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The Correlation between Spatial Configuration and Development Status of Isfahan's Neighborhoods*

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ABSTRACT

Non-narrative study and determination of the correlation between living space and society is a subject that has been neglected in the studies by space creators (architects, city and landscape designers, and theorists of this field) and social specialists (sociologists, anthropologists, etc.). While environmental sciences have not been able to provide a convincing theoretical framework for the role of society, in social sciences, also the acceptable understanding of the concepts of space and environment has not been reached. Trying to overcome this shortcoming is as a missing loop that is difficult to achieve and will undoubtedly answer many common environmental issues. The present study aims to examine the correlation between spatial configuration and development status of Isfahan's neighborhoods to help to eliminate this shortcoming in some way. For this purpose, this correlation is tested in 188 neighborhoods of Isfahan at three level, global, mean and local, using correlation analysis. In this process, the spatial configuration of the neighborhoods is analyzed using space syntax method and their level of development is determined using TOPSIS method. The results of this study show that although there is a significant relationship at the two scales, global and mean, but this correlation is weak. At local scale, also there is basically no significant correlation. Accordingly, if it is supposed to improve the structural integrity of Isfahan City and the development status of its neighborhoods by making changes in its spatial configuration, the priority should be given to changing the streets connecting the neighborhoods as well as the main street of the city , instead of interfering in and changing the neighborhood access network, taking into account that these changes should not be expected to necessarily have a positive effect on the development status of neighborhoods.

Keywords: Spatial Configuration, Neighborhood, Development Status, Space Syntax, Isfahan.

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1. INTRODUCTION

The growth of urbanization, along with dramatic changes, has changed the situation of cities (Choay, 1996, p. 2), disrupted the old foundation of communications, and severely damaged neighborhood organization (Habibi, 2003; Karimi, 2000). These structural fragmentations and sprawl developments have changed the city's spatial organization and its main structure and led to functional inefficiencies in urban system both economically and socially (Jamali Shahni, Saeedi Mofrad, & Mahd Nejad, 2013). These changes, which have occurred due to the changes in external factors (not internal factors) in some urban areas, have led to urban contraction- formation of deteriorating areas- due to large population decline, economic downturn in cities, as well as deteriaration of urban environments, and disrupted urban relations.

In such circumstances, lack of a proper knowledge and understanding of the impact of spatial forms and social processes of the city on the governing relations and urban phenomena has also made it impossible to define an appropriate and comprehensive framework for all urban subsystems. As a result, some subsystems have not been able to establish a proper connection to the city as a whole system and consequently, gradually separated from the system and turned into less developed areas in the process of urban development. This process has widened the gap between different parts of the city, and consequently has instigated the "increasing polarization" of social geography (Dalyan, 2009; Vaughan & Arbacci, 2011).

To eliminate this gap, balance the development of cities, and thereby improving the development status of neighborhoods, reforming the spatial structure of the city can be the basis for proposing ideas in order to organize and link the main streets and centers, while providing the stability and continuity of the whole city (Hamidi, 1997).

Accordingly, and since the correlation between spatial and social phenomena in the city has been less developed despite the theoretical acceptance of it as well as it has been paid less attention to the effects of built environment on the community in social sciences and the effects of socio-cultural phenomenon on the environment in spatial sciences[1] (Hillier & Vaughan, 2007), the present study, while recognizing and analyzing the spatial configuration of Isfahan city using space syntax method, aims to scrutinize its correlation with development status of neighborhoods in the city non-narratively and empirically.

2. LITERATURE REVIEW

So far, various studies have been conducted in Iran to investigate the effect of spatial configuration of cities on various issues such as organization of movement system, cognitive features, development, crimes, and spatial segregation (Yazdanfar, Mousavi, & Zrgardaghigh, 2009; Rismanchian & Bell, 2010; Bahreyni & Taghabon, 2011; Abbaszadegan, Bidram, & Mokhtarzadeh, 2012; Rafieian, Alizadeh, & Taghvayee, 2016; Hamedani Golshan, 2015). But few domestic studies have analyzed the spatial configuration of "urban neighborhoods" in a non-narrative way and examined its correlation with the development status of them.

However, abroad, after the introduction of space syntax method in the late twentieth century, numerous studies have been carried out on the effect of spatial configuration on the form of poor settlements and spatial organization of economic and social activities among which the study by Lima (2001) can be mentioned. In his study, he has shown that there is a significant correlation between the spatial configuration of Belem, Brazil, which has been studied using "syntactic measurements", and socio-economic indicators (Lima, 2001). In their study on Santiago City, Chile, Hillier, Green, and Desilas also have pointed out that the spatial configuration of the city has played a key role in the promotion and decline of poor settlements. In their study, they have investigated these neighborhoods in terms of the socio-economic indicators in relation to their spatial configuration using space syntax method (Hillier & Vaughan, 2007, pp. 205-230).

The study by Vaughan (2005) in London is another study which indicates there is a significant difference between spatial configuration of poor and rich neighborhoods. The results of this study have indicated that in some neighborhoods, despite their appropriate economic and social structure, a large part of native population has decreased and been replaced by low-income migrants only due to their improper spatial configuration (Vaughan, 2005, p. 231). There are other studies with different case studies that have confirmed the significant correlation between the spatial configuration of cities and socio-economic status of their different parts (Omer & Goldblatt, 2012; Rodriguez, Saker, Sam, & Hillier, 2012; Legeby, 2013).

In the next section, reviewing different perspectives and theories on the correlation between spatial forms and social processes, it was attempted to briefly introduce the recent theories used in this article.

3. THE CORRELATION BETWEEN SOCIAL PROCESSES AND SPATIAL FORMS

The correlation between social processes and spatial forms has always been considered by geographers and sociologists. But specifically, the emergence of the spatial- science paradigm, Kurt Schaefer's (1953) criticism of exceptional thinking in geography, the expansion and explanation of this paradigm by geographers such as "William Bunge, Petter Hagget, David Harvey, Abler, Adams, Gould, William Garrison, Edward Ullman, Brian Berry, and Desi" and studies on the interactions of forms and processes by sociologists

such as "Weber, Zomer, Leo-Strauss, Löwenthal, Henri Lefebvre, Manuel Castells, and John Urry" have made the issue of "the correlation between social processes and spatial forms" to be considered more than before and the required ground was prepared to provide strong theoretical supports for the following statement: "social process and spatial form are inextricably mixed and related to each other, and therefore they should be considered as complementary to each other in urban planning or environmental design in order to solve problems in both dimensions simultaneously".

By arguing that spatial forms and social processes are different ways of thinking about the same issue (Cuthbert, 2005; Castells, 2001), Harvey emphasizes the effectiveness of both spatial and social aspects of phenomena. Or although John Avery does not consider an independent effect for space per se, he believes that spatial arrangement of social objects can affect social relations. By stating "space is both the product and producer of social relations", Henry Lefebvre also emphasizes the dialectics between space and society and considers class inequality and conflict the product of space above all else. Castells, like Harvey, emphasizes that the spatial form of a society is closely related to general mechanisms of its development such that to understand cities, it should be required to understand the processes by which spatial forms are formed and changed (Giddens, 1998).

Similar beliefs about the influence of the built environment on social characteristics of the environment have been common in architecture and urbanism, the most recent of which is related to the views of Bill Hillier and Laura Vaughan (2007). In order to understand the relationship between space and activity, they emphasize the recognition of the city as one thing and state that in urban studies, a city is usually divided into two sectors: 1. The body or the physical city which is a set of built environments and open spaces; and 2. The social city which includes all social activities; and depending on the perspective with which the research is carried out, one sector is considered as the foreground and the other as the background. Therefore, a large number of sectoral theories have been developed, none of which deals with the relationship between the two sections. Meanwhile, Hillier and Vaughan believe that "social city and physical city are the same; social city brings the physical city in to existence, and then the social city acts within the physical city according to the constraints imposed by the physical city" (Hillier & Vaughan, 2007, p. 206). In urban studies, the correct method is to consider the city as one. Therefore, it is necessary to understand how the city design relates to and reifies social ideas and vice versa, because if we cannot understand the social city in relation to the physical city and have no sufficient knowledge of social meanings of urban form, there would be a risk of forming cities that do not support the society.

One of the theories and methods that claim to have taken an effective step in responding to this need is the space syntax theory. This theory states that urban spaces are the product of social relations and the relationship between urban spaces pursues social goals. As a result, understanding the relationship between urban spaces can help to understand behavioral patterns and quantitative and qualitative analyses. This theory believes that spatial configuration and urban spaces syntax are the main factors for the distribution pattern of socio-economic activities such as the distribution patterns of uses, different ethnicities, and movement in the city (Hillier, 2007, pp. 121-125). In this theory, the movement created from the spatial body is introduced to have high potentials in shaping socio-economic qualities and paying attention to it not only can spatially integrate the isolated textures with other urban areas, but also can be effective in the economic and social development of different regions, especially the less developed ones (Hillier & Vaughan, 2007, p. 223).

in the present study, the same logic- on which the space syntax theory is based- was considered a basis for studying the spatial status of neighborhoods in Isfahan as the case study- to investigate the correlation between this variable and the socio-economic development of each neighborhood, while validating the capability of this theory in explaining the spatial structure of the city.

4. METHODOLOGY

The relationship between spatial and socio-economic aspects of the city is examined in three parts: 1. The study of socio-economic development of the city at the local scale; 2. The study of spatial structure of the city; and finally, 3. The combination of the previous two parts in order to identify their correlation. For this purpose, a combination of different methods is needed to examine and analyze the issue. Organizing and combining these methods can be presented in a framework consisting of the following three steps:

A. Study of socio-economic development of the city neighborhoods: In this section, it is possible to compare neighborhoods with each other in terms of social, economic, and welfare statuses. To do this, the analysis indicators were determined and after determining the weight and importance of each indicator, using TOPSIS[2] method, the rank and position of each neighborhood were identified in terms of development compared to other neighborhoods.

B. Study of the spatial characteristics of the urban system: At this stage, the spatial position of each neighborhood is identified and determined compared to other neighborhoods and also in relation to the whole city. For this purpose, by considering the space as the main and primary core playing a role in the occurrence of social and cultural events, the relationship between spaces within a larger system, called spatial configuration, is analyzed. Due to the similarity between the logic of space syntax method[3] and the aforementioned points, this method was used in the further examination of the spatial structure.

C. Correlation: In the last step, the significance and degree of the correlation between spatial and socio-economic dimensions are evaluated using the results obtained from the two stages above (Fig. 1).

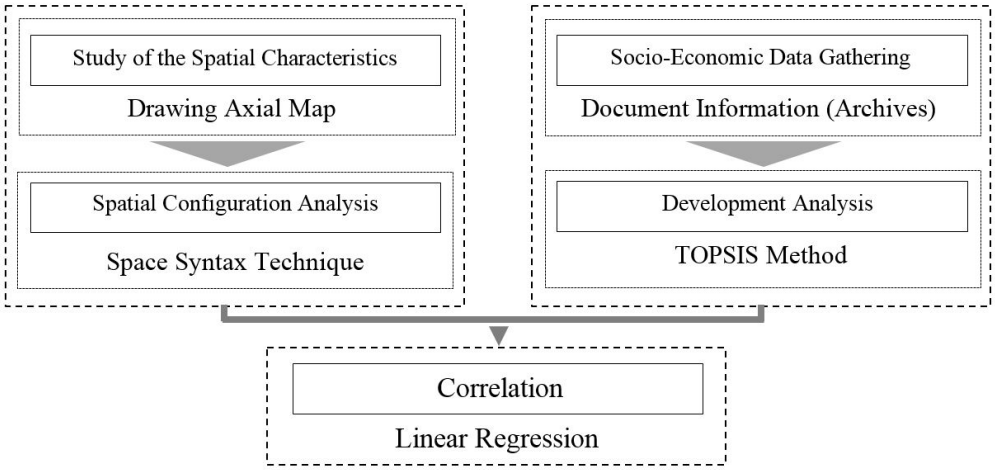

Fig. 1. Technique Used for Data Gathering and Analysis

4.1. Research Indicators

The indicators provide the ground for statistically expressing the status quo of the neighborhood (Kalantari, 2001, pp. 111-112) and drawing a good image of its situation. In the present study, according to the research purpose, 35indicators were selected from the indicators classified in the section of sustainable development[4] by the UN (United Nations, 2007) as well as those applied in previous relevant studies, and then used under three social, economic, and physical-welfare groups (Table 1) for assessing the socio-economic development.

Table 1. Research Indicators Used to Assess the Development Status of Neighborhoods in Isfahan

Component	Criterion	Indicator
Social	Social Composition	- Household size and population density in neighborhoods - The share of employees by main occupational groups
	Literacy	- Percentage of literate population - Percentage of illiterate population - The share of literate population of each neighborhood
	Social Stability	- Immigration rate - Percentage of native population
	Housing	- Household density in a residential unit - Number of rooms in a residential unit - Number of rooms available to the family
	Health	- Percentage of the disabled population
Economic	Land Value	- The price of land in neighborhoods
	Welfare	- Employment and unemployment status - Residential floor area - Type of housing ownership - Quality of housing - Building age
	Economic Dependence	- Willingness to invest - Economic participation of men - Dependency burden - Economic participation of women
Physical-Welfare	Access to Infrastructures and Private Facilities	- Percentage of residential units with all facilities - Percentage of households using computers - Percentage of car ownership in the neighborhood - Percentage of the enjoyment of landline phone - Floor area per person
	Access to Public Facilities and Services	- Access to educational services - Access to health services - Access to sports facilities - Access to public transportation

The information of each development indicator was surveyed using available documents and references (including Isfahan Metropolis Atlas, 2015; Isfahan's Revised Detailed Plan Document, 2013; the latest version of Isfahan GIS maps, Revision Plan Basis, 2013; and Strategic Sustainable Regeneration of Isfahan's Inefficient Urban Textures Document, 2015) and then, spatial models were obtained[5].

In order to study the spatial status of neighborhoods in the present study, the integration indicator was used as the main concept of space syntax method (Abbaszadegan, 2002). This indicator, which indicates the depth of each space (or the number of interface spaces) in relation to other spaces in the structure of the city (Hillier, 1996), was selected since it makes it possible to examine the position of each of urban spaces and neighborhoods in the whole urban system and measure their degree of integration or isolation (Turner, 2007, p. 542) and also it is measured based on a simplified diagram of urban streets and open spaces called Axial Map.

Regarding the analysis of spatial structure, there are three types of integration based on the radius of analysis in the space syntax method: A) global Integration (R_n), which represents the integration value of spaces relative to the whole system with the rotation radius of n; B) Local Integration (R_3), which is obtained by limiting the rotation radius of n; Local Integration value is usually calculated with the rotation radii of 3, 5, 7, etc.; and C) Mean Integration (R_r), that the rotation radius of r is used for its calculation[6].

In the present study, the integration of the city was analyzed to understand how the urban components behave and how are the characteristics of spatial structure of the city in all three radii defined. In this analysis, at the mean and local scales, the radii of 10 and 3 were considered, respectively.

5. CASE STUDY

In the present study, by selecting the neighborhood as the field of study, the research indicators are examined and analyzed in the neighborhoods of Isfahan City. The Isfahan city, with an area of about 550 square kilometers and a population of 1,908,968 people, has 15 districts and 199 neighborhoods (Fig. 2). Due to the access limitation to socio-economic information of all the neighborhoods, 188 of 199 neighborhoods were analyzed in terms of research indicators.

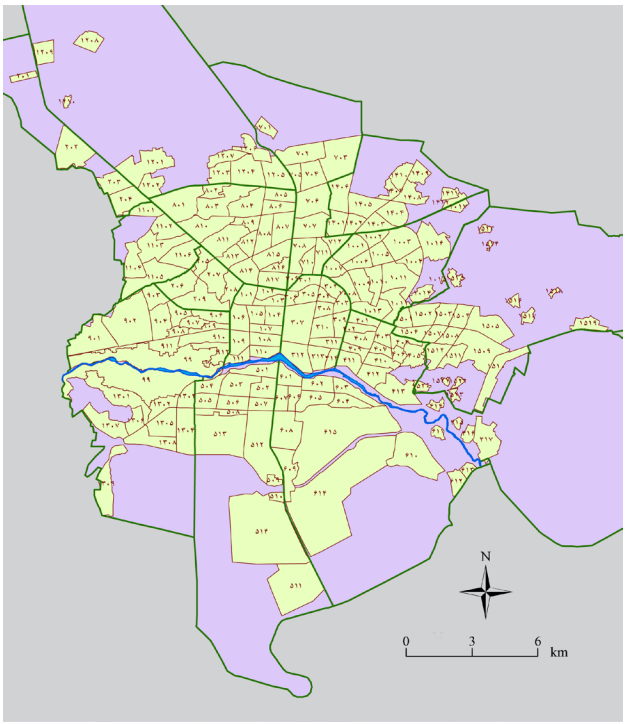

Fig. 2. Map of Isfahan's Neighborhoods, Based on Urban Divisions in 2013
(Isfahan Municipality, 2015)

6. RESULTS

Given the three-part analysis process, the obtained results are presented separately by each part:

6.1. Socio-Economic Status and Degree of Isfahan's Neighborhoods Development

The multi-criteria (indicator) decision-making method was used to determine the development status of the neighborhoods of Isfahan and rank them. In the multi-criteria (indicator) decision-making method, there is a need to know the relative importance of indicators before ranking. In the present study, the indicators were weighted using the combination of factor analysis and subjective judgment (Delphi method). The neighborhoods were ranked by TOPSIS method.

To do this, first, the decision-making matrix, with 188 rows (neighborhoods of Isfahan) and 35 columns (indicators), was developed and then, normalized using Equation (1). In the next step, the weights of indicators were multiplied by the normalized matrix.

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}} \qquad \text{Equation (1)}$$

Then, the ideal and non-ideal solutions were determined using the weighted matrix. The ideal solution refers to the solution obtained by summing up the maximum values of indices, while the non-ideal solution refers to the solution obtained by summing up the minimum values of indicators. In fact, two virtual options (neighborhoods) were created, one as the best neighborhood and the other as the worst one. The TOPSIS method is based on the concept that the selected option should be the closest one to the ideal solution (best possible mode) and the furthest one to the non-ideal solution (worst possible mode). Accordingly, the distance of each neighborhood from the two ideal and non-ideal neighborhoods and the relative closeness of options (neighborhoods) to the ideal solution were determined using Equations (2) and (3), respectively.

$$s_i^+ = \sqrt{\sum_{i=1}^{n}(v_{ij} - v_i^+)^2} \qquad i = 1, 2, \dots, m$$

$$s_i^- = \sqrt{\sum_{i=1}^{n}(v_{ij} - v_i^-)^2} \qquad i = 1, 2, \dots, m \qquad \text{Equation (2)}$$

$$c_i^+ = \frac{s_i^-}{s_i^- + s_i^+} \qquad 0 < C_i^+ < 1 \qquad \text{Equation (3)}$$

It should be noted that the degree of development of each neighborhood is relative and was obtained from the internal comparison between the neighborhoods of the city and the hypothetical ideal neighborhood. So, the development value of each neighborhood was determined compared to other neighborhoods. Due to the space limitation and the large number of studied neighborhoods, only the most and least developed neighborhoods (each group includes 20 neighborhoods) are presented[7] (Tables 2 & 3).

Table 2. The Top 20 Most Developed Neighborhoods

Neighborhood	Development Value	Rank	Neighborhood	Development Value	Rank
Isfahan University	0.011270577	1	Histan	0.005746511	11
Arghavanieh	0.007994778	2	Abshar	0.005706106	12
Bagh Negar	0.006441448	3	Sa'adat abad	0.005688381	13
Kooye Narges	0.006058633	4	Sonbolestan	0.005658444	14
Mahmood Abad	0.006001399	5	Gourt	0.005621041	15
Ghale No	0.005951586	6	Saeb	0.005588382	16
Meshkin	0.005871233	7	Khatoon abad	0.005582734	17
Mehrabad	0.005811251	8	Bagh zereshk	0.00557795	18
Hezar Jarib	0.005800767	9	Bagh karan	0.005558965	19
Abbas Abad	0.005766722	10	Kooye vali asr	0.005546782	20

Table 3. The Top 20 Least Developed Neighborhoods

Neighborhood	Development Value	Rank	Neighborhood	Development Value	Rank
Mahale Sofla	0.004988939	169	Hese Jonobi	0.004793993	179
Soudan	0.004979665	170	Pinart	0.004764597	180
Sanjavan Mare	0.00497893	171	Hese Shomali	0.004746841	181
Montazerolmahdi	0.004970894	172	Ghale Bertyanchi	0.004729205	182
Shahrake Vali Asr	0.004968838	173	Jolvan	0.004722588	183
Bahram Abad	0.004961641	174	Koye Sepahan	0.004714928	184
Vahid	0.004951356	175	Gian	0.004662011	185
Zeynabieh	0.004941011	176	Denart	0.004571313	186
Naser Khosro	0.004930035	177	Jay Shir	0.004516573	187
Bouzan	0.004901532	178	Atsharan	0.004500617	188

To visually represent the ranking results, the neighborhoods were divided into 10 categories based on normal distribution and the ranks obtained from TOPSIS analysis were assigned to a shape file representing the neighborhood boundaries. Figure 3 shows the development status of different neighborhoods (as the color becomes darker, the level of development becomes lower). This figure shows that the peripheral neighborhoods- especially the northwest, northeast, and southwest areas- have lower levels of development than other neighborhoods and the central neighborhoods in the north and south of the Zayandehrud River have higher levels of development.

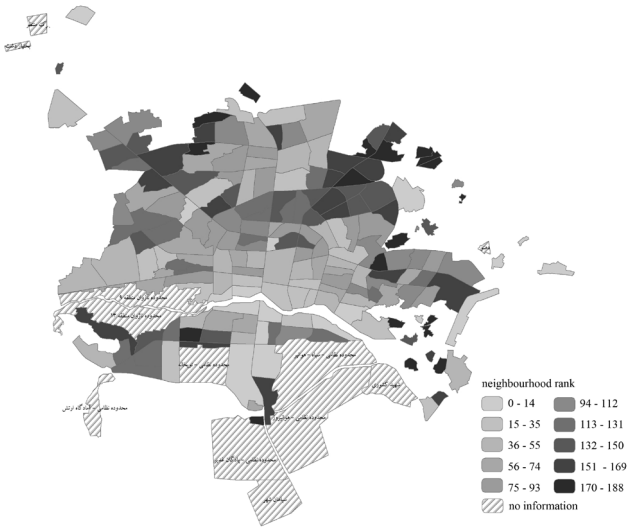

Fig. 3. Ranking of Neighborhoods of Isfahan City in Terms of Development

6.2. Spatial Configuration Analysis of Isfahan City

To analyze the spatial configuration of Isfahan city using space syntax method, first the linear map of the city was prepared[8], and then, the integration value was calculated for three radii[9], using Depth Map software. Table 4 shows integration values for different radii.

Table 4. Integration Values in Isfahan City

	Maximum Value	Minimum Value	Average	Standard Deviation
Global Integration (R_n)	2.18	0.57	1.15	0.27
Mean Integration (R_{10})	2.82	0.35	1.45	0.41
Local Integration (R_3)	5.32	0.21	1.72	0.81

The integration analysis of Isfahan city (Fig. 4) shows that there is no symmetrical and centralized distribution relative to a central core in the city. In other words, in Isfahan city, there is no core-periphery relationship and the structure of the city does not follow a simple form of centrality, in which the integration value of the core is high while it is low for the periphery. Such situation indicate the existence of a network structure in the city, the analysis and display of which will not be possible without the use of axial-line analysis (configuration analysis). However, in the same network structure, as moving toward the periphery- especially in the western, northwestern, and eastern parts of the city- it is observed that the intensity and value of integration has gradually decreased so that the neighborhoods and areas in these parts of the city undergo spatial segregation.

Fig. 4. Analysis of Global Integration Value (R_n) in Isfahan City

Since the present study seeks to analyze the correlation between the changes in the integration value and socio-economic development of neighborhoods (as the intended scale of analysis), the spatial value of each neighborhood must be known. For this purpose, the map of Isfahan's neighborhood boundaries and the maps obtained from the analysis of integration value at different scales were overlaid and the integration value of each neighborhood was determined as compared to other neighborhoods by calculating the average value of the lines located in neighborhoods using spatial analysis functions[10].

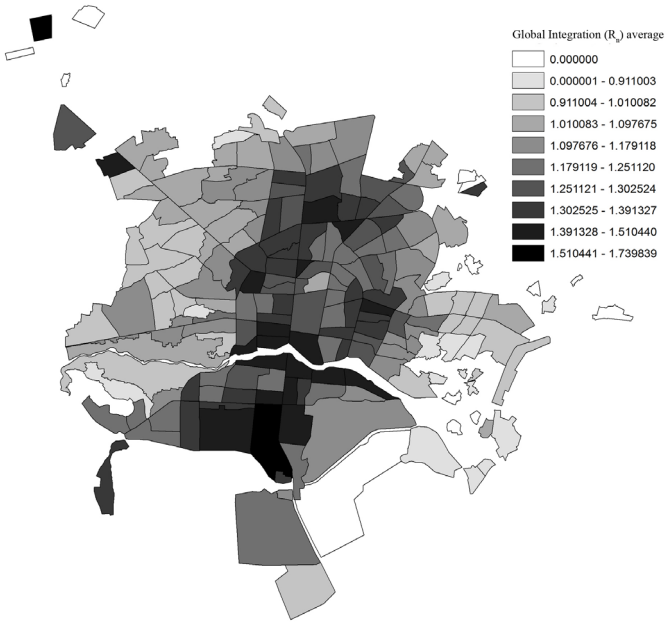

Fig. 5. Changes in Global Integration (R_n) Value of Neighborhoods

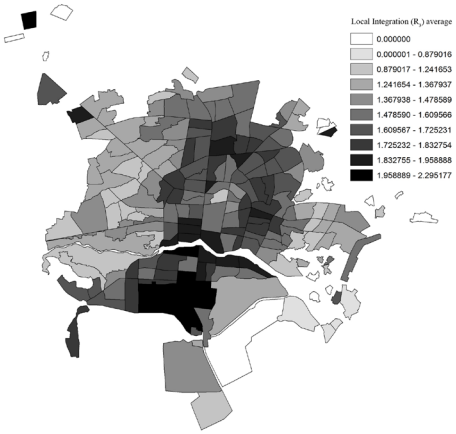

Fig. 6. Changes in Local Integration (R_3) Value of Neighborhoods

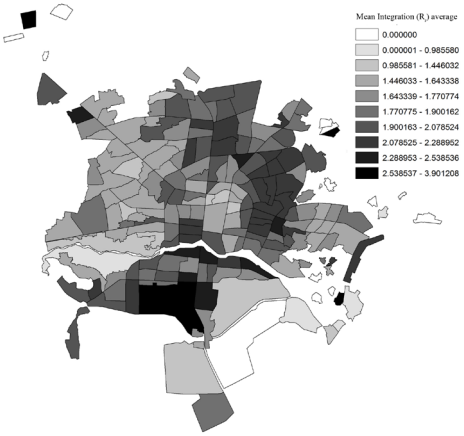

Fig. 7. Changes in Mean Integration (R_r) Value of Neighborhoods

In the above figures, the neighborhoods and areas marked with lighter colors (close to white) have lower integration values. These neighborhoods either have a discrete and incoherent internal structure or could not establish a proper connection with the spatial structure of the city and their surrounding neighborhoods. Therefore, in the whole structure of the city, these neighborhoods are considered isolated neighborhoods. Conversely, the neighborhoods and areas marked with darker colors (close to black) have a high integration value and thus, a more cohesive spatial structure. Now, it should be investigated whether there is a significant correlation between the spatial status and development of these neighborhoods.

6.3. The Correlation between Spatial Configuration and Development Status of Isfahan's Neighborhoods

In the two previous sections, a score of spatial structure at all three scales mentioned in the analysis and a score of development were obtained for each neighborhood of Isfahan. In this section, the significance and value of the correlation between spatial and socio-economic dimensions of the neighborhoods were investigated

using correlation analysis. The results of correlation analysis, which is a statistical tool for examining the intensity and also the type of correlation (direct or inverse) between variables, indicate the correlation between the two variables of development status and integration at the two scales, global and mean, were 0.289 and 0.272, respectively (Table 5), which was significant (p-value=0) but weak . However, the correlation between the two variables of development status and integration in the three level is different. Its value is so negligible and distorts the significance of the correlation.

Table 5. Multiple Correlation Coefficient of the Two Variables of Development Status and Integration Value at Three Levels

		Global Integration	Mean Integration	Local Integration
Development Status of Isfahan's Neighborhoods	Pearson Correlation	0.289**	0.272**	0.073
	Sig. (2-tailed)	0	0	0.345

Given that there is a correlation between the spatial integration and development status in the radii of n and r, it is not possible to simultaneously consider the spatial integration variable with the two mentioned radii in the same equation and form a multivariate regression (Bidram, 2002, p. 53). Therefore, a simple regression equation was determined between each of the integration radii of n and r and development status. As shown in Figure 8, despite the dispersion of the points, there is a significant correlation between the two variables of development status and global integration (R_n) with R^2=0.094 (weak correlation). Therefore, by providing the possibility of exchange between different neighborhoods, defining a coherent and integrated spatial configuration for Isfahan city at the global scale "may" be effective in reducing the difference between neighborhoods in term of development status or in other words, reducing inequality.

About the two variables of development status and mean integration (R_r), there is a weak correlation between them, and its value is lower than in the value obtained for the global scale (Fig. 9). However, since this weak correlation is significant, it is possible to provide an opportunity to make changes in socio-economic development of neighborhoods without interfering in the structure of local network (structure of neighborhoods) and with minor modifications of the network of streets connecting neighborhoods.

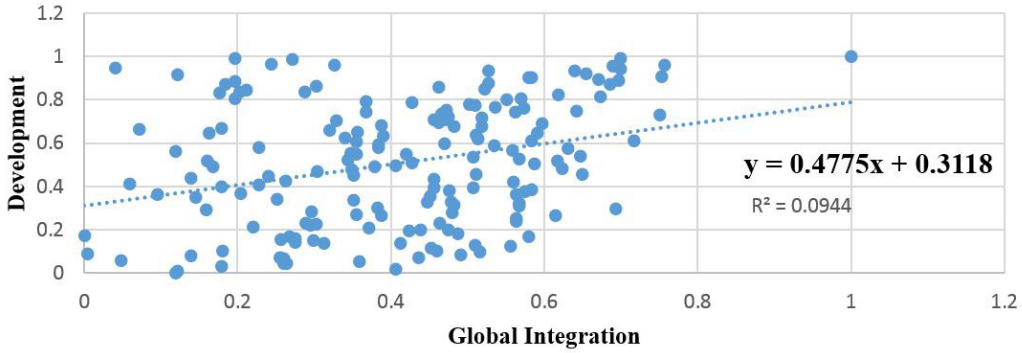

Fig. 8. Diagram and Equation of Regression Line between Variables of Development Status and Global Integration (R_n) Value

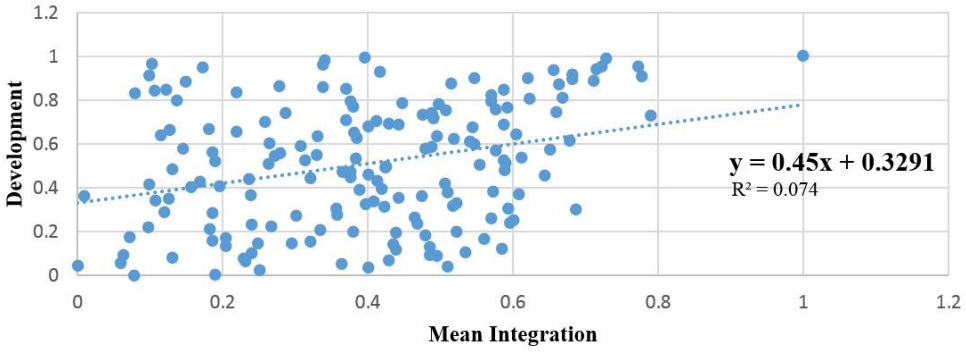

Fig. 9. Diagram and Equation of Regression Line between Variables of Development Status and Mean Integration (R_r) Value

7. CONCLUSION

In the present study, it was attempted to investigate the relationship between spatial configuration and socio-economic development of neighborhoods through a case study. Accordingly, the socio-economic status of Isfahan's neighborhoods (development status of neighborhoods) and the integration of spatial structure of neighborhoods were assessed separately. The results showed that by moving from the center to periphery- for example in new urban textures of Isfahan, which have been formed in the north (northwest and northeast) and south (southwest) of Isfahan City as a result of rapid population growth and new constructions- both the development and spatial integration of neighborhoods gradually decrease. Although at first glance, this indicates the correlation between the spatial status of the city and its socio-economic development, in order to scrutinize how this correlation is at three scales, global, mean, local, the spatial configuration and development of Isfahan's neighborhoods were analyzed using correlation analysis. It was found that although at the global and mean scales, there is a significant but weak correlation between spatial configuration and socio-economic development. Moreover, at the local scale, such a correlation is essentially insignificant. Thus, the neighborhoods with high values of integration at the global and mean scales and a good connection with the spatial structure of the whole city can be considered more developed, but as the correlation is weak, this claim is not necessarily confirmed. However, it is not unexpected that by making changes in the spatial configuration of the city at the global and mean scales, the socio-economic status of Isfahan's neighborhoods, especially those that do not have a high level of development, will change. The obtained results can be inferred as follows:

- The findings of the present study and other domestic and foreign studies should be taken into account in order to validate the application of space syntax method in analyzing spatial structure of cities and examining the significant correlation between the spatial configuration of the city and the socio-economic status of its different parts. Given the differences between the results of this study and previous studies, conducting further studies in different cities (multiple case studies) will shed light on various dimensions of the correlation between spatial configuration and socio-economic structure of cities;
- General strategies for urban systems should be defined in such a way that the policies designed to change the spatial form are considered in conjunction with the policies designed to influence social processes in the city, because despite the results obtained in the present study, spatial patterns in the city cannot be seen as inanimate objects and environments, in which social processes occur, because they contain social information and content that should be studied and read;
- If in Isfahan city, it is supposed to improve the structural integrity of the city and development status of neighborhoods by making changes in spatial configuration of the city, given the significance of the correlation at global and mean scales, the priority should be given to changing the streets connecting the neighborhoods as well as the main streets of the city rather than interfering in and changing the local access network,;
- By creating a spatial balance in the city and modifying the configuration, it is hoped to reduce socio-economic inequalities in Isfahan city, although it should not be assumed that the only factor in development or non-development of neighborhoods is their spatial position in the city configuration.

END NOTE

1. For many years, many studies have been carried out to explain the relationship between the city and society (Giddens, 1984; Durkheim, 1895; Turner, 1974; Bintliff 1999; Kristiansen & Rowlands, 1998); but there are still questions which have remained unanswered, such as what is the relationship between spatial and social statuses of the city or how do spatial networks relate to social networks?
2. Technique of Order Preference by Similarity to Ideal Solution (TOPSIS).
3. The space syntax method examines the representations of physical space of the city in order to try to understand its structure and then analyze the relationship between the structure and its functions (Hillier, 1998; Masoudi Nejad, 2005). This method has the ability to understand the complexity and morphological logic of urban networks and their growth (Hillier, Penn, Hanson, Grajewski, & Xu, 1993. p. 32) and by using the variables obtained from spatial configuration analysis, it recognizes different geometric element patterns created by buildings and cities (Abbaszadegan, 2002). Using this method, it is possible to understand how cities were formed spatially, how they work, grow and change (Daha, 2009).
4. Since these indicators were studied at the macro scale (national scale) and many of these indicators have not been measurable in sustainability assessment at local scale, many studies have reviewed and redeveloped these indicators at the desired scale according to local needs. In these studies, according to the needs and access to different information as well as the scale, which includes neighborhoods, districts, and suburban areas, some indicators appropriate to the research subject have been developed. These indicators follow the generalities of global sustainable development indicators (Habitat, 2009; DETEC, 2004).
5. The information on each of the indicators representing the criteria of "social composition", "literacy", "social stability", "housing", and "health" under the social component, "welfare" and "economic dependence" under the economic component, and "access to private infrastructures" under the physical-welfare component have been obtained by referring to the Isfahan Metropolitan Atlas (2015) and basic GIS maps used for the revision of the detailed plan of Isfahan city (2013). The indicator of "access to public services" related to the physical-welfare component was calculated using spatial modeling. For example, in measuring the access to public transportation services, first, the spatial data related to public transportation lines such as bus and taxi lines, routes, and stations, and high-speed systems in Isfahan city were collected. Since these four spatial layers were not integrated and on the other hand, they were different in terms of topology, a Python-language tool was developed in the Arc GIS software platform through which the rate of access to public transportation services in Isfahan was modeled. The "land value" indicator related to the economic component was also calculated in two different phases of field survey and spatial modeling. At the field survey stage, in different neighborhoods of the city and considering a suitable distribution, land price data was first collected. In the next step, the information of the surveyed points was attributed to a shape file. In the last step, after interpolation of the data using Kiriging method, the average land price for each neighborhood was calculated in Arc GIS software environment.
6. In the Mean integration (R_r), the radius is equal to the average depth from the most integrated line at the global integration; therefore this radius is different for cities with different structures.
7. For information on the ranking of all neighborhoods in Isfahan, refer to the Ph.D. thesis of the first author: Moazezi Mehr-e-Tehran, Amir Mohammad (2016). Urban segregation; a review of socio-spatial separation pattern in cities (case study: Isfahan neighborhoods); PhD thesis of urban Conservation, Isfahan: Art University of Isfahan, Iran.
8. Line map with about 51970 lines, which covers the whole city of Isfahan, was drawn manually in AutoCAD Software.
9. By selecting all three radii of study and analysis, it is aimed to show which of the global, Mean- and Local-scale spatial structure of the city has the greatest influence on the development or underdevelopment of neighborhoods if there is a significant correlation between these three scales of integration and spatial structure of the city.
10. The reason for calculating the average value of integration lines in each neighborhood is that each of the lines in the integration map has a different numerical value depending on its location in the city and its connection with the surrounding spaces.

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