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Assessing the Urban Structure Cohesion based on Principles of Integration with Space Syntax Technique: A Case Study of Central Area of Mashhad

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ABSTRACT

In evaluating the spatial structure of cities, in addition to identifying physical functional elements, how these relate in a coherent set is also essential, because the urban structure is the product of continuous formation, the most important feature of which is the interaction between physical and spatial aspects. One of the main problems of urban structure in modern urban development is a devaluation of public places, destruction of the space organization, losing special identity, and disconnecting different parts of the city. These rapid changes in Mashhad have weakened the connection of the holy shrine of Imam Reza as the most important element of the spatial organization of Mashhad with the surrounding tissue and have made it lose its cohesive nature. In addition, the continuation of the process of destruction of the old and valuable parts, especially in the joint area of the holy shrine with its adjacent texture, destroys structural cohesion and integration. Whereas the integration of an urban space shows degrees of its cohesion with the whole city, it is necessary to try to recreate the integration indicators in this context. Integration is one of the main concepts related to space composition, which has been developed based on Space Syntax. Therefore, this study seeks to analyze the integration of the joint area surrounding the holy shrine in the central area of Mashhad and to find the separate areas in terms of cohesion and integration, the Space Syntax technique has been used by DepthMap software version 10.

Keywords: *Integration, Cohesion, Urban Structure, Space Syntax Technique*

1. Introduction

Urban context cohesion in terms of maintaining coherence and connection between different parts of a city has long been one of the main topics discussed by urban planners that in today's urban development process and unplanned interventions in recent times have undergone major changes in concept and structure. In addition to promoting incorrect patterns of urban planning and modernist architecture, the unbridled growth and development of cities have also led to congestion, the loss of individual control over the environment, and distorted spatial planning [5]. Also, in the process of physical development in many cities with historical records, such problems as inability to adapt to physical changes and environmental stability [24], lack of proper connection with the existing network structure [21], changes in the transformation of spaces together [12], the loss of spatial coherence and value [32] etc., have affected such important urban nuclei. In addition, to understand the organization and spatial structure of the city, alongside examining its physical and functional elements, the relationship of these elements in a coherent physical-spatial set is also considered. However, the old part of the city is the product of a continuous formation that has taken place over several centuries, due to many factors [7].

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The physical-spatial cohesion of Iran's old cities is based on the connection between the city center and neighborhood centers, through a series of spaces and elements connecting the main passages and squares [31]. Cohesion in the structure of the city means a continuous combination of urban spaces that have been manifested in different ways in the historical cities of the world [25]. The structure of old cities in Iran is based on the same link between the city center and the centers of the connected neighborhoods, established through a series of spaces and elements connecting the main passages and squares.

In general, the coherence of the structure of old cities of Iran is based on the connection between the city center and neighborhood centers, based on a series of spaces and connecting elements of main passages and squares[31], which form the whole structure of the city. The city of Mashhad is also one of the historical cities in Iran, which due to the location of the shrine of Imam Reza in its central area it has special features that have always undergone various changes, and in each historical period in a special spatial form, such as the concept of Bala-Khiaban and Paeen-Khiaban streets of Safavid era, due to the streets leftover from the Pahlavi era and the developments of urban regeneration cycle and modern renovations, such cases have disappeared in contemporary urban contexts, especially in the areas around the holy shrine, and the meaning of hierarchy does not exist there anymore. The result of rapid physical and spatial changes in this city has weakened the relationship between the shrine of Imam Reza as the most important element of the city's spatial organization with the surrounding tissue. The main purpose of this article is investigating the cohesion of the texture of contemporary cities, especially the unhealthy condition of the texture around the shrine of Imam Reza in the central area of Mashhad. The process of destruction of valuable urban spaces of the past, especially the connection of the shrine with its adjacent texture, taken from the connection between urban elements such as Bazar-e AbbasQoliKhan, Bazar-e Farsh, Gozar-e Sar-Shour, has destroyed the spatial-physical connection, and the hierarchy between spaces and identity. The purpose of this article is to analyze the correlation between the joint structure of Imam Reza Shrine and its surrounding texture in the central area of Mashhad with a qualitative and interpretive view, which has been used to achieve the goals of spatial arrangement technique by Depthmap software.

2. Literature Review

2.1 The Concept of Cohesion and Connection in the Structure of the City

The central and historical context is considered as one of the most important parts of the identity of any society and its emergence follows obedience to climatic, cultural, social, physical, and structural structures[11]. On the one hand, the ossification of old cities is known as the most obvious and complex part of the physical system[17] and on the other hand, it represents the social structures of the city along with its internal contradictions[22]. Among the most important criteria for valuing this type of urban texture are antiquity, unity[3], originality in architectural form, social dynamics[2], innovation of patterns[13], historical values[15], collective memories[20], connection with nature[8] and connection with the context[6], which results in the dynamics in the design of this structure, logical relationships between components and urban systems and their function and process together[15]. Usually, in the central context, the roads in the role of the backbone of the city start from the market when they reach the neighborhoods[31], and following the function of residential spaces, they have multiple branches while providing access and communication between city components, and neighborhoods form an integrated whole in the citY[29]. All of the above factors together can lead to integration and harmony in space[14], which is a context that leads to the functioning of the entire urban system[28]. In general, the physical-spatial structure of the city means how the elements are formed, evolved and located in different parts of the city and how is their relationship with each other. The urban geographical and physical modes form the spatial structure of a city in a coherent and integrated context, in relation with each other.

