

Analyzing the Relationship between Spatial Structure and Legibility in Administrative Buildings using Space Syntax Method; Case Study: Administrative Buildings of the Fourth post-Iranian Revolution Decade*

Haniye Nemati^a- Kourosh Momeni^{b**}- Mansour Yeganeh^c

^a M.A. of Architecture, Department of Architecture, Faculty of Architecture and Urban Planning, Jundi-Shapur University of Technology, Dezful, Iran.

^b Associate Professor of Architecture, Department of Architecture, Faculty of Architecture and Urban Planning, Jundi-Shapur University of Technology, Dezful, Iran (Corresponding Author).

^c Associate Professor of Architecture, Faculty of Art, Tarbiat Modares University, Tehran, Iran.

Received 04 November 2020;

Revised 28 June 2021;

Accepted 07 August 2021;

Available Online 21 June 2022

ABSTRACT

In each era, the Iranian architecture has provided a specific construction style and method. The Iranian architecture underwent some changes and transformations after the Iranian Revolution. Legibility is an important element in architectural spaces, and plays an effective role in the efficiency and quality of administrative spaces due to the public referral to these buildings. Since architectural books have investigated the contemporary Iranian architecture and the buildings constructed in Iran before 2009, and recently, numerous notable buildings have been built, current study aims to investigate the spatial structure of the administrative buildings designed by the young and modernist architects of the last decade (2010-2020). The main research question is “what are the structural features considered for the legibility of administrative spaces designed by the modernist architects of the fourth post-revolution decade?” Spatial structure is analyzed using the space syntax method in Depthmap and AGRAPH software. This method is used to interpret the relationship between the connectivity and integration in the plans. The results of data analysis indicate that legibility is significantly correlated with visibility, the natural movement of space users, space depth, and integration. It seems that modernist architects have more used three types of spatial structures including radial, centralized, and grid spatial structures with highest legibility in spaces designed with the radial structure. In this type of design, the creation of deep space is minimized and subsequently, visibility, the movement of space users, and space integration are increased. Generally, this structure has paid enough attention to the legibility of the administrative space to meet the architectural needs.

Keywords: Administrative Building, Space Syntax Method, Modernist Architects, Legibility, The Fourth Post-Revolution Decade.

* The present research is derived from the first author's Master's thesis entitled “Designing an administrative complex with the architectural space promotion approach from the perspective of the Iranian contemporary modernist architects”, defended under the supervision of the second author and advice of the third author in the Department of Architecture, Faculty of Architecture and Urban Planning, JUNDI-SHAPUR University of Technology, Dezful, in 2020.

** E_mail: k_momeni@jsu.ac.ir

1. INTRODUCTION

Workspace as an environment, in which the individual passes half the day, has been always taken into consideration by contemporary architecture. Clearly, workspace highly affects the employees' activities and can bring numerous positive and negative outcomes for their job-related activities (Chandrasekar, 2011). It is important to recognize the factors affecting the quality of administrative spaces. The current study has aimed to recognize effective components, features, and factors in architectural design of administrative buildings of the last decade. The main research question is: 1- what are structural features considered for the legibility of administrative spaces designed by modernist architects of the fourth post-revolution decade? To achieve the objectives and answer the research question, the present study has applied new architectural theories to investigate the components affecting the quality of administrative spaces using computer programs. Among the logical architectural and urban research systems, space syntax theory has been more focused in contemporary architecture and urbanization literature (Groto & Wang, 2013). Since the use of space syntax allows designers to predict the movement behaviors of the space user, this model can be used in the design process to create an interaction between the space body and the space user's behavior (Abbaszadegan, 2002). The individual's cognitive map of space is first influenced by the legibility of the environment, i.e. a legible environment can allow its audience to create a unique cognitive map. If this environmental quality is not responsive, the individuals will be confused and cannot communicate with the environment and identify it. As a result, a complete mental image of environment is not formed in their minds. In contemporary architecture, introduction of the western architecture to Iran, and especially the presence of modern architecture in the late Pahlavi era has increased the pace of evolution in the area of architecture and urbanization. The dissociation the 1979's Iranian Revolution created in the Iranian history and society initiated a new movement in all aspects of people's lives among which construction played a fundamental role. After the Iranian Revolution, all higher education institutions and universities were closed for more than two years and then reopened to begin professional training (Bavar, 2010). Two years after the Iranian Revolution, due to the Iran-Iraq war, all construction was stalled for eight years. After the war ended, constructions were reinitiated, however, it was done to meet the basic needs such as housing. In the recent decade, which is the fourth decade after the Iranian Revolution, architecture and construction are revived, architecture has moved towards the post-modernism, and new architects have come to work, each with their own style. It can be said that the architects of this decade are trying to make the most of nature

and the environment, and in designing high-rise administrative buildings, attention has been paid to transparency and free plan. The current study aimed to recognize and investigate the components affecting the legibility of the high-rise administrative buildings designed by modernist architects of the fourth post-revolution decade.

1.1. Research Questions

- What are the structural features of legibility of administrative spaces designed by modernist architects of the fourth post-revolution decade?
- What structure has the highest level of legibility in the administrative buildings designed by modernist architects of the recent decade?

1.2. Research Hypothesis

- It seems in the administrative buildings constructed by the modernist architects, the legibility of the environment can be analyzed by evaluating the general depth, integration, the movement of space user, and the visibility of spaces.
- The highest legibility belongs to spaces with a radial design. In this type of design, the creation of deep space is minimized and subsequently, visibility, the movement of the space user, and space integration are increased.

