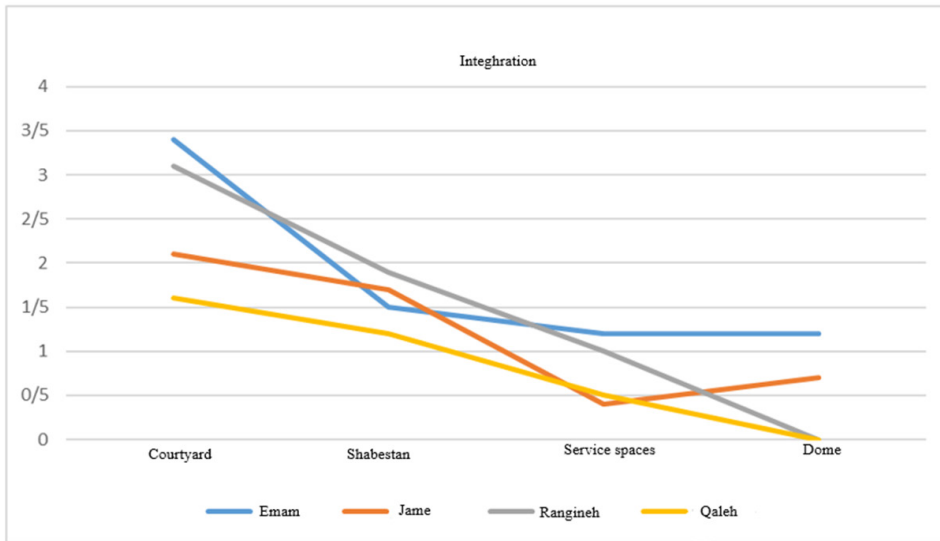


Fig. 2. Examining Spatial Integration in the Spaces of Historical Mosques of Borujerd

The highest rate of spatial continuity in mosques is seen in their courtyard space, and the lowest rate of spatial continuity occurs in dome space. Moreover, it can be stated based on the function of the spatial integration component that space usability and functional efficiency of space are greater in mosques with central patterns. This means that there is better access to the main and subspaces through the courtyards in mosques with a central organization rather than the mosques without a central organization.

6.2. Connectivity

The component of connectivity is directly related to the spatial continuity concept. This component indicates more usability and desired spatial circulation

in a spatial complex. Regarding the analysis of connectivity in the historical mosques of Borujerd, the rate of these components is greater in the Emam and Rangineh mosques than Qaleh and Jame mosques. Therefore, there is more desired spatial circulation in mosques with central patterns compared to other types of mosques. The presence of a central courtyard in the mosques with central organization results in easy access to the main and subspaces and dome. The higher connectivity rate is seen in the space of the central courtyard of mosques and the lowest rate of connectivity occurs in the space of the dome. This point indicates that courtyard space plays the most important role in the spatial continuity of a spatial complex (Fig. 3).

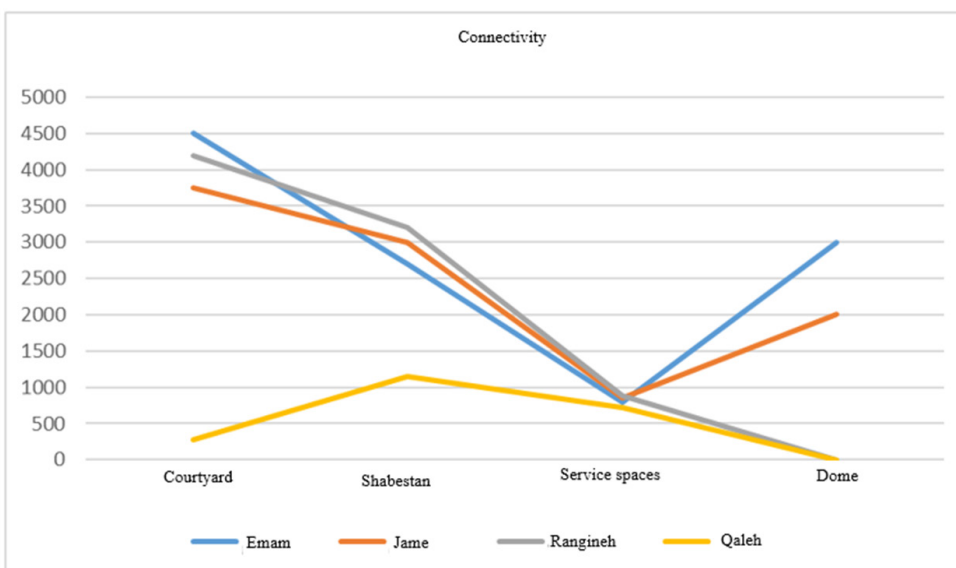


Fig. 3. Examining Spatial Connectivity in the Spaces of Historical Mosques of Borujerd

6.3. Choice

Choice is a dynamic component that is used to measure the flow rate of a space. The higher the choice rate of a spatial complex, the more the distribution rate of it in the urban fabric and the higher the spatial continuity in the urban fabric (Volchenkov and Blanchard 2007, 8). According to analyses, Emam Mosque has the highest

choice rate among selected cases. Also, the highest choice rate of spatial elements is seen in Shabestan of mosques. This indicates that Shabestan plays a significant role in spatial distribution and spatial flow that provides an easier way to find routes in the spatial complex of the mosque (Fig. 4).