Spatial coherence is introduced as a set of connections resulting from urban form, crowds, transportation, and the flow of goods and information[27]. The coherence of the city structure is a combination of two components: 1. spatial distribution of population and 2. the pattern of people traveling from their residence to different destinations and places where an important social activity or interaction takes place[7]. The coherence of the central structure of the city shows the order and relationship between physical elements and uses in the city[9]. To integrate the spatial structure and to connect and integrate urban spaces[30], movement systems can be used as the organizing forces to space; in this case, the spatial order can lead to social order in the city as a whole[19]. Thus, it can be said that the organizing

forces and the spatial structure of a city are in a two-way or integrated relationship[18]. The term cohesion is defined in different theories from different angles and dimensions. In one study, Alberti sees harmony as the juxtaposition of different components of nature to achieve a whole, which is a kind of definition of coherence. In another definition, it is observed that proportionality is a factor related to coherence[26]. The ancient Greeks believed that if something went out of proportion, its coherence would be destroyed[4]. A point that can be relied on among different theories in this regard is that the concept of cohesion is related to the issue of unity and integrity. Life from the whole is derived from the cohesion within the whole, and cohesion is a whole that determines its character[1]. Therefore, it can be said that the physical connection of elements of multiple urban spaces in a coherent network can lead to integration in the city or its neighborhoods[23].

Table 1. Indicators of the Cohesion of the City Structure with an Integration View (Source: Authors)

Component	Criterion	Sources	Indicator
Merge		(Hall and Tewdwr-Jones 2011)	Existence of geometric fusion of mass and space from the smallest to the largest components of the texture
Readability	Spatial Integration	(Olson 2008)	Existence of proper connection between the texture components in the formation of macro-compounds through interface spaces
Centrality	Spatial Connection	(Smith 2011)	The connection between the main spaces in order to create the structure of the texture and the center
		(Rodrigue, et al. 2009)	The function of the components as part of a living and complex whole
Hierarchy	Spatial	(Ana Júlia , et al. 2010)	Existence of physical order in various scales
	Physical		Having a distinct geometric center, confinement and asymmetric macro compositions
	Functional		Existence of access orders in different scales
Variety	Physical diversity	(BeigZade Shahraki 2013)	Existence of continuous domains of activity, the existence of adjacent, diverse and dissimilar functional centers
Integrity		(Bahrainy and Foroughifar 2017)	Existence of a network structure of centers andthe existence of ossification connecting public spaces
			Existence of the main structure for which other structures are function and it serves as the main focus of static space in the middle
			Boundaries are both limiting and connecting
Order	Rhythm	(Falamaki 2006)	High readability of the texture, use of simple original shapes
			Existence of continuous activity domains and defined pedestrian orders
	Order in signs	(Alexander 2002)	Existence of physical order in the passing and pedestrian zones, in different scales
Unity	Flexibility	(Bertaud 2001)	Existence of coordinated multiplicity in the physical components of the street that affects the routing
	Intermittent repetition	(Ardalan and Bakhtiar 2017)	Existence of functional order in different scales
			Existence of a network of spaces and movement paths
Connectivity		(Hillier, 2005)	Existence of individuality, legibility and transformability
		(Hillier, 1996)	The edges change slowly and delicately in a spectrum

2.2 The Concept of Integration in the Urban Structure

Based on the concepts mentioned in the previous concept, the integration and coherence of the city structure is a concept defined as unity [3], harmony [1], coherence[16]&[17], connection[22] and continuity[12] in theoretical texts. Coherence is the main concept of space composition that has been developed based on the space arrangement method [15]. In the concept of integration, the value of the amount of connection of each line (space) is the average number of intermediate lines (or spaces) by which all the spaces of the city can be reached. In other words, it is the average number of changes by which one can reach all the spaces of the city. Spatial configuration analysis has a fundamental role in recognizing the patterns governing the structure of the urban texture, and evaluating the correlation between the elements in the structure of a city has a great role in understanding and explaining the relationships and cohesion of the texture [12]. It can be said that the greater the degree of integration and connection between the elements, the greater the coherence of the texture, that one of the most important techniques in this evaluation is the spatial arrangement technique [17]. Therefore, coherence in the spatial arrangement method has a relational concept and not a distance and metric concept. Thus, in spatial arrangement analysis, the concept of "depth" (or the number of connection points between the line of origin and the destination) is more applicable than the concept of "meter distance"[7]. The integration of an urban spaceshows the degree of its connection with the whole city [23].

3. Research Methodology

This article following the quantitative approach seeks to determine the degree of integration and coherence of the structure of the central area of Mashhad with the help of space syntax technique. The purpose of this method is to develop a pattern for the distribution of spatial values and texture cohesion in various macro, medium, and micro scales, for which AutoCAD and DepthMap software program have been used. The method of arranging the space is a technique for quantitative analysis of the qualitative factors of the city. This theory was founded by Hillier and Hanson in 1984 in London and is based on the research about the relationship between social and spatial forms. This theory believes that space is the primary and main core in how social and cultural events occur, on which various studies have been conducted on different cities in Iran. In this article, to introduce this method as much as possible, its basic elements are introduced, and then an example of the application of this method and the obtained maps and values such as the degree of correlation in understanding the structure of the central area of Mashhad are presented. Based on this goal and the studied theoretical foundations, the correlation indices affecting the spatial physical structure of the city texture are presented in the following diagram.

Accordingly, the above-mentioned indicators will be initially assessed according to the structural features of the central area of Mashhad, and after adjusting the values related to integration, they will be evaluated. Therefore, it is necessary to first introduce and analyze the physical-spatial features of the central area of Mashhad in the past and the current situation.

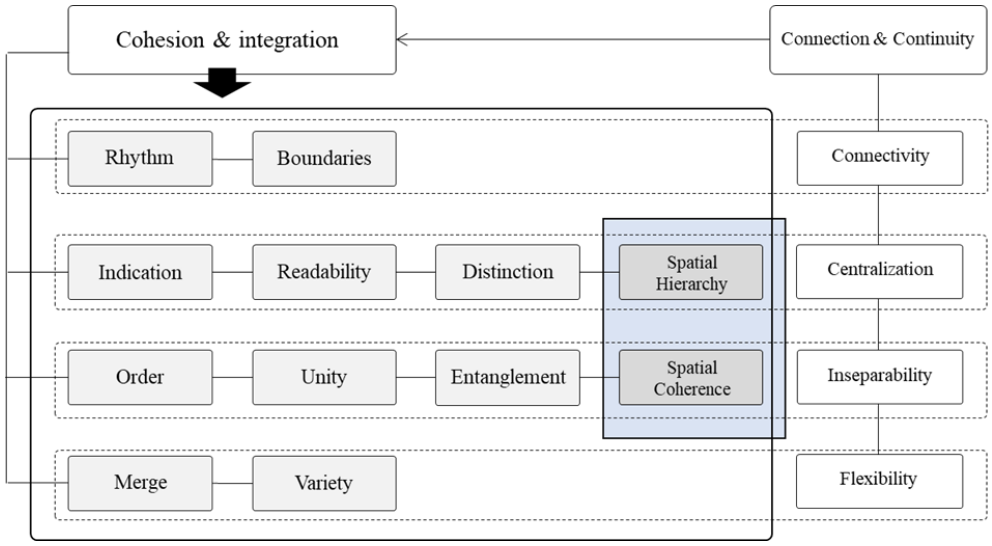

Diagram 1. Integration Indicators Affecting the Cohesion of the Spatial Structure (Source: Authors)

3.1 Analysis of Physical-Spatial Cohesion in the Central Area of Mashhad

The purpose of this section is to localize and achieve the characteristics of the central area of Mashhad affecting the layer of functional-access" cores and physical -context form, which are the main indicators of measuring the integration of the urban texture structure.

3.1.1 Structure of the Central Area of Mashhad in the Past

Mashhad is one of the cities formed based on the structure of the Iranian cities, where the shopping routes were the main streets that connected the neighborhoods to the city center. The basis of the east-west streets was like the Bala-Khiaban Street and the Paeen-Khiaban street, which played the role of the main streets from Quchan gate and the other side towards Sarakhs gate. Also, the streets of this area pass in a circular manner near the shrine of Imam Reza, so that in addition to their tourist function, they can offer their residents a state of privacy. The main street is the same Bala-Khiaban and Paeen-Khiaban, where the shopping routes played the role of connecting streets. Therefore, the main structure of Mashhad in the past was based on the formation of the Bala-Khiaban and Paeen-Khiaban streets in the corridor of Enghelab courtyard or the current Atigh courtyard, and the main shopping routes that were Bazare-e Zanjiri, Bazar-e Sarshur, and Farsh, Bazar-e Uzbek and such schools as Abbas Qoli Khan School, and such mosques as Shah mosques, tekyehs, and circular local passages (Source: Interview with urban experts in Mashhad).

Changes in the city's physical coherence between 1300 (1921) and 1321(1941) were influenced by unplanned and prescribed urbanization. Establishing railways and factories around Mashhad in the second, third and fourth decades of the last century was as the first key measures of the urban elements of the new civilization, in the orientation of the growth of cities and the establishment of the population in subsequent periods. The location of these elements outside the autopsy was chosen at a minimum distance, or up to several kilometers away. Since 1345 (1966), the development of the city of Mashhad has been determined by the city's comprehensive plan lines. The plans were often prepared by the Technical Office of Consulting Engineers, and until 1350 (1971), the first and second stages of that were approved. In the process of developing the city of Mashhad, the focus on Shirazi (Bala-Khiaban) and Nawab (Paeen-Khiaban) streets became less and the main focus of the development constructed this year was the Sento road, which set the southern and western limits of the city until 1355 (1976).

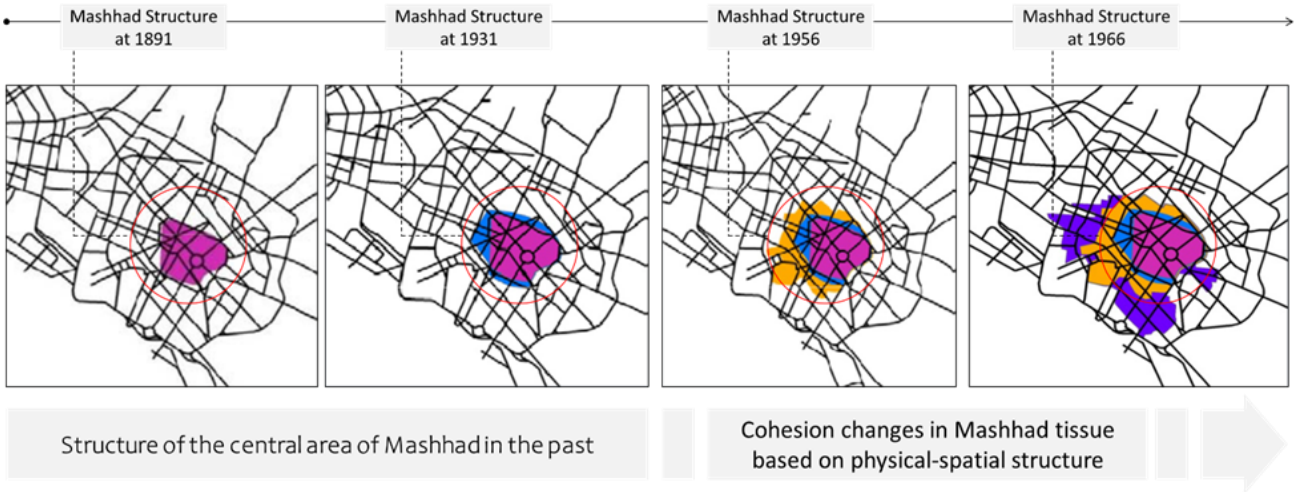

Figure 1. Mashhad Structure over Years (Source: Authors)

3.1.2 Structure of the Central Area of Mashhad

This section of the paper is allocated to the status of the city of Mashhad, which includes recognizing the mechanical physical structure and network of passages. In physical terms, there are many characteristics to examine this area, but due to the presence of the shrine in the center of texture, there is a specific meaning to communication and spatial areas that have been disrupted. Obviously, in the physical and spatial conjugations of the central tissue of Mashhad, the holy shrine has a high position, and in the past, space access and openness for this spiritual space were formed. But today, due to unplanned decision-making and the state of the situation, the role of the parallel shrine incoherence has been diminished on its peripheral texture

structure. Also, the main outlets and elements of the central texture of Mashhad are separable to several groups, including residential, religious, commercial, and educational applications. In this structure, the residential function as an important factor affects other functions, such as commercial functions, recreational functions, etc., and includes a large share of the functions of this field, in such a way that residents illegally assigned their units to this form of function. However, such functional spaces as Abbas Qali Khan, Bazar-e Amin, Bazar-e Saheb-Kar which remained scattered, still strengthen the identity of the texture, although their relationship has been disconnected through the new access network.

The main access to the central area of Mashhad, which has been created in different courses and completed in later periods are Shirazi and Nawab in created by the style used in the Safavid period, Tehran streets (Imam Reza, and Tabarasi created by the style used in Reza Khan period and Sharestan created by the style used in improvement and renovation plans. This kind of street planning and unplanned street widening destroys the hierarchy, the old accesses in the texture and the communication of the holy shrine with its surroundings immediate ways (reference: authors). The uncontrolled development of new streets in recent times in the city of Mashhad has always been considered as the most important factor in the collapse and rupture of the cohesion of the old texture by urban planners. Accordingly, the 10[1], has been used. The coherence of a large structure of this analysis will be obtained, which according to the purpose of the research, is the value of spatial homogeneity in three macro, middle and local levels selected, which continues to examine them.

Integration is the main concept of Space Syntax. The value of each line is the average number of integrated lines that can reach to all the spaces of the city. The value of the coherence of space is a mathematical parameter, indicating the depth of the line from all other lines in the city, which shows comprehensive homogeneity. In fact, the pervasive integration of an urban space shows the extent to which it blends in with the whole city. But if the distance from the whole line is not considered for the analysis of each line and is determined from a certain number of lines (specific depth or radius), the peripheral correlation value of the axial lines is obtained. According to what was mentioned in this research, the degree of correlation value at the macro-level (Rn), at the intermediate level (R8), construction of new streets has destroyed the structure of the old texture and its historical, identity, and physical values have changed, and a set of factors has caused this texture to become an isolated, inefficient, and anonymous texture during the development of the city. What effect have these changes had on the structure of the old texture of Mashhad and how has they caused the rupture of this texture and also the reduction of spatial-physical values in it?

4. Findings

To analyze the structure of spatial cohesion in Mashhad, using space syntax, the axial map of it should first be prepared, which is a map of the city's axial lines based on the measured indicators presented in the theoretical concepts. "Axial lines" are the longest access lines and vision in a city. In this way, about 17,000 lines are drawn to cover the entire city of Mashhad in the AutoCAD environment and have been transferred to the DepthMap software for analysis. After entering the axial lines to the analysis environment, first, the amount of connection in the other line is checked, and then the software will be analyzed. Depth Map software, based on space syntax analysis, first forms a graphic network and then based on the mathematical relationships defined for those analyzes, it does the intended analyses, and shows the desired output graphically from the desired map with colors. In this research, the latest version of this software, which is version

and the local level (R3), have been investigated. Studies show that for large cities such as Mashhad, radius 3 is suitable for local integration. But to calculate the middle radius, the average depth of the most connected line at the macro level will be considered. This radius, which can be different for different regions and cities, is called “Rr”. Integration values, at the level introduced in the table below, can be seen in the city of Mashhad.

Based on the above values and changes in the spatial structure, Mashhad has been studied in four separate periods. In this section, the distribution pattern of integration value in different periods of growth of the structure of Mashhad city based on macro and local radius has been studied.

Get this software from the University of UCL England through the official website of the university, for students and university professors (Http://www.vr.ucl.uk/depthmap.com).

Table 2. Values of Integration in Mashhad (Source: Authors)

Values of Integration	Maximum value	Minimum value	Average	Standard deviation
Macro Integration (Rn)	1.71	0.35	1.05	0.20
Middle Integration (Rr)	2.32	0.35	1.53	0.33
Local Integration (R3)	5.26	0.35	1.98	0.78

Table 3. Changes in the Value of the Urban Structure of Mashhad Integration (Source: Authors)

Values of Integration	Mashhad Structure Growth	From the beginning to the year 1270 A.H.	From 1270 to 1310 A.H.	From 1310 to 1340 A.H.	From 1340 A.H. onwards
Macro Integration (Rn)	Mashhad Mean	0.6	0.62	1.06	1
	Max	0.88	0.96	1.83	0.69
	Min	0.33	0.34	0.53	0.33
	Standard deviation	0.1	0.12	0.24	0.2
	Structure Mean	0.85	0.9	0.91	1
Local Integration(R3)	Mashhad Mean	1.3	1.38	1.78	1.96
	Max	3.55	3.82	4.55	5.19
	Min	0.33	0.33	0.33	0.33
	Standard deviation	0.43	0.46	0.64	0.76

Therefore, the pattern of correlation changes in the structure of the central area of Mashhad can be expressed based on the four periods introduced as follows:

Integration changes from the beginning to the year 1270 A.H: According to the evidence shown in the map, in the first period (from the beginning to 1270 AH) the lower axis of the street, which is an east-west axis, connects the eastern areas of the city to the holy shrine, and the bazar area has the most integration and cohesion throughout the city. In general, the important axes of the city, especially the bazar, have a high correlation value. Also, according to the presented table, the rate of standard deviation and the difference between the most and the least correlation in this period is less than the next period. The higher the standard deviation, the more incoherent and heterogeneous the structure of the domain. Therefore, in this period, the structure of the city has the highest integration and cohesion, compared to the following periods.

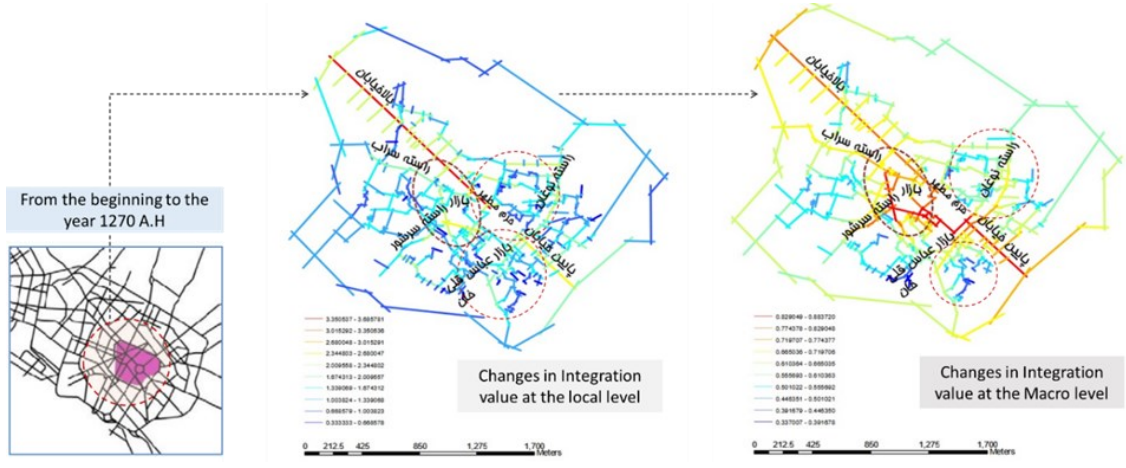

Figure 3. Mashhad Integration from Beginning to the Year 1270 A.H with Space Syntax Technique (Source: Authors)

Integration changes from 1270 to 1310 A.H: According to the map of the second phase, with the expansion and growth of the city to the west in the second period (from 1270 to 1310 AH) and increasing communication and access in the western part of the city and low development of the eastern part of the city and the holy shrine, lines in the western part become bolder than the eastern region, so in this period they find higher cohesion and integration compared to the eastern regions. Bazar in this period is still in the category of the highest integration and acts as one of the main elements of the cohesiveness of the texture and also its integration value is higher than the city average.

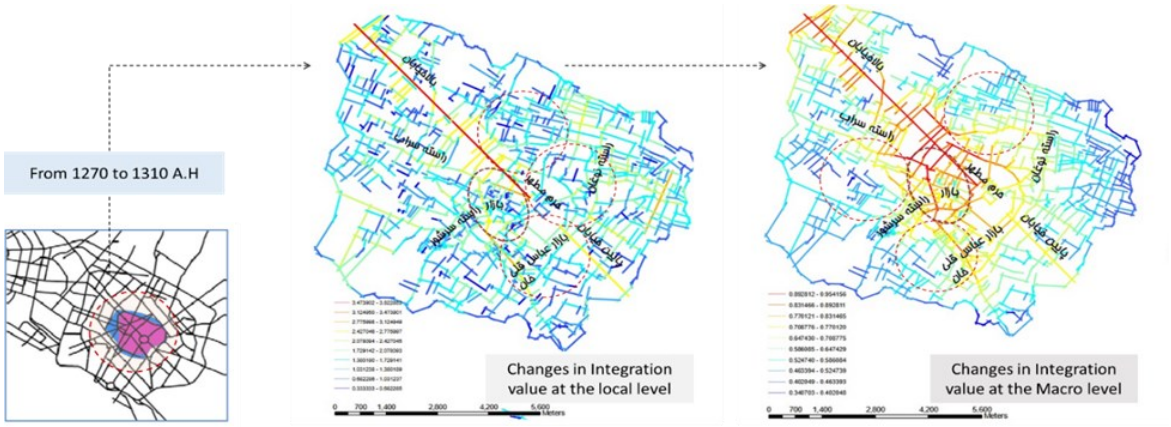

Figure 4. Mashhad Integration from 1270 to 1310 A.H with Space Syntax Technique (Source: Authors)

Integration changes from 1310 to 1340 A.H: In the third period of growth and development of the city structure, new streets are created with the arrival of cars and the growth and development of the city structure continues rapidly towards the western part of the city. The integration map in this period shows that the western regions have a higher integration and the urban areas are moving towards isolation. The amount of standard deviation in this period has increased sharply compared to the previous period and has increased from 0.12 in the second period to 0.24 in this period. This rate as mentioned indicates the inconsistent structure of the city and shows that parts of the city are spatially isolated. Therefore, the lack of connection and coherence of the western context with the central and eastern areas of the city has caused the isolation of some areas in the central texture of Mashhad, which has caused a rupture of cohesion in most areas of this area.

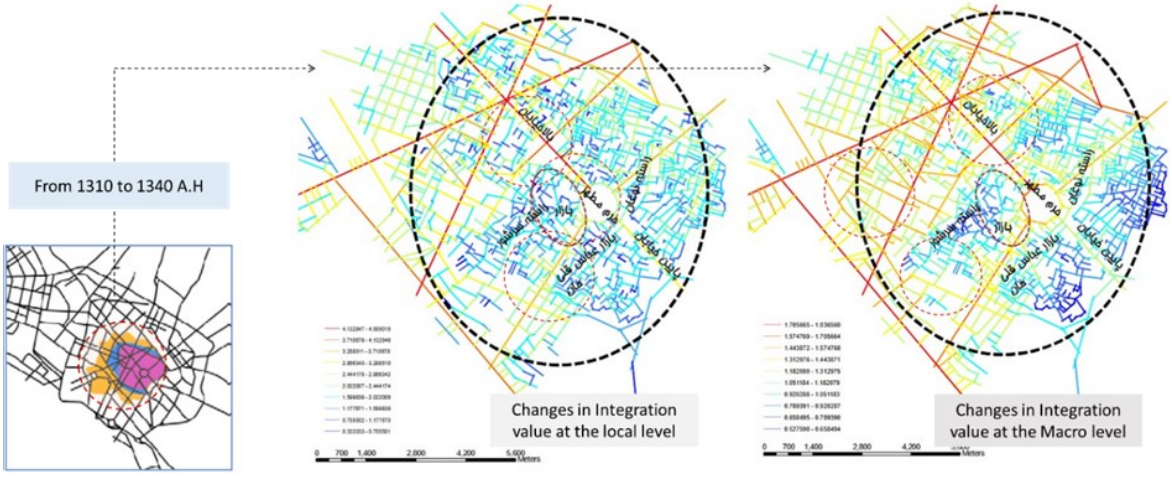

Figure 5. Mashhad Integration from 1310 to 1340 A.H with Space Syntax Technique (Source: Authors)

Integration changes from 1340 A.H. onwards: During this period, the growth of Mashhad was mainly to the west, so that the center of Mashhad is located in the eastern part of the city and its internal texture is still broken and isolated. Today, according to some criteria, part of it has become worn and inefficient areas, but what makes this texture to continue to be considered by the city and its citizens and to be still considered as the beating heart of the city, is the establishment of the holy shrine in it. But the population living in this area is evacuating and migrating to other urban areas. And the central area compared to other urban areas, in terms of breaking the cohesion of the texture, has many changes that have created an intervention in this texture with many problems in a specialized position. The rate of standard deviation in this area has increased from 0.1 in the first period to 0.2 now, which indicates an increase in the disintegration of tissue structure and cohesion.

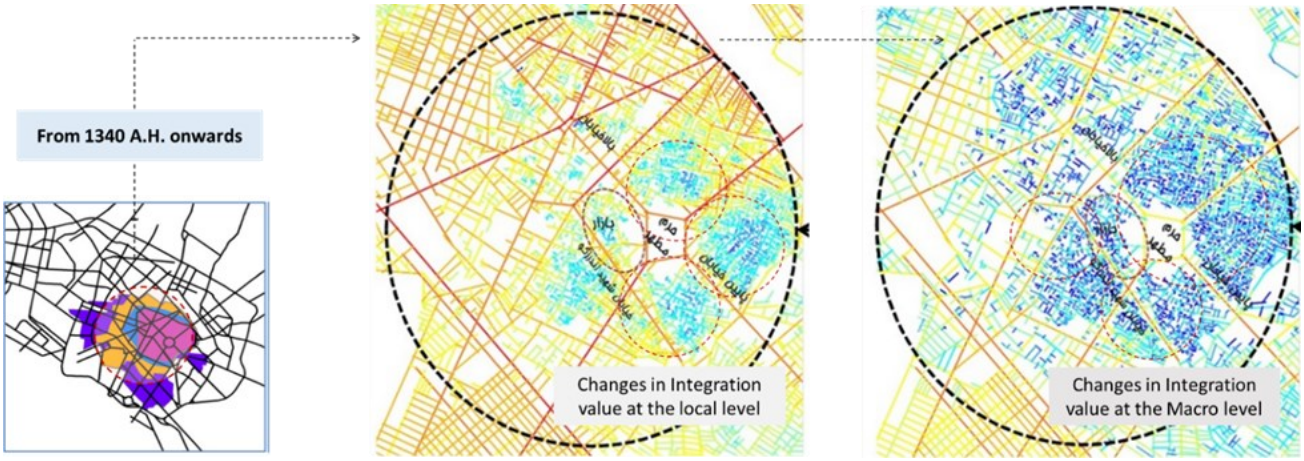

Figure 6. Mashhad Integration from 1340 A.H Onwards with Space Syntax Technique (Source: Authors)

In the 50's AH, the tendency of settling the urban population in the more remote suburbs around the communication axes increased. From this period, after the physical cohesion, the layers of Mashhad city were severely reduced and the marginal texture is a continuation of the construction of the expanding texture. In the physical structure of Mashhad in the 50s, in addition to the zoning of activities and polarization of the population that is concentrated, other changes can be observed. The population living in the commercial-service area, or in other words, the silent historical and old texture, leaves the old houses due to the intensification of non-residential and non-local activities, air pollution and noise pollution, and the lack of adequate amenities for the local texture. Physical connection and social cohesion also decreased in this area. The importance of this point has been seen in the evaluation of local correlation. The city of Mashhad in the seventies and beyond has been a full-fledged mirror of the above developments. The confrontation of internal currents and the global reality, a huge range of construction and development projects with a variety of plans against the expansion of the city and population growth is its reality. Construction of tens of kilometers of boulevards and streets, tens of hectares of parks, various non-level intersections, development and equipping of the transport fleet, various renovation, and improvement projects, etc. are just some of the measures taken in this context. However, the most important issue that later became a problem and even a crisis, is the lack of organization and integration in physical and spatial development in the central part of Mashhad and the reduction of integration over several periods of time.

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5. Conclusion

Roads, squares, and connecting urban elements are the main components and infrastructure in creating physical-spatial cohesion in a city, and this is evident in the central area of Mashhad, especially the joint around the holy shrine of Imam Reza with its articulated texture. It is possible to identify the connecting elements between the squares, physical-spatial elements, and the main passages that form the joint boundary of the shrine with its immediate texture, as well as to determine their influence in space and connecting their functions together, to take action to restore ossification and spatial cohesion of this part of the city of Mashhad. With such an approach to change and structure and strengthen urban joints that connect the past to the present and future and various activities to each other and citizens to civic life, the quality of places and the physical connection of space and urban spaces are improved, restoring physical, spatial and functional richness to them. The process of changing the elements affecting the integration of the spatial physical structure of Mashhad is presented in the table below

Table 4. Mashhad Structure Growth and Integration Elements of the Physical Structure in Different Periods

Mashhad Structure Growth	Integration elements of the physical structure of Mashhad in different periods		
	Physical Elements	**Spatial elements**	**Connection Elements**
From the beginning to the year 1270 A.H.	Disconnection between shopping routes (Bazar)	Religious and government citadel, bazaar, mosque	Bala-Khiaban & Paeen-Khaiban Roads, Bazar
	The gates and fortifications of the city	Arg neighborhood	Bala-Khiaban & Paeen-Khaiban Roads with a lot of changing
From 1270 to 1310 A.H.	Sarab-Bazar Routs	School, Bazaar and Arg neighborhood	Connecting Chaar-Bagh to Sarshur
From 1310 to 1340 A.H.	Square and street	Shohada Square " Shah", shrine complex, Arg Routs	Tehran Routs, Arg & Khosrawi
From 1340 A.H. onwards	Railway, University	Railway, university, Zist-khavar shopping center, Kooh-Sangi and park	Development of checkered streets, Khayyam Street
	Detached neighborhoods	Large-scale functions	Intercity highways

Therefore, this spatial distribution has worked well in maintaining the entry points and the coherence of the city spaces with the holy shrine in different eras, and any plan will not be successful without considering this identity and the coherence governing this space. In order to clarify the elements of the space-physical organization of the central area of Mashhad in historical periods, in addition to summarizing the mentioned cases, the construction and the main foundation of the city are also presented in the form of a map, which can be seen below.

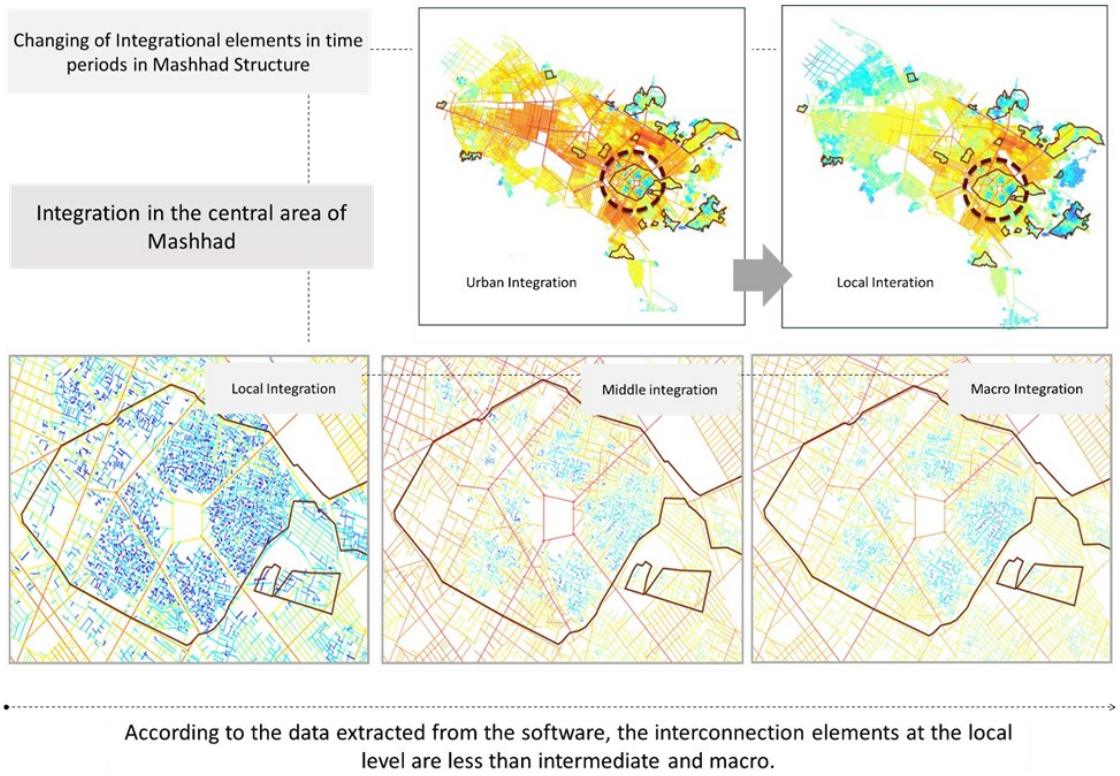

Figure 7. Mashhad Structure Growth and Integration Elements of the Physical Structure in Different Periods

In general, the growth and development of urban structure in Mashhad shows an increase in large and local interconnected changes, so that with the collapse of the city wall and the development of new interconnected streets, compared to the first two periods, this period has changed significantly. Changes in local correlation also show an increase in standard deviation during the development of

Mashhad. This indicates the value of interconnection between city limits or neighborhoods, depending on the local radius. Therefore, changes in the value of cohesion and integration in the structure of Mashhad show that despite the relative cohesion of the central area with the surrounding areas and other centers in the city, this area, in terms of internal and spatial details, has broken the cohesion of its physical structure and connections, and the connection between local paths or spaces has been lost.

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