1.3. Research Background

Recently, various domestic and foreign studies have addressed the space quality in administrative buildings and the application of the space syntax method. Among these studies, the following can be noted: Faisal Sultan (2016) investigated the effects of office design on the employees of the Islamic banks in Pakistan. They identified eight factors affecting the quality of the environment using the descriptive-analytical method and field experiments through the distribution of 300 questionnaires among the employees working in 10 administrative buildings. Then, the data were analyzed using the SPSS software and it was concluded that the three variables of administrative furniture, administrative equipment, and legibility have affected the employees' efficiency while other factors were not much effective (Faisal Sultan, Raghieb Zafar, & Anila, 2016). Namdari & Karbasi investigated the correlation between the outward view of the administrative buildings through the windows, inward views of the space, and the employees' satisfaction with the administrative spaces. In this study, administrative spaces were divided into four categories based on the distance from the window, and by the use of the quantitative method and questionnaire, 79 questionnaires were distributed in the buildings of Municipal District 1 of Tehran, of which 68 were filled in. the data were analyzed by the SPSS and Depthmap and finally, it was concluded that in addition to the role of windows in the creation of a suitable outward view,

the inward view-related qualities, which is the same space legibility, play a very important role (Namdari & Karbasi, 2017). In another study, Pirbabaei & Maleki (2009) investigated the desirable attributes of the administrative space. To do so, they used a descriptive-analytical method and distributed 208 questionnaires among 14 administrative buildings in Tabriz. They concluded that psychological factors are the most effective factors on the individuals, and in the workspace design in Iran, the type of work and the superior-subordinate relationship are very important. The office design should facilitate managers-employees and employees-employees relationships to provide a suitable psychological environment for employees (Pirbabaei & Maleki, 2010). Also, in three volumes of the book "thought of contemporary Iranian architects", Azimi Hasanabadi et al. have interviewed some contemporary architects in all three volumes of the book. In the first Volume, architectural concepts and perceptions have been more discussed. In the second Volume, they have had a critical view of Architectural traditions and system organization, and in the third Volume, they have dealt with the progressing architecture and new theories (Azimi Hasanabadi et al., 2014). Investigating the samples, it is revealed that paying attention to the importance of components affecting administrative spaces is vital, and legibility is one of these components. In the studies on the Iranian contemporary architecture, especially the post-Iranian revolution architecture, due to the turbulence created in the Iranian architecture, this area was very rarely addressed and most of the research have addressed the Pahlavi era's architecture and the post-Iranian revolution architecture in the years before 2010. A great portion of these studies addressed buildings' façade and their forms. Now, using the Depthmap program, the plans of the constructed buildings can be turned into precise graphs to be used for space syntax. The current study has aimed to recognize the works by contemporary architects of the fourth post-revolution decade to investigate their consideration of legibility and the methods applied to create it in space.

1.4. Methodology

The current study has investigated the quality of legibility of administrative buildings in the fourth post-revolution decade to evaluate how much the modernist architects have paid attention to legibility components. To do so, using library study and reviewing documents and samples, the architecture of abovementioned administrative buildings has been investigated. To achieve this objective, first, the required graphical maps related to space user-oriented communicative feature were prepared and analyzed by the use of the Depthmap simulation program. Then, by the use of the content analysis method, the correlation between these features and space legibility has been investigated.

2. LITERATURE REVIEW

The related literature is divided into the Iranian contemporary architecture and the definition of legibility.

2.1. Iranian Contemporary Literature

"It can be assumed that the Iranian contemporary architecture has been initiated from about 1921 onward. This is the time the Iranian city's appearance was transformed due to the political, social, and economic evolutions, and new buildings required for the new lifestyle such as administrative buildings, factories, banks, railway stations, universities as well as new residential complexes and units emerged in cities. Unlike the previous centuries' buildings which were designed and built by the traditional architects, new buildings were gradually designed by the well-educated architects. These architects were non-Iranian at first, and then, gradually, those architects who studied abroad returned, and with the establishment of the First Iranian School of Architecture, the first Iranian educated architects joined them around 1941" (Mirmiran, 1999).

There have been numerous famous architects in each era of the Iranian contemporary architecture, however, due to the gap created, the modernist architects and their working style has been less addressed, which is the objective of the current study.

2.2. Definition of Legibility (Intelligibility)

The movement circulation system in administrative buildings is one of the basic principles of the functional consideration. A successful circulation in such buildings can promote space user's routing and reduce getting lost and confused in building. Intelligibility (legibility) in architectural arrangement can create a memorable visit for the audience and help them get aware of the design and spatial arrangement of the building right after entering it (Soltani & Khaki, 2014). Lynch (1960) describes legibility to be the ability to logically organize and build mental patterns of a place (Lynch, 1960). Lorch (2003) considers legibility to be a character of a space that, besides the creation of the understandable cognitive maps, can help individuals with routing. Legibility is highlighted on two levels of physical form and activity patterns. It is especially important for strangers since they need to perceive the place with no previous arrangements and rapidly (Bentley, 1985).

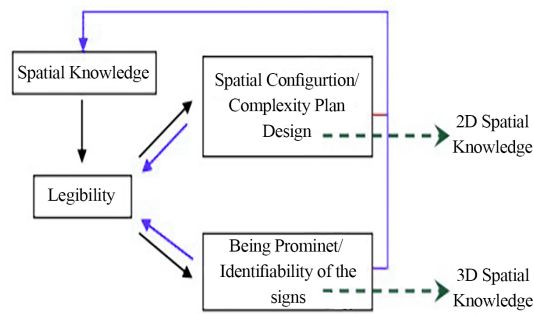


Fig. 1. Components of the Legibility Concept



According to Figure 1, space legibility is linked with spatial knowledge, since legibility is one of the factors that affect people's perception of the environment. The legible space has a clear, simple, and obvious hierarchy. These features allow for faster and easier recognition of the environment (Koseoglu & Erinsel Onder, 2001).

3. INTRODUCTION OF THE SAMPLES



For a comprehensive investigation in the field of contemporary architecture, it is better to choose the

buildings efficiently, so that they can be successful and significant case studies. The inclusion criteria are: 1. The buildings mentioned in the analyses done by contemporary Iranian architecture critics, 2. The buildings addressed by the specialized architectural journals, and 3. The buildings raised at the macrolevel or have won prizes in the architectural competitions. Buildings are generally categorized in four categories based on the number of storeys and the way they are placed on the ground. One and two-storey buildings, three and four-storey buildings, building with more than four storeys until the height of 23 meters, and the buildings higher than 23 meters. According to the definition of Article 22 of the National Building Regulations, high-rise buildings are buildings higher than 23 meters (National Building Regulations, 2013). In this study, high-rise administrative buildings with a height of more than 23 meters, which have been built in Iran in the last decade (2010-2020), and most of them have succeeded in receiving awards and prizes, have been selected by the researchers (Table 1).

Table 1. Famous High-rise Administrative Buildings in Iran from 2010 to 2020

No.	Building Name	Architect	Construction Year	Number of Storeys	Total Number of Storeys	Number of Plans	Image
1	Gandom (Zar Macaron)	Mahram Khoshroo	2017-2019	5 storeys below ground and 8 storeys on and above ground	13	4 plans for storeys, 1 plan for parking	
2	Mica 911	Alidoost et al.	2017-2018	5 storeys below ground and 10 storeys on and above ground	15	4 plans for storeys, 2 plans for parking	
3	Hakim A'azam	Delaram Bolourchi	2015-2017	3 storeys below ground and 7 storeys on and above ground	10	1 plan for storeys, 1 plan for parking	

No.	Building Name	Architect	Construction Year	Number of Storeys	Total Number of Storeys	Number of Plans	Image
4	Azaran Central Office	Reza Sharif Tehrani	2012-2016	4 storeys below ground and 10 storeys on and above ground	14	8 plans for storeys, 2 plans for parking	
5	Saba Office	Mehdi Hamzenejad	2013-2016	2 storeys below ground and 8 storeys on and above ground	10	6 plans for storeys, 2 plans for parking	
6	Sefid Administrative Building	Farshad Kazerouni et al.	2015	1 storey below ground and 7 storeys on and above ground	8	2 plans for storeys	
7	Valiahdi	Hooman Balazadeh	2010-2015	2 storeys below ground and 12 storeys on and above ground	14	3 plans for storeys	
8	Saadatabad	Mohsen Kazemian Fard	2013-2015	2 storeys below ground and 7 storeys on and above ground	9	5 plans for storeys, 1 plan for parking	
9	Mehraz Commercial Administrative	Hamed Badri Ahmadi	2012-2015	3 storeys below ground and 9 storeys on and above ground	12	2 plans for storeys	

No.	Building Name	Architect	Construction Year	Number of Storeys	Total Number of Storeys	Number of Plans	Image
10	Asef Administrative Building	Hamed Badr Ahmadi	2013	طبقه منفی 3 طبقه مثبت 7	10	پلان طبقات 2 پلان پارکینگ 1	
11	Saadatabad's Royal Commercial Administrative Building		2015	7 storeys below ground and 11 storeys on and above ground	18	3 plans for storeys	

4. SPACE SYNTAX METHOD

Space syntax (Hilleir & Hanson, 1984) is a theory and tool for analysis of architecture and urbanization founded by Steadman in London in late 70s and early 80s (Montello, 2007). Hillier and Hanson believed that creation of architectural space is something more than forming the physical elements, and when the architect shapes the physical space, he also shapes behavioral and spatial settings people live and move in (Montello, 2007).

The spatial configuration determines the possibility of people facing or not facing each other and influences such social patterns (Hillier & Hanson, 1984). The space syntax method provides various facilities and tools for the description of the spatial configuration. Numerous studies have indicated that the various measurement tools in this method can be helpful in testing routing and legibility. One of the ways to measure spatial connections is the integration indicator. Integration measures the rate of a space's connection to other spaces. Movement in space is correlated with spatial integration, i.e., a space with higher intelligibility is perceived as a legible space by the space user (Penn & Turner, 2003). In this discussion, it is talked about a space with high integration, i.e., a shallow connection with this space. The connection indicator in this approach is defined as the number of points a point is directly connected to other points. The two other indicators based on which the social features are measured in this theory are the control and the choice. Control is a parameter that determines the degree of the choice of a point from other points to which it is connected. In other words, the lower the degree of the choice of a point compared to a specific point, the less control there is over it. Choice is a general scale of the amount of flow in a space. In fact, a space has a high degree of choice

when a large number of the shortest connecting paths pass through that space (Kamalipour, 2012). Now, it is necessary to briefly mention some basic concepts of this method that are related to the topic. These concepts are spatial order, legibility, and natural movement. the analyses provided in the following chapters are based on these definitions.

4.1. Spatial Order

Spatial order is the way spaces are arranged beside each other and their mutual relationships. Any changes in space syntax affect the activities in that space. Space syntax, both in a building environment and in the city, imposes certain obligations on people who use space. How to understand the whole built environment, among other factors, is also related to how space is arranged (Abbaszadegan, 2002).

4.2. Intelligibility (Legibility)

Hillier also explains that the city's intelligibility is directly correlated with the concept of the reconstruction of the whole city in the mind and arranging these pieces beside each other (Kamalipour, 2012). Intelligibility means the extent and degree of our view of other spaces in the collection, which indicates the number of spaces associated with it (Zhang, Chiaradia, & Zhuang, 2013). In other words, intelligibility indicates the amount of spatial information that can be visually obtained from space.

4.3. Natural Movement

The natural movement is a part of movement which is determined by the space syntax structure. The most important effective factor of movement in a city is the origin and destination points. The passages are mediations are just interfaces that are not necessarily an origin or a destination, but they should be passed

through to reach the destination. How these spaces are chosen by the pedestrians to reach a specific destination is explained by the space syntax method (Abbaszadegan, 2002).

The analyses obtained from the space syntax method are usually provided in the form of graphs, axial maps, numerical analyses, and graphical maps, and based on the research question and objective, any of these techniques can be used. In the simulation process, two methods have been used by the space syntax program. These maps show a better relationship between human behavior and physical environment and they are easier to read and analyze. These two methods are the visibility graph analysis approach and the user movement-based approach, and the AGRAPH program which is the graph theory based on the space syntax technique. The main elements of the graph are the nodes and connections. AGRAPH creates an integration matrix (which shows to what extent the nodes are connected) and an internal distance matrix (which shows the shortest distance between the nodes in the graph). The space syntax parameters are determined by performing some simple calculations on these matrixes, which will be briefly introduced in the following. It should be noted that in the analyses obtained by this program, the architectural scale has been considered.

The Visibility Graph Analysis approach investigates the main indicators of the space syntax approach by the use of visibility analysis. The output of this analysis is a map that indicates the maximum-minimum range of the intended indicator (Kamalipour, 2012). The integration index rate has been investigated in the current study. As was mentioned, the correlation between this index and legibility can be evaluated. The Agent-Based Analysis provides some maps

which are based on the prediction of the space users' movement in the space. The predicted movements inside the plan are simulated based on two main hypotheses: The movement is purposeful, and the models have good information about that environment.

The human behavior, here, is planned based on standing, speaking, looking, and gathering (Penn, Turner, 2003).

The total depth of a node, named n , or TD_n , is the total sum of the shortest distances between that node and the other nodes in a system, i.e. TD_n is the total sum of line n (or column n) in the distance matrix.

AGRAPH is a useful program for space syntax calculations and its output information can be used. It also allows for drawing or modifying the graphs.


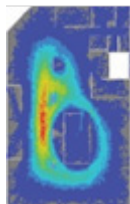
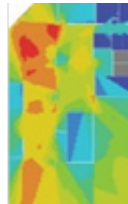
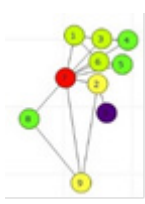

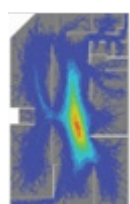

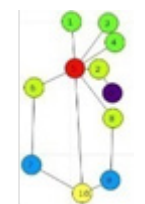

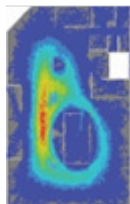
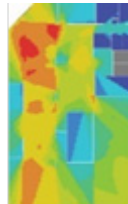
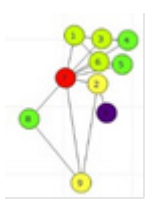

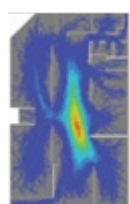

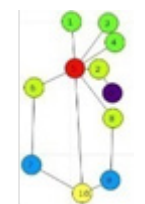
The mean depth for a node is its average depth (or mean shortest distances) between the node, n , and other nodes. If k is the number of all nodes in a system, the relative order of the relative asymmetry determines the integrity of a node and its value ranges from zero to one, in a way that the lower values indicate higher integrity.


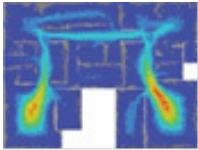
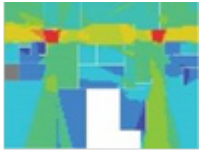
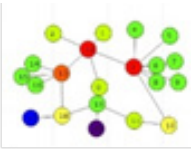

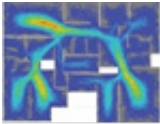
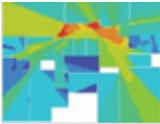
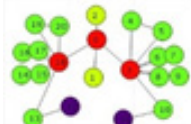

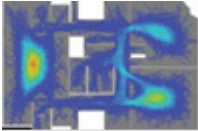
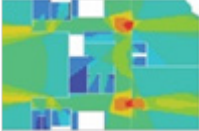
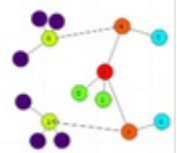

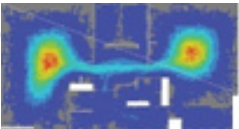
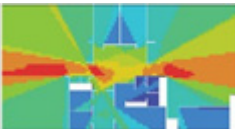


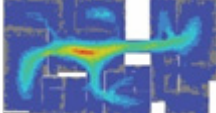
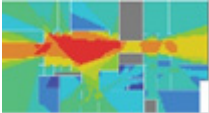


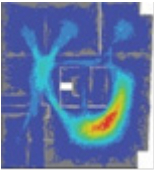
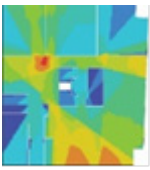


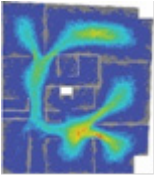
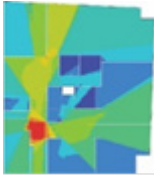
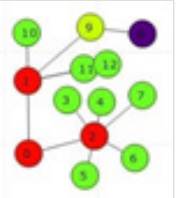
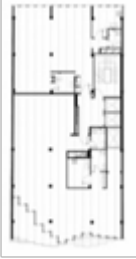
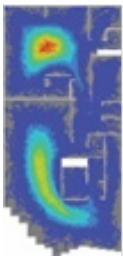


Integration is a parameter for which, unlike the relative asymmetry, higher values indicate higher integrity. When a node is well integrated with the surrounding nodes, this parameter is increased. In other words, it acts inversely to the previous parameter.

5. ANALYSIS OF RESULTS

The plans in the administrative spaces built by the modernist architects after the Iranian revolution have been investigated in terms of the space legibility (Table 2) and their output maps have been assessed.

Table 2. Maps and Analysis of the Space Syntax Method for Famous Iranian High-rise Administrative Buildings Built from 2010 to 2020

		AGRAPH	Visibility	Space User Movement	Maps	Plan Type
Open Plan	Gandom					
						
Combined Plan	Gandom					
						

AGRAPH		Visibility	Space User Movement	Maps	Plan Type
Open Plan	Mica 911				
Combined Plan	Mica 911				
Closed t	Hakim A'azam				
Open Plan	Azaran				
Combined Plan	Azaran				
Open Plan	Saba				
Combined Plan	Saba				
Open Plan	Valiahdi				

AGRAPH	Visibility	Space User Movement	Maps	Plan Type	
Combined Plan	Valiahdi				
Combined Plan	Sefid				
Combined Plan	Saadatabad				
Open Plan	Mehraz				
Combined Plan	Mehraz				
Combined Plan	Asef				
Closed Plan	Saadatabad's Royal				

In this regard, the structural legibility is investigated and then, by evaluation of components such as integration, link, depth, view, and space users' movement in the administrative buildings, space legibility along the visual integration can be

investigated and assessed, which itself indicates the complexity or simplicity of the spatial connections. From analysis of Table 2, which results in the justified Table 3, the following can be categorized.

Table 3. Legibility Indicators (Total depth, Mean depth, Relative order, Integration, Space User's movement, and Visibility) of the Famous High-rise Administrative Buildings in Iran Built from 2010 to 2020

Building Name	Total Depth (TDn)	Mean Depth (MDn)	Integration i	Space User's Movement	Visibility
Gandom (Open plan)	16	1	7	47.17	14.32
Gandom (Combined plan)	21	2	4	17.78	13.26
Mica (Open plan)	58	2	5	30.11	5.96
Mica (Combined plan)	58	2	5	18.87	7.46
Hakim	44	3	3	14.1	8.77
Saadatabad's Royal	38	15	1	17.17	4.05
Saba (Opn plan)	19	2	6	32.45	10.90
Saba (Combined plan)	31	3	2	30.11	8.23
Sefid	15	1	4	40.75	13.18
Saadatabad	20	2	5	48.41	17.27
Mehraz (Open plan)	22	2	4	36.59	6.90
Mehraz (Combined plan)	21	2	3	23.51	8.48
Valiahdi (Open plan)	30	2	3	31.95	7.57
Valiahdi (Combined plan)	60	3	5	17.65	6.09
Azaran (Open plan)	28	2	6	34.29	8.45
Azaran (Combined plan)	46	2	3	37.42	6.88
Asef	31	2	2	7.9	9.42

The space legibility rate is correlated with indicators such as the depth and integration of space, visibility, and space user's movement. Regarding the analyses done, it is revealed that the deeper the space, the lower the space integration, and subsequently, the visibility and space user's movements are lowered and space legibility is reduced. Based on extracted numbers and values, the highest total depth belongs to the Valiahdi building with 60 units and the lowest total depth belongs to the Sefid building with 15 units. If we compare the plans of these buildings, we would find out that the Valiahdi plan is drawn with long walls and the building is divided into three sections in the middle. This spatial division has led to the creation of deep space and lower visibility, and subsequently reduced integration and increased movement. But in

the Sefid building, the plan is open, and to separate the spaces, instead of using walls, the furniture has been used, which has prevented the creation of deep space and increased the inward view of the building, and as a result, the integration and movements have also increased which is indicative of the increased legibility of the building space.

Analyzing the natural movement graphs in high-rise administrative building plans, it can be said that natural movements are higher in wider spaces, and after that, tendency to movement is focused in the connective corridors. The modernist architects have well used this feature and by the use of free plans and appropriate placement of the stairs, the lowest confusion is created in the plan, i.e. space user can easily find the intended employee right after entering

the building. According to the analyses, the highest natural movements belong to the open plans with the maximum use of furniture for space separation. The plans have obtained the maximum natural movement by separating the service space from the administrative space.

To assess the legibility components in the administrative buildings' plans, some graphs can be obtained in the Depthmap program by the use of two methods. One is Visibility Graph Analysis and

the other is Agent-Based Analysis. In the obtained graphs, the regions in red are the most visible and as the colors become cooler, legibility is decreased. In the analyses, the VGA, which determines the inward view in the plans, is maximized in wide spaces without any partitions or walls, according to the graphs. That is why the administrative section is designed more openly, and in the plans designed openly, this component is increased (Fig. 2).

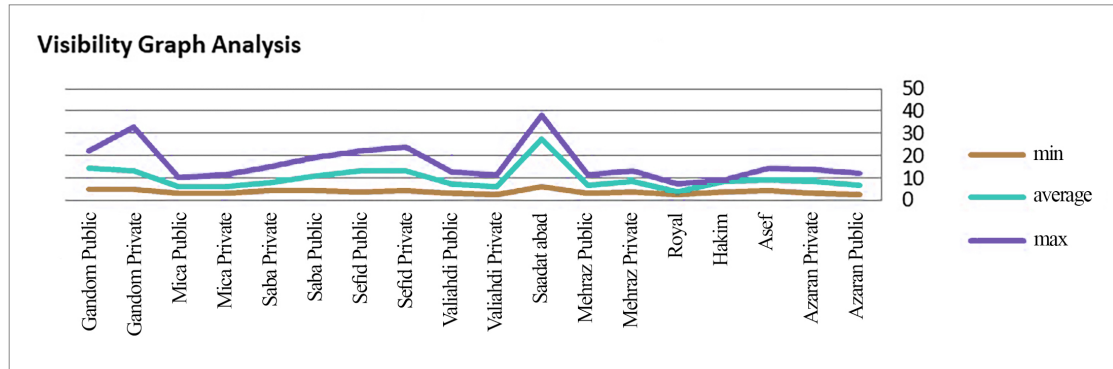


Fig. 2. Analysis of the Studied Administrative Buildings' Visibility

Also, in the graph of the users' movement in space, the higher this component in the plan, the warmer the color (red), and in spaces with a lower rate of movement, the color becomes cooler (blue). Based on the output graphs, the highest rate of movement in

the administrative spaces are seen in the corridors and corridor intersections in the plan. After these spaces, the highest rate of movement are seen in wide spaces and free plans (Fig. 3).

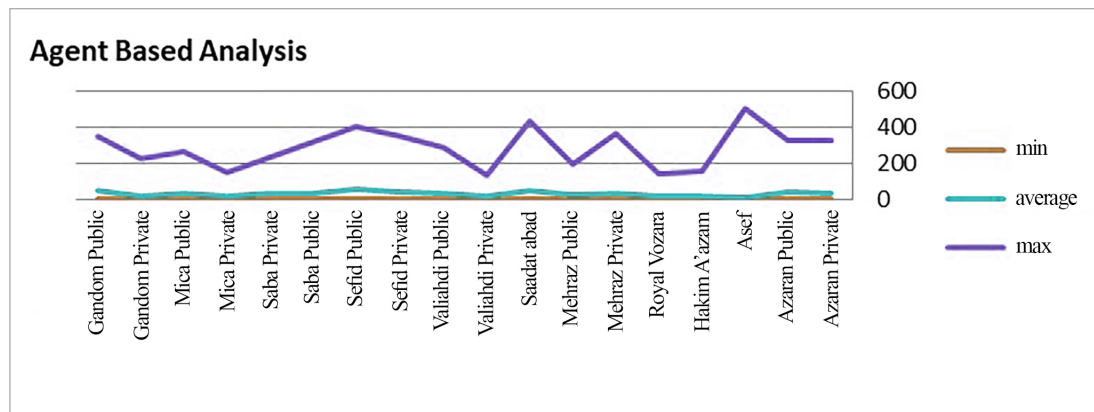


Fig. 3. Agent-based Analysis in the Studied Administrative Buildings

The young and modernist architects of the fourth post-revolution decade have used furniture to separate spaces, instead of partitioning, so that the space user can find the intended employee as fast as possible, after entering the space. Also, the employees would enjoy an appropriate inward view. Using furniture for partitioning space prevents the creation of deep spaces and increases integration in the plans. It can be noticed that space legibility is more effective in space design than other components, and based on the analyses in the Justified Graph, the administrative

buildings can be divided into radial, central, and grid organization categories (Fig. 4).

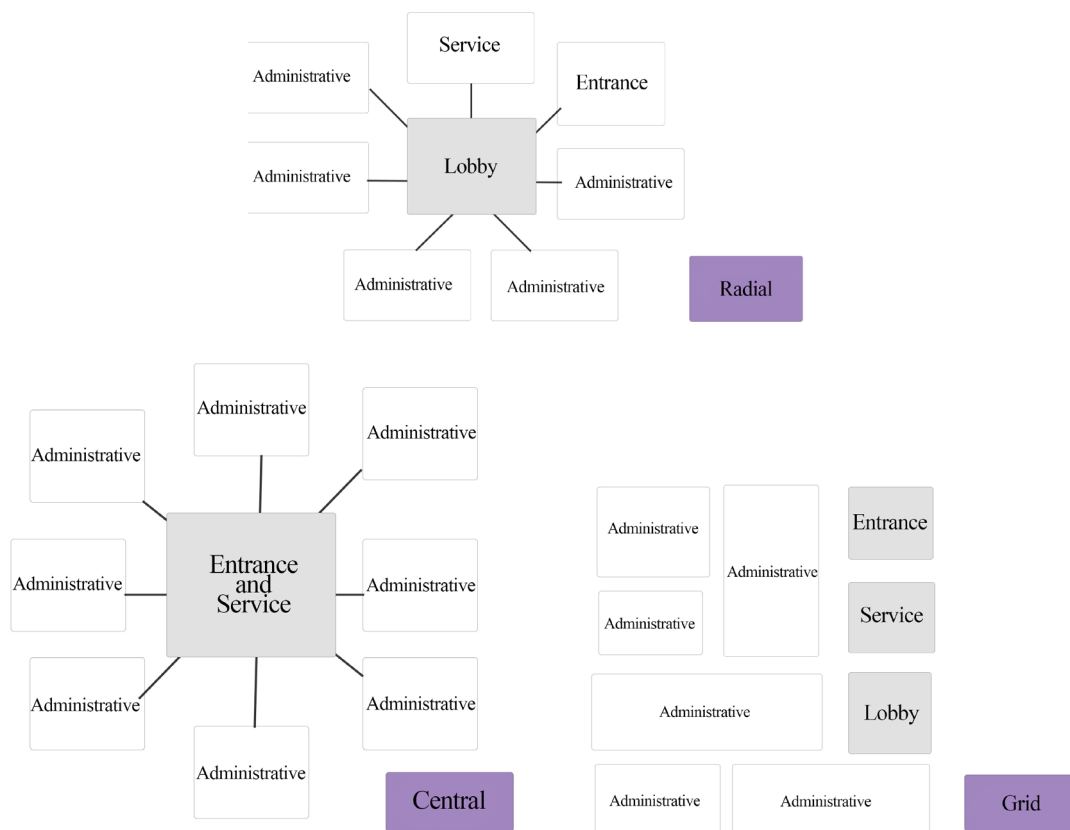


Fig. 4. Radial, Central and Grid Organization of Studied Administrative Buildings

In the central organization, space depth is increased due to the type of circulation, and the user's movement in space is decreased. Also, the inward view is reduced. Some examples of such organizations are the Hakim A'azam, Mica, and Saadatabad's Royal administrative buildings. According to the

output graphs and diagrams, the legibility of this space compared to other administrative spaces has decreased due to the placement of the stair box in the middle and the division of the plan into two separate parts (Fig. 5).

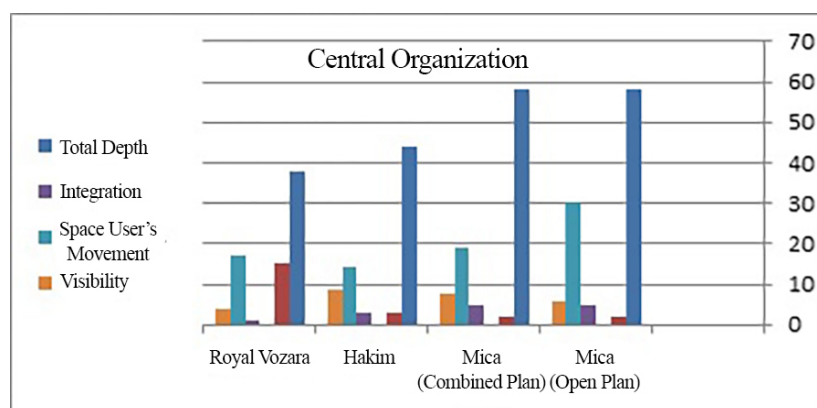


Fig. 5. Legibility of Studied Administrative Buildings with Central Spatial Structure

In the radial organization, the entrance and service sections are placed on the corner of the plan, and the space user enters the lobby or waiting room after passing through a wide area. Vast administrative rooms are placed around the lobby. In such spaces,

since spaces are mainly separated by furniture and the service section and entrance are placed in the corners, the angles are not created in space. The inward visibility in spaces is increased and the movement in the administrative spaces is facilitated. Examples

of such buildings are the Gandom, Azaran, Sefid, Saadatabad, and Mehrnaz. Based on the outputs, the

highest legibility belonged to this type of organization (Fig. 6).

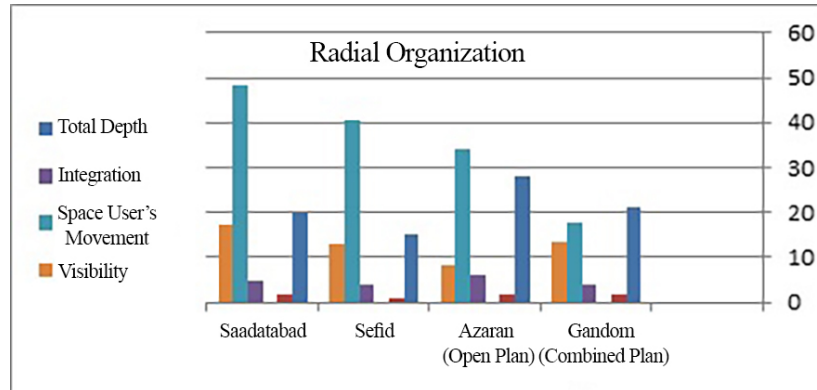


Fig. 6. Legibility of Studied Administrative Buildings with Radial Spatial Structure

Another spatial organization used in administrative buildings is the grid organization. In this type of organization, the spaces are divided based on a specified distance which is mostly the design's columns. Such spatial organization is more used in the buildings with combined plans. In most combined plans, the connective spaces are located in the corners and the service spaces are located in the middle with the administrative spaces around them. The space is very deep and thus, the visibility is decreased and the

space user's movement is also reduced. As a result, the space integration is also decreased. However, the difference between this spatial structure and the central structure is that the central structure is divided into two separate spaces, and the legibility is minimized, however, in the grid structure, the whole space is moving and interacting, and it is not wholly divided. Examples of such structures are Asef, Mehrnaz, Valiahdi, Saba, and Azaran administrative buildings (Fig. 7).

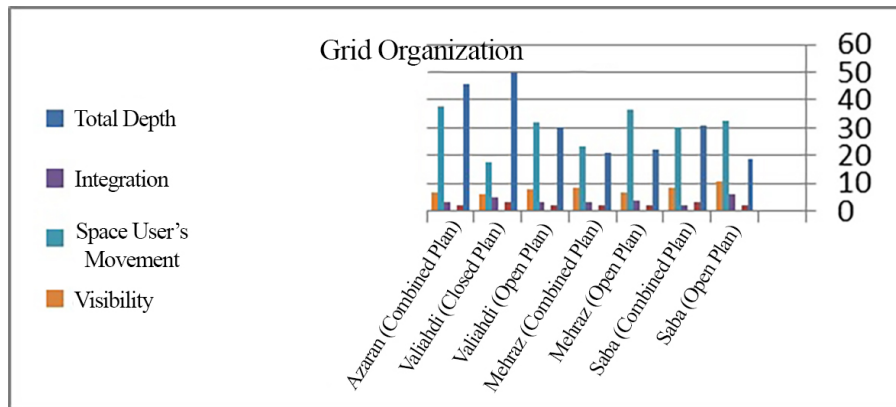


Fig. 7. Legibility of Studied Administrative Buildings with Grid Spatial Structure

7. CONCLUSION

Legibility is one of the most principal components of design which creates desirability for employees and customers in the administrative buildings. Legibility in architectural space can be assessed with the components such as depth, integration, space user's movement, and visibility. Based on the analyses, it seems that the deeper the space, the lower the rate of the space user's movement and visibility in space, and subsequently, the lower the legibility. Based on the assessments, it seems that the post-

revolution modernist architects have more used three radial, central, and grid spatial structures in the last decade, and regarding obtained outputs, the highest legibility belongs to spaces with a radial design. In this type of design, deep spaces are minimized and as a result, visibility, the space user's movement, and space integration are increased. Legibility has been increased in the radial structure, the total depth has ranged from 15 to 28, and the space user's movement has ranged from 17 to 48%. After the radial structure, the grid structure has had the highest legibility which has been more used in the combined plan designs. In

this structure, the total depth has ranged from 21 to 50, while the space user's movement has ranged from 18 to 37%. And finally, the central structure has had the lowest legibility which has been more used in closed plans. In this structure, the total depth has ranged from 38 to 58%, while the space user's movement has ranged from 17 to 30%. It can be concluded that the modernist architects of the fourth post-revolution

decade have more designed plans with the grid organization due to the access to semi-open plans and the creation of combined administrative space to meet all spatial needs of the design. They have designed open plans by the use of radial structure and closed plans by the use of central structure paying enough attention to the legibility alongside all architectural needs.

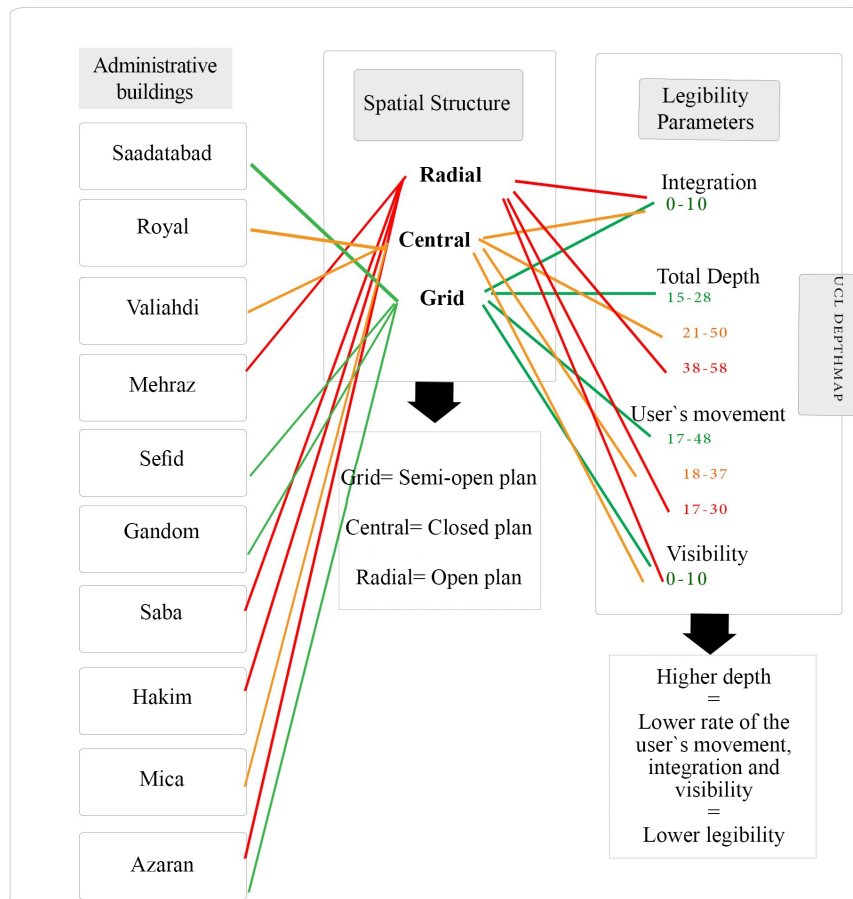


Fig. 8. Template Suggestion of Administrative Buildings Constructed by Modernist Architects

REFERENCES

- Abbaszadegan, M. (2002). Space syntax method in the urban design process. *Urban and rural management*, 9, 75-64. <http://ensani.ir/file/download/article/20101109192703-6.pdf>
- Azimi Hassanabadi, A., & Ghahari, S. A. (2014). *Thought of Contemporary Iranian Architects 2*. Tehran: Farhang Saba.
- Bavar, S. (2010). *A View on the Emergence of New Architecture in Iran*. Tehran: Faza Publishing.
- Bentley, I. (1985). *Responsive environments: a manual for designers*. London: Architectural Press. https://books.google.com/books/about/Responsive_Environments.html?id=pMCjgvyPOYQC
- Chandrasekar, K. (2011). Workplace environment and its impact on organisational performance in public sector organizations. *International Journal of Enterprise Computing and Business System*, 1(1), 1-20. <https://www.ijecbs.com/January2011/N4Jan2011.pdf>
- Faisal Sultan, M., Raghieb Zafar, M., & Anila. (2016). Office Design and its impact on employees' productivity: evidence from the Banks from Karachi. *International Journal of Scientific and Research Publications*, 6(6), 335-342. <http://www.ijsrp.org/research-paper-0616/ijsrp-p5446.pdf>
- Kamalipour, H., Memarian, Gh. H., Feizi, M., & Mousavian, M. F. (2012). Formal composition and spatial configuration in indigenous housing: A comparative comparison of guest space zoning in traditional houses in Kerman. *Housing and rural environment*. 31(138), 16-3. <https://www.sid.ir/fa/journal/ViewPaper.aspx?id=167075>
- Koseoglu, E., & Erinsel Onder, D. (2001). Subjective and objective dimension of spatial Legibility Social and Behavioral Science. *Procedia - Social and Behavioral Sciences*, 30, 1191-1195. <https://www.sciencedirect.com/science/article/pii/S1877042811020568>
- Lynch, K. (1960). *The image of the city*. Cambridge Mass: The Technology Press & Harvard University Press. https://www.miguelangelmartinez.net/IMG/pdf/1960_Kevin_Lynch_The_Image_of_The_City_book.pdf
- Mirmiran, S. H. (1999). A new trend in today's Iranian architecture. *urban architecture*, 50 and 51, 1-4. <https://bayanbox.ir/view/7140058963009548892/53.pdf>
- Montello, D. R. (2007). *The Contribution Of Space syntax To a Comprehensive Theory Of Environmental Psychology*. 6th International space syntax symposium. Istanbul, 1-12. <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.509.3933>
- Namdari, M. R., & Karbasi, A. (2017). Investigating the relationship between outside view of rooms and configuration of office spaces on employees' satisfaction with the desirability of these spaces: Case Study: District 1 municipality building. *Seffeh Publishers*, 27(79), 19-35. <https://www.sid.ir/fa/journal/ViewPaper.aspx?id=356531>
- Penn, A., & Turner, A. (2003). *Space syntax based agent simulation*. Bartlett school of graduate studies, London . 1-16. https://www.researchgate.net/publication/32884789_Space_Syntax_Based_Agent_Simulation
- Pirbabaei, M. T., & Maleki, M. (2009). Factors affecting the desirability of administrative workspace. *Fine Arts (Architecture and Urbanism)*, 1(40), 70-61. https://jfaup.ut.ac.ir/article_68360.html
- Soltani, S., & Khaki, A. (2014). *Study of legibility in workspace using analytical method of space syntax: Case study: Administrative building in the pre-construction stage*. National Conference on New Theories in Architecture and Urban Planning, 1, 12-1. <https://www.sid.ir/fa/seminar/ViewPaper.aspx?ID=17500>
- Zhang, L., Chiaradia, A., & Zhuang, Y. (2013). *In the intelligibility maze of space syntax: A space syntax analysis of toy models, mazes and labyrinths*. Proceedings of the Ninth International Space Syntax Symposium, Seoul, Sejong University, 1-18. http://sss9sejong.or.kr/paperpdf/scb/SSS9_2013_REF082_P.pdf

HOW TO CITE THIS ARTICLE

Nemati, H., Momeni, K., & Yeganeh, M. (2022). Analyzing the Relationship between Spatial Structure and Legibility in Administrative Buildings using Space Syntax Method; Case Study: Administrative Buildings of the Fourth post-Iranian Revolution Decad. *Armanshahr Architecture & Urban Development Journal*. 15(38), 133-148.

DOI: 10.22034/AAUD.2021.227407.2347

URL: http://www.armanshahrjournal.com/article_152318.html

**COPYRIGHTS**

Copyright for this article is retained by the author(s), with publication rights granted to the Armanshahr Architecture & Urban Development Journal. This is an open- access article distributed under the terms and conditions of the Creative Commons Attribution License.

<http://creativecommons.org/licenses/by/4.0/>