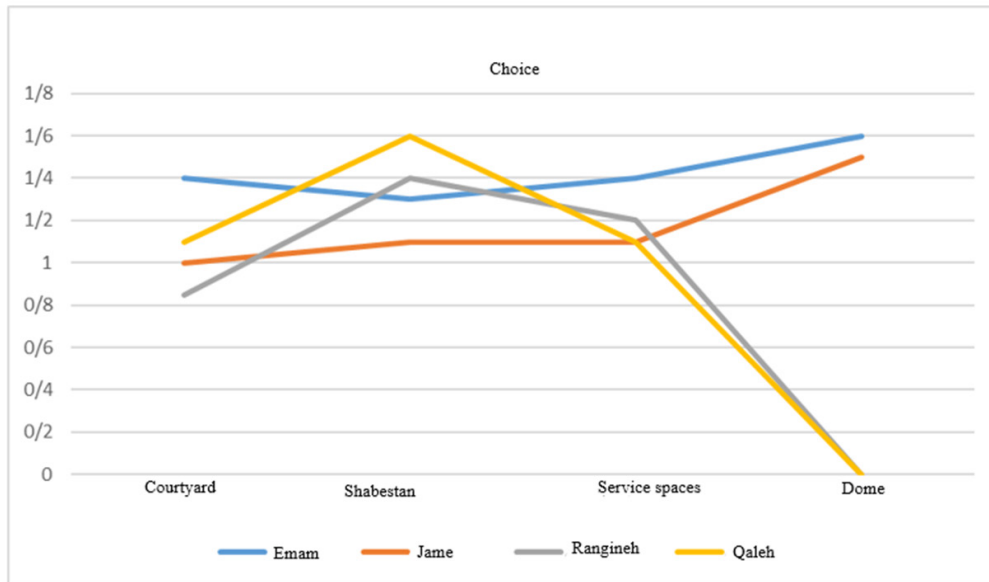


Fig. 4. Examining Choice in the Spaces of Historical Mosques of Borujerd

6.4. Spatial Depth

The index of depth in historical mosques has been considered from the entrance gate of these mosques. The results obtained from spatial depth assessment in historical mosques of Borujerd indicate that Qaleh and Jame mosques have the highest spatial depth, and Rangineh Mosque has the lowest spatial depth rate. This case is interpreted in this way the location of the mosque's courtyard and its impact on the spatial hierarchy is the reason resulting in this case. Therefore, access to Shabestan and service spaces and dome passes through the courtyards in the mosques have a central organization that has less spatial depth compared to mosques with linear organization. There

is a reverse relation between spatial depth and spatial continuity. However, the higher the spatial depth in a spatial complex, the less the accessibility and attendance indicators will be in that space reducing spatial continuity. Therefore, it can be explained that the location of spaces relative to distributive space (in the courtyard of mosques) is the most important factor used in assessing spatial depth. Among the main spaces of mosques, service space has the highest spatial depth because these spaces are located in the complex of mosques, and the lowest spatial depth rate is seen in dome space because this space is located in the entrance space of the mosque (Fig. 5).

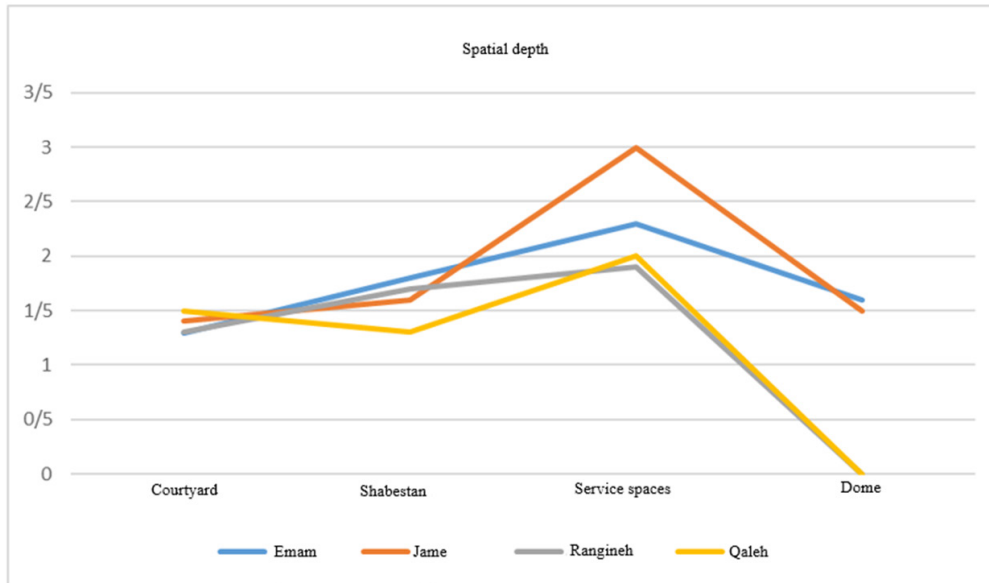


Fig. 5. Examining Spatial Depth in the Spaces of Historical Mosques of Borujerd

7. CONCLUSION

Identification, application, and extraction of initial and precious architectural patterns of historical mosques are of valuable origins to achieve recommendations and principles for understanding the architecture of mosques. The principle of spatial continuity is one of the most important principles used in the architecture of historical mosques. In space continuity, borders become flexible, the space is perceived as a fluid concept, and human achieves ownership of this unmeasurable, intangible, and meanwhile, the absolute space as far as human abilities and imaginations allow them. In the case of Iran's architecture, this important case means that continuous navigation of space has been facilitated based on the concept of spatial continuity for the space perceiver. Iranian architecture mixes various scales from the city to small spatial units inside the building through hierarchical planning of diverse and connected spaces in the entrance system, and this feature prevents the audience from facing spatial disconnection and integration of urban and architectural spaces. In a few

studies conducted on the concept of spatial continuity, researchers have explained only the types of spatial continuity in selected case studies without using data quantification. However, the extant study analyzed this important case on all historical mosques of Borujerd City, by using the components of space syntax theory, including integration, connectivity, choice, and spatial depth in addition to the types of spatial continuity. Before expressing the concepts related to types of spatial continuity in the historical mosques of Borujerd, it should be explained that courtyard space is the most important spatial element in the spatial organization of a mosque that plays a significant role in spatial continuity. In addition to interaction with other spaces in the function of mosques, the courtyard has served as a space for gathering together and also a distributive space in the spatial organization of mosques leading to unity of spatial organization of mosques and spatial continuity in the mosques particularly those with central organization pattern. Table 9 reports the most important features related to the concept of spatial continuity in the historical mosques of Borujerd.

Table 9. Features related to the Concept of Spatial Continuity in Historical Mosques of Borujerd

Row	Types of Spatial Continuity	Explanations	Mosque's Name
1	Visual Continuity (Transparency)	Removal of the in-between space between the dome and Shabestan: this type of spatial continuity is used in domed mosques. Visual continuity leads to expansion in the fronts around the dome space. Increasing the opening of Shabestan based on structure techniques: this type of spatial continuity is done using arch and stoop. This type of continuity is done to expand the surrounding space and a better understanding of space by the person.	Emam and Jame Emam, Jame, and Rangineh

Row	Types of Spatial Continuity	Explanations	Mosque's Name
2	Structural Continuity (Continuation)	Coexistence between the space of mosque and city: this type of spatial continuity is realized by defining an entrance system in the early space of mosques, which adjusts the hierarchy in the mosque.	Emam and Jame
		Coexistence between Shabestan and courtyard: it is created by some semi-open spaces such as porches and niches in the mosques.	Emam
		Coexistence between Come and Shabestan: it is created by the corridor around the Shabestan and dome in mosques.	Emam
3	Visual-Structural Continuity	Expansion of courtyard space in mosques: this type of spatial continuity is achieved through the balcony element in the porched mosques.	Emam and Jame
		Expansion of dome space: this type of continuity tends to expand the space of the dome.	-
Component of space syntax method matched with spatial continuity concept in the mosque			
4	Integration	This variable has a direct relation with the concept of spatial continuity and assessment of this variable determines the spatial integrity and usability of space. The turning point of spatial integrity in the mosques is seen in the mosques with the central organization of their courtyards. The space of the dome in the mosques has the lowest rate of spatial integrity so has the least impact on spatial continuity.	The Highest Rate of Integration Rate: Emam and Rangineh Mosques
5	Connectivity	This variable has a direct relation with spatial continuity. Assessment of this component determines the desired spatial circulation in the mosques resulting in a suitable relation between spaces in the mosques and suitable access to spaces in the mosques that indicates spatial continuity in the mosques. The highest rate of connectivity belongs to the courtyard space while the lowest rate is related to the dome.	The Highest Assessment Rate of Connectivity: Emam and Rangineh Mosques
6	Choice	This variable has a direct relation with the concept of spatial continuity and indicates discreputability in the spatial complex of the mosque. The highest and lowest rate of choice is seen in Shabestan and Dome, respectively.	The Highest Assessment Rate of Choice: Emam
7	Spatial Depth	This variable has a reverse relation with the concept of spatial continuity. The more the spatial depth in the mosques, the lower the attendance and accessibility in the spatial complex of the mosque. This component interprets the location of spaces relative to the distributor space. The highest and lowest rates of spatial depth are seen in service spaces and domes, respectively.	The Highest Rate of Spatial Depth: Qaleh

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CONFLICT OF INTEREST

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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 state that they have directly participated in the stages of conducting research and writing the article.

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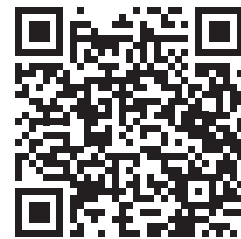
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