Studying Flexibility Factor in the Architecture of Khaneh-Hussainias Using Space Syntax Theory with Approach to Social Relations, Case Study: Amini, Razavi and Akhavizadegan Khaneh-Hussainia in Qazvin*

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ABSTRACT: In recent years, space syntax theory has been used for analyzing spatial configurations; these analyses mostly focus on social aspects. According to the space syntax theory, space arrangements affect the space usage in buildings. This paper aims at studying spatial configurations of some traditional houses in Iran in terms of flexibility factor. Besides of having the housing function and providing inhabitancy, having Hussainia function and providing a place for holding religious ceremonies, these buildings have turned to a flexible space due to those two different functions. Considering building time of these houses, Qajar period, they are taken into consideration of these terms. This paper discusses flexibility as a quality factor due to the concept of space syntax. Three Khaneh-Hussainias have been selected by the non-probabilistic sampling from the city of Qazvin, named Amini, Razavi and Akhavizadegan. Then the access graphs of these houses are represented as data processing matter with convective degrees of two functions. Orosi has been introduced in this paper as an element that influences flexibility of spaces. The methodology of this paper is based on descriptive-analytical research in order to be adopted with plans of the houses for analyzing data. The results which are concluded from deductive argumentation demonstrate that flexibility in these houses is formed from justified space syntax on the basis of socio-cultural factors.

Keywords: Space Syntax, Khaneh-Hussainia, Flexibility, Social Relations.

INTRODUCTION

Space syntax originated in the early seventies in an **e**ffort to understand why, from a spatial point of view, buildings and built environments were as they were, and occupied only a small corner of the theoretically vast field of architectural and urban possibility. The earliest space syntax work took real environments, such as organic settlements, and vernacular buildings, and tried to identify the formal, spatial and functional forces that generated their characteristic spatial forms. The earliest uses of the term space syntax in the mid seventies described this type of work. From there, space syntax moved to an attempt to create consistent techniques for the representation and analysis of spatial patterns with a view to eventually

being able to simulate spatial design proposals and arrive at a basis for predicting how they would work (Hillier and Hanson, 1997).

In this paper, using space syntax approach, "flexibility in the function" has been studied as it is one of the fundamental aspects in formation of some traditional vernacular dwellings in Iran. Flexibility is one of the key concepts in architecture. So if it will be studied and contemplated deeply it can help today`s dwelling design. Flexibility depends on different functional, socio-psychological and economic factors; and over time the change in dwelling system of families, daily and seasonal needs and changes of family members' activities, has influenced it (Einifar, 2003, pp. 64-77). In this paper three

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Khaneh-Hussainias have been chosen in city of Qazvin. Since Khaneh-Hussainias are one of the urban space elements in Iran which form urban context so studying them employing space syntax approach would show main space arrangements of these houses and gives us a pattern of planning.

METHODOLOGY

The first publication of space syntax analytic techniques were in the early eighties, and they were then included in 'The Social Logic of Space', although this was a book whose primary intention was to try to redraw the theoretical map of socio-spatial studies. But it is true to say that an important aspect of the influence of that book has been methodological. Numerous scholars in many fields all over the world took up the analytic techniques for their own problems (Hillier and Hanson, 1997). So, unsurprisingly, many attempts have been made in this field in Iran. For instance, Memarian and Sadoughi`s studies in which justified graph is used to explore social relations with respect to "privacy and seasonal changes"[1].

An important aspect of space syntax method is to examine the degree of circulation in or through each space. Spaces that connect more spaces are more integrated and those that only have a minor relationship are more segregated. From this point of view, a central courtyard in an Iranian house will generally be a highly integrated space. Many of the rooms, however; such as the "central room", the most important winter room- and the Talar- the most important summer space are relatively segregated. Highly integrated spaces are identified as the most accessible or public and those spaces with a high degree of segregation can be considered to be more isolated or private spaces (Memarian and Sadoughi, 2011). By studying three case studies in this paper, it will be noticed that integrated spaces such as Central Courtyard, Central

Room, Winter Room and Talar, exist in all of them (Figs. 4-21). "The access graph is undoubtedly a useful tool to analyze spatial relations. As Brown has observed: One of the great virtues of the access graph is its visual clarity: it translates the topological structure of the building plan into a simple and highly legible diagram. Drawn in justified format, with the exterior as root, it becomes especially easy to determine the number of alternative routes for coming in or going out of the building, and the consequent relationship that each internal space has with the outside: tree-like patterns may be distinguished at a glance from those with cycles or rings" spaces (Memarian and Sadoughi, 2011).

LITERATURE REVIEW

Space syntax is introduced as: a set of techniques for representation and quantification of "spatial patterns". The steps towards quantification can be achieved by considering the space pattern as a two-dimensional convex structure (Orhun, 1995, p. 476). In some articles "space pattern" is called "space configuration" as Hillier accounts. "Configuration" seems to be a concept addressed to the whole of a complex rather than to its parts. Intuitively, it seems to mean a set of relationships among things which are interdependent in an overall structure of some kind. There is a way of formalizing this idea that is as simple as it is necessary. If we define spatial relations as existing when there is any type of link - say adjacency or permeability - between two spaces, then configuration exists when relations between two spaces are changed according to how we relate one or other, or both, to at least one other space. This rather odd sounding definition can be explained through a simple graphic example (Fig. 1). Configurationally differences are shown rather neatly, and clarify by using the j-graph (Hillier, 2007).
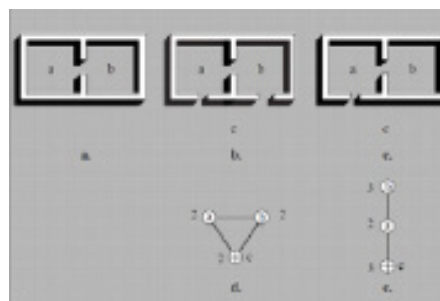

Fig. 1. J-Graph (Hillier, 2007)

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According to Julian Hanson`s research which confirms that within a building or a settlement, the spatial measure of how integrated or segregated a particular space is a powerful predictor of how busy or quiet it is likely to be. She also declares: "Integration is the key by which we can understand the social content of architecture and show how buildings and places function at a collective level. This is not a naive 'architectural determinism' which says that buildings and places compel people to behave in particular ways. The effects which we have identified are from spatial patterns to patterns of movement among collections of people, which arise from everyone going about their business in a very ordinary way. Houses articulate relations between social groupings, not individuals, and so most dwellings, however simple, are already elaborations of the elementary building. The forms of habitation which we have considered so far have been relatively stable in their internal layout over time, but in many cultures dwellings take on a dynamic aspect growing, partitioning and eventually fission and re-forming, in a cyclical pattern dictated by the evolving composition of domestic group" (Hanson, 1998).

Architecture is about the exploration of possibility which can be possible space syntax techniques. In the recent past, access graphs have been applied as a space syntax technique to analyze the spatial configuration of buildings in correlation with the social concepts.

Social Relations: Philosophers have always been puzzled by relations because they seem at once to exist in the real world, and to be abstractions. Typically, the philosophical problem of relations re-appears at the very heart of architecture. Architecture, we say, is the art of 'assemblage'. In creating works of architecture we create complexes of relations which we call by such names as compositions, plans, styles and types. Such terms indicate that both as spaces and as forms buildings are essentially relational schemes. It is through their relations that we recognize the difference between one kind and another. Yet we have few terms or concepts for these differences.

We talk easily of this formal element or that space, but we have little idea how to talk about the spatial and formal relational schemes which give each building its critical identity. Nor is it clear that relational schemes of space and form have any necessary connection to each other. Not only does a problem of philosophy appear in architecture, it seems, but it appears in a very complex way (Hillier and Hanson, 1997).

Standing on the subject of culture is just the starting point of understanding home culture. Concerning the cultural effect on house form as a consequence of socio-cultural factors considered in their most general meaning while building a house is a cultural phenomenon in itself (Rapport, 1969, p. 47)

In investigating home culture; social relation as a system of internal socio-cultural factor is clearly important. Given the importance of understanding home culture, the question of spatial configuration analysis system appears. Can space syntax of architecture, with the use of justified graphs indicate a perfect image of internal social relations of houses? In this paper two kinds of graphs have been suggested due to both functions that the houses provide which could make clearer demonstration of social events in them. Having khaneh and hussiania functions in these building bring the flexibility terms to the mind that do these places account for flexible places? If so what are the affections on graphs?

Flexibility and Features: The concept of flexibility is quite often misunderstood. To some, it means that the building can accommodate growth through expansion. To others, it means that the building can allow for changes in function through the conversion of spaces. To still others, it means that the building provides the most for the money through multi-function spaces. Actually, flexibility covers all three factors—expansibility, convertibility, and versatility (Pena and Parshall, 2001, p. 85).
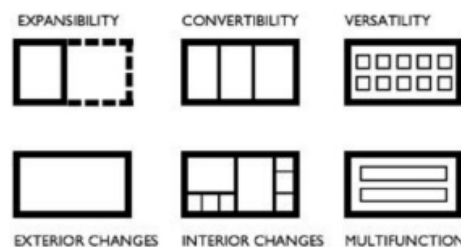

Fig. 2. Flexibility Features (Pena and Parshall, 2001)

There are justifications for the multi-functionality of room both at the same time and at different time. The multi-functioning room is a possibly truer answer to the Modern architect`s concern with flexibility. The room with a genetic rather than a specific purpose, and with movable furniture rather than movable partitions, promotes a perceptual flexibility rather than a physical flexibility, and permits the toughness and permanence still necessary in our building. Valid ambiguity promotes useful flexibility (Venturi, 1966, p. 34).

There are many elements associated with the flexibility in buildings; one of the elements which significantly has been used in Amini Khaneh-Hussainia is Orosi, a mesh wooden window with colored glasses, that can be opened vertically. When the Orosi is installed indoor it will act as a temporary partition which connects separated spaces into a whole great space. When the Orosis are opened three Talars change to one great Talar. So it will be more appropriate for holding indoor ceremonies as it is mentioned in Fig. 3.

Fig. 3. Amini Orosi

Khaneh: A Persian word equivalent for house. Houses everywhere serve the same basic needs of living, cooking and eating, entertaining, bathing, sleeping, storage and the like, but a glance at the architectural record reveals an astonishing variety in the ways in which these activities are accommodated in the houses in different historical periods and cultures. The important thing about a house is not the list of activities or rooms but the pattern of space, governed by intricate conventions about what spaces are, how they are connected together and sequenced, which activities go together and which are separated out, how the interior is decorated, and even what kinds of household objects should be displayed in the different parts of the home. If there are principles to be learned from studying the design of dwellings, they do not yield easily to a superficial analysis of 'basic human needs' (Hanson, 1998, p. 2).

History of Iranian Urbanization and Architecture: Archaeological research and historical documents give evidence that the history of Iranian urbanization and urban planning goes back to the pre-historic periods, from that time architectural and urbanization styles developed in different directions particularly with regard to religion.

In general the 11th/16th century was a period of splendor and magnificence, both for the development of different arts and urbanization in Iran. During the reign of the first Safavid ruler, there was not much architectural and building activity. At the time of second Safavid ruler, the capital was transferred from Tabriz to Qazvin. The city of Qazvin, because of its geographical position, was important even from the Sassanian period. Qazvin was also important in the Seljuk period, and at that time many beautiful buildings such as mosques and defensive walls, were constructed. During Qajar reign, Tehran became capital and a developed city, and many interesting monuments were constructed in Tehran (Kiani, 1995, pp. 121-122); similarly, in other cities of Iran like the old capital, Qazvin, such monuments were built; some of the instances of buildings are Amini Khaneh-Hussainia, as well as Akhavizadegan and Razavi Khaneh-Hussainia which are the major focus of this study.

Ceremonies and Places for Mourning; Hussainia: Although the details of Muharram differs not only in the various communities including the Shia in Iran, Arab countries and India, but also from city to city and even from neighborhood to neighborhood. The ceremony generally consists of two main parts, one rally like as meeting and the other congregate groups of mourning. Holding mourning ceremonies in Iran and Iraq has a long history, and has even stated that mourning for Imam Hussein is rooted in Iranian culture. But the political situation led the Shia not to be appeared in public spaces, so often the meetings were held in private houses. After the fall of the Umayyad caliphate, Shias, particularly in Iraq, found the opportunity to go to Karbala and visit the shrine of Imam. But those for whom it was impossible to pilgrimage to the shrine of Imam due to distance of Karbala would gather in the shrines of other Imams for Muharram ceremonies. Two traditions of meeting in houses and visiting Imam shrine are still important during Muharram ceremonies, although over time the public places for mourning meetings were used (Aminzadeh, 2000, p. 57). So, Hussainia, also known as an Ashurkhana or Imambargah, is a congregation hall for Shia commemoration ceremonies, especially those associated with the Remembrance of Muharram.

Khaneh- Hussainia: Synthesizing the two functions, Khaneh and Hussainia, results in a house with a flexible usage; besides its main function as a house a part of it is dedicated to religious ceremonies; people gather there for religious ceremonies and hold anniversaries and bewail for their Imam.

ANALYSIS AND RESULTS

In the following pages plans and access graphs of Amini, Razavi and Akhavizadegan Khaneh-Hussainias have been represented according to space syntax approach:

Figs. 6 , 7 and 8 presents Andaruni, Biruni and

basement access graphs of amini Khaneh-Hussainia in which some bullets have been put in separated zones as in Fig. 6 we see a square around the bullets which are located at the 5 to 8 convective degrees; this zone is allocated to kitchen of the house and is accessible only by one space; bullet 33. At convective degree of 3 another zone has been separated which are about basement of Andaruni that are accessed from court yard.

Also, at Akhavizadegan Khaneh-Hussainia in Fig. 17, from 6 to 8 convective degrees, another zone has been shown that is accessible only by one place; bullet 13 which is stairs.

Table 1. Space Numbers in Amini Plan

| 1- Entrance	2- Reception Courtyard		3- Corridor	4- Corridor	5- Room
6- Room	7- Talar	8- Talar	9- Room	10- Room	11- Tea Room
12- Room	13- Room	14- Corridor	15- Corridor	16- Talar	17- Room
18- Corridor	19- Talar	20- Kitchen	21- Abanbar	22- Room	23- Room
24- Corridor	25- Ivan	26- Corridor	27- Private Courtyard		28- Talar
29- Talar	30- Court Yard	31- Talar	32- Room	33- Corridor	34- Room
35- Corridor	36- Room	37- Kitchen	38- Court Yard	39- Room	
40-Pastoo (Store)		41- Corridor	42- Talar	43- Kitchen	44- Talar
45- Entrance	46- Room	47- Court yard	48- Talar	49- Corridor	50- Store
51- Ivan	52- Stairs	53- Toilet	54- Toilet	55- Bath Room	56- Corridor
57- Bath	58- Corridor	59- AbAnbar	60- Corridor	61- Room	62- Kitchen
63- Corridor	64- Corridor	65- Store	66- Sardabeh	67- Corridor	68- Corridor
69- Store	70- Store	71- Store	72- Store	73- Sardabeh	74- Stairs
75- Corridor	76- Toilet				
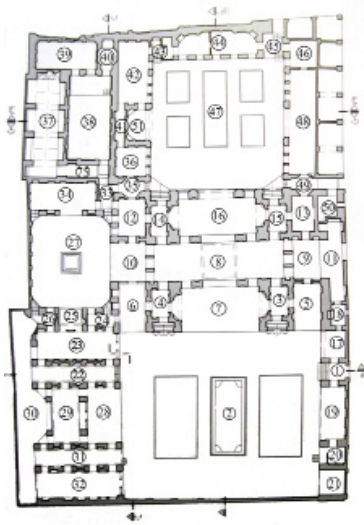
Fig. 4. First Floor Plan of Amini Khaneh-Hussainia (Mohamadzadeh et al., 2007)
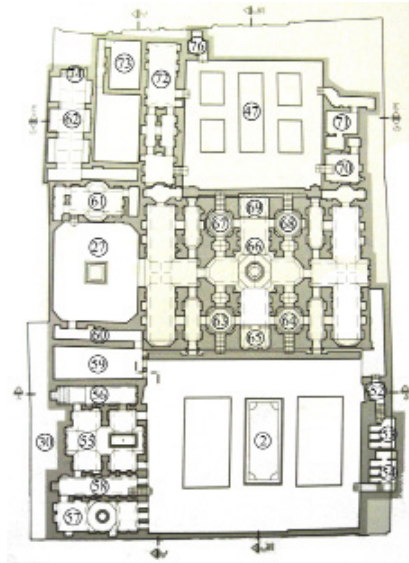

Fig. 5. Basement Floor Plan of Amini Khaneh-Hussainia (Mohamadzadeh et al., 2007)
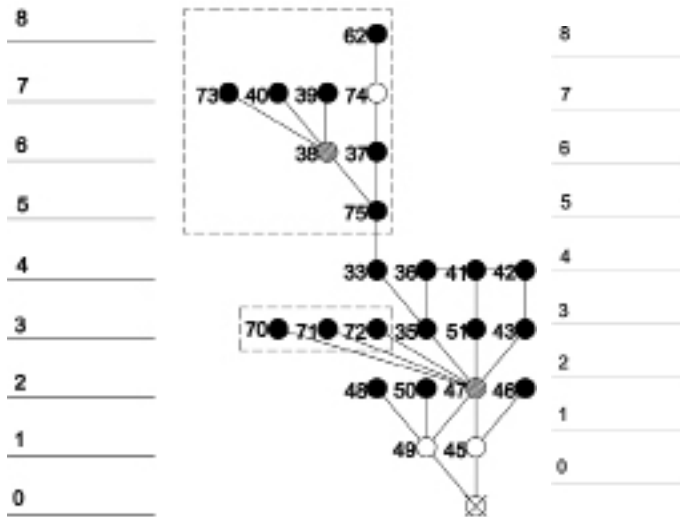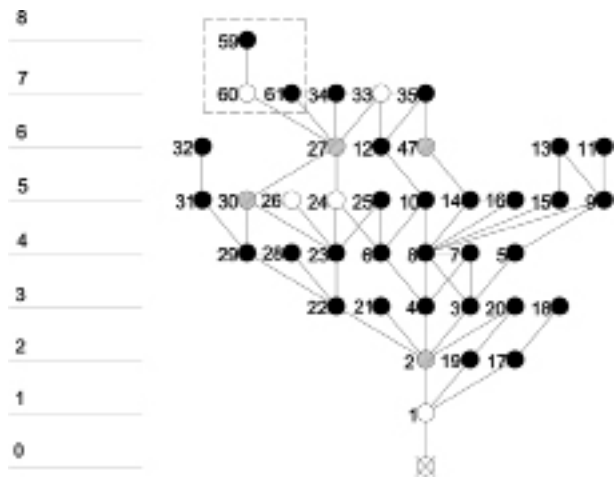

Fig. 6. Andaruni Access Graph of Amini Khaneh-Hussainia

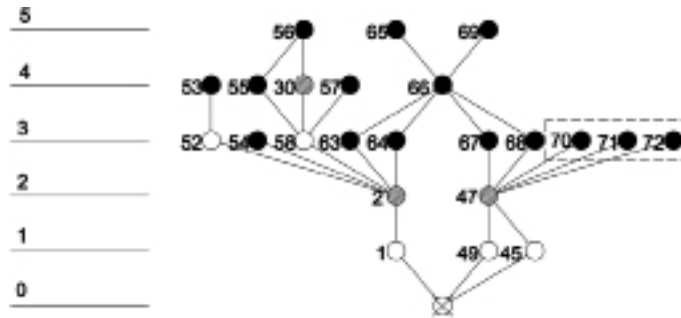**Fig. 7. Biruni Access Graph of Amini Khaneh-Hussainia**

Fig. 8**. Basement Access Graph of Amini Khaneh-Hussainia**

Table 2. Space Numbers in Razavi Plan

1- Versatile	2- Corridor	3- Courtyard	4- AbAnbar	5- Talar	6- Corridor
7- Room	8- Room	9- Ivan	10- Yard	11- Stairs	12- Entrance
13- Corridor	14- Room	15- Room	16- Courtyard	17- Corridor	18- Corridor
19- Room	20- Room	21- Tanabi	22- Tanabi	23- Room	24- Room
25-CentralRoom	26- Kitchen	27- Store	28- Corridor	29- Corridor	30- Room
31- Room	32- Room	33- Room	34- Room	35- Room	36- Talar
37- Stair	38- Sardabeh	39-HozKhaneh	40- Store	41- Store	42- Store

Fig. 9. **First Floor Plan of Razavi Khaneh-Hussainia (Mohamadzadeh et al.,** 2007**)**

Fig. 10**. Basement Floor Plan of Razavi Khaneh-Hussainia (Mohamadzadeh et al.,** 2007**)**
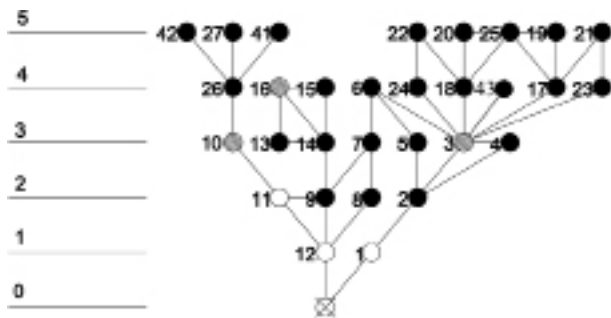
Fig. 11. First Floor Access Graph of Razavi Khaneh-Hussainia
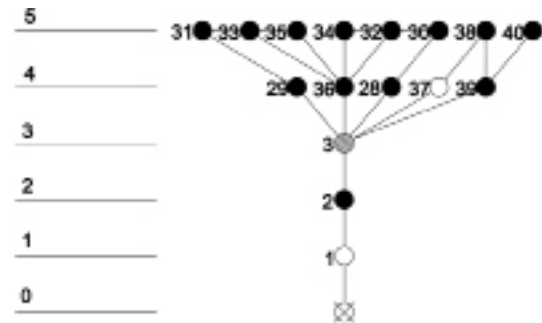
Fig. 12. Basement Floor Access Graph of Razavi Khaneh-Hussainia

Table 3. Space Numbers in Akhavizadegan plan

1- Versatile	2- Antechambe	3- Court Yard	4- Room	5- Talar	6- Corridor
7- Talar, Summer Room		8- Corridor	9- Room	10- Talar	11- Corridor
12- Talar, Winter Room		13- Stairs	14- Corridor	15- Mahtabi	16- Corridor
17- Sardabe	18- Store	19- HozKhaneh	20- AbAnbar	21- Corridor	22- Sardabe
23- Toilet					

Fig. 13. Basement Floor Plan of Akhavizadegan Khaneh-Hussainia (Mohamadzadeh et al., 2007)
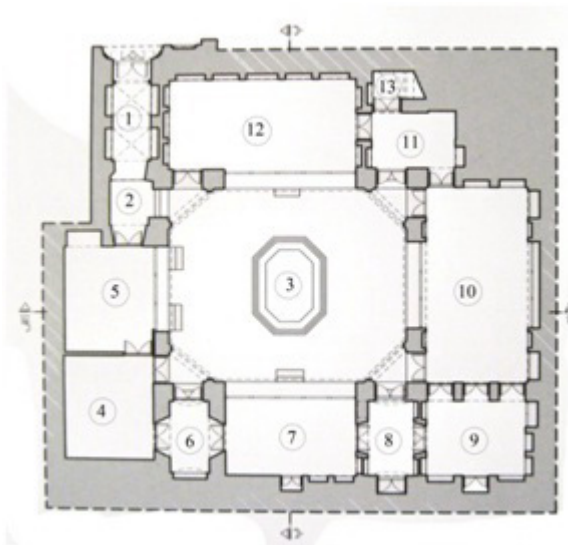
Fig. 14. **First Floor Plan of Akhavizadegan Khaneh-Hussainia (Mohamadzadeh et al.** 2007 **)**
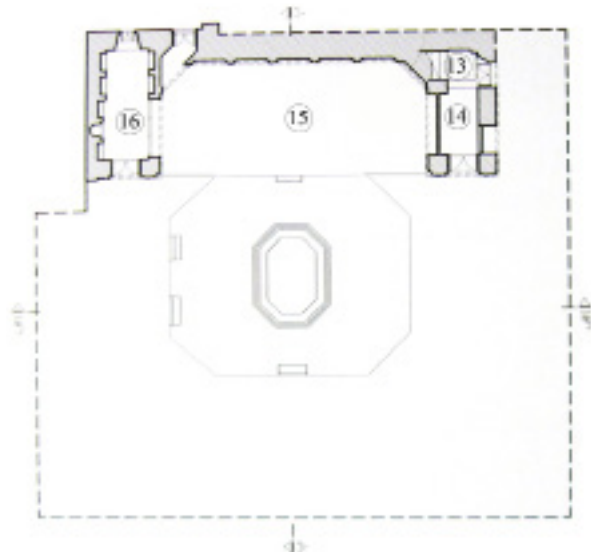
Fig. 15. **Second Floor Plan of Akhavizadegan Khaneh-Hussainia (Mohamadzadeh et al.** 2007**)**
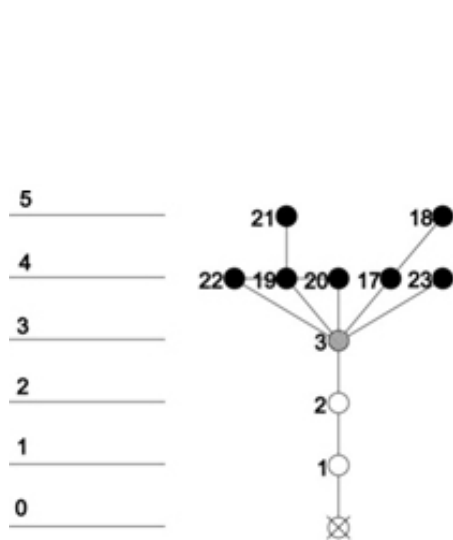

Fig. 16. **First Floor Access Graph of Akhavizadegan Khaneh-Hussainia**
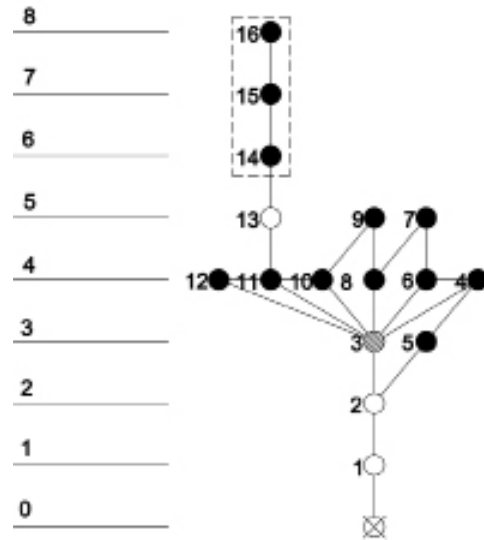

Fig. 17. **Basement Floor Access Graph of Akhavizadegan Khaneh-Hussainia**

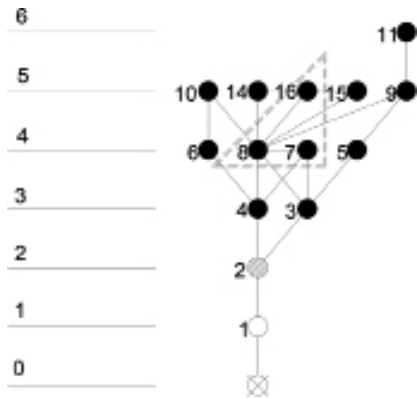The following access graphs illustrate the Khaneh-Hussainias when they are being used just for ceremonies holding reasons;

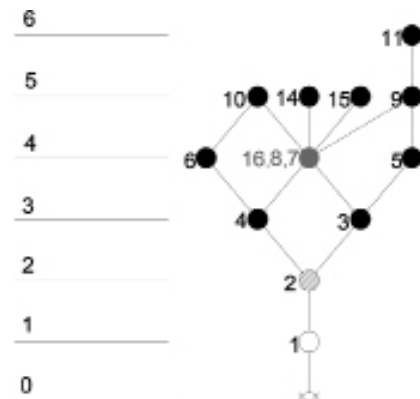Fig. 18. **Access Pattern of Amini Khaneh-Hussainia at Ceremony Periods.**

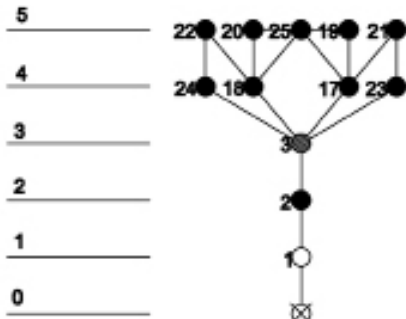Fig. 19. **Access Pattern of Amini Khaneh-Hussainia at Ceremony Periods.**

Fig. 20. **Access Pattern of Razavi Khaneh-Hussainia at Ceremony Periods.**
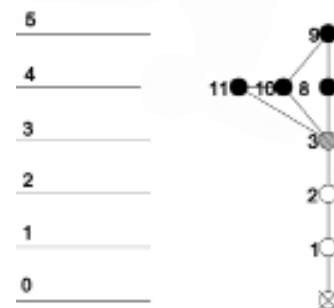

Fig. 21. **Access Pattern of Akhavizadegan Khaneh-Hussainia at Ceremony Periods.**

DISCUSSION

The following tables are extracted from access graphs of the Khaneh-Hussainias for discussion reasons:

Table 4. Comparing Total Number of Bullets in Amini Khaneh-Hussainia Floors and Common Bullets in Both

Row	Total Number of Bullets				The Common Bullets in Both Functions
	Khaneh		Hussainia		
	Basement	First Floor	Basement	First Floor	
1	3	1	-	1	(1)
2	5	3	-	2	(2)
3	13	6	-	1	(3),(4)
4	9	7	-	4→3**	(5),(6),[(7),(8),(16)]
5	4	10	-	5→4**	(9),(10),(14),(15)
6	2	6	-	1	(11)
7	4	5	-	-	-
8	1	1	-	-	-

* A Modification in the Graghs; Numbers Reduces After Opening of Orosis
** Numbers Reduces After Opening of Orosis

Table 5. Comparing Total Number of Bullets in Razavi Khaneh-Hussainia Floors and Common Bullets

Row	Total Number of Bullets				The Common Bullets in Both Functions
	Khaneh		Hussainia		
	Basement	First Floor	Basement	First Floor	
1	2	1	-	1	(1)
2	4	1	-	1	(2)
3	7	1	-	1	(3)
4	9	5	-	4	(17),(18),(23),(24)
5	7	8	-	5	(19),(20),(21),(22),(25)

Table 6. Comparing Total Number of Bullets in Akhavizadegan Khaneh-Hussainia Floors and Common

Row	Total Number of Bullets				The Common Bullets in Both Functions
	Khaneh		Hussainia		
	Basement	First Floor	Basement	First Floor	
1	1	1	-	1	(1)
2	1	1	-	1	(2)
3	1	2	-	1	(3)
4	5	6	-	3	(8),(10),(11)
5	2	3	-	1	(9)
6	-	1	-	-	-
7	-	1	-	-	-
8	-	1	-	-	-

By comparing presented charts and tables and investigating room numbers which are the same in both functions, Hussainia and Khaneh, it should be noticed that the rooms are all related to the public spaces such as halls and adjoining rooms to halls (Tanabi). Also corridors lead to the halls. All these spaces are Birooni part of the houses. In other words, Hussainia function which is related to holding ceremony by different groups of people, whether resident individuals or the neighborhood, is provided through public spaces in these houses. Private spheres that include private spaces such as bedroom are not used at the time of ceremonies. As the main intention of builders of the houses are not clear for us at the time of building and through designing procedure and related documents are not available, studying the graphs do not demonstrate as if Akhavizadegan or Razavi khaneh-Hussainia were designed for the purpose of Hussainia originally or not, but despite some of the factors such as

Orosi in the interior of Amini, it is probable that constructor and original owner of Amini had the intention to have magnificent mourning ceremony in this house.

Since, each of the halls is majestic by itself opening Orosis will make a greater unified atmosphere for a more majestic ceremony to be held.As it can be seen in the justified graphs, the convective degree that illustrates distance of involving and combining of inner space from the origin space, outside, suggests that these buildings are relatively introverted spaces. It is the opportunity for future studies to survey khaneh-Hussainias in extroverted areas. In the tables taken from the graphs, the numbers shown in the rows present convective degree; the total number of spaces in the tables demonstrates that peak number, which belongs to Khaneh function, could be seen in the Hussainia function at the same convective degree as well. These places belong to public spaces which are the most accessible spaces.

these places named in space syntax theory, integrated. In addition, the other overhead convective degrees are allocated to private spaces mostly which called segregated and belongs to spaces like kitchen in which special people would go like servants.

CONCLUSION

Based on the application of justified graphs the term of flexibility is challenged for three Khaneh-Hussainias. The presented access graphs demonstrate the architectural aspect of space syntax theory, which is based on internal social relations of the houses. It may be concluded that from the beginning of the formation of these Khaneh-Hussainias, a multi functional spaces had been considered in the planning beside the climatic and socio-cultural factors but outcomes do not express it as it was mentioned in discussion section. Need to note this point that analysis of spatial relations with the use of justified graphs may lead to the ignorance of other elements of vernacular architecture.

At Amini Khaneh-Hussainia, Orosi, as it was introduced an element of flexibility effects justify graphs (Figs 18 and 19). This kind of affection has not been observed before in any graphs produced by space syntax theory. Since terms of multifunctional in the houses have become obvious and they are considered to have flexible spaces, two kinds of access graphs were drawn for each function; one related to ordinary function of house and the other one related to the Hussainia function. Common spaces in both functions were clarified after comparing tables retrieved from these graphs. Studying common spaces indicated that they are the ones which account for exterior spaces (Birouni). From the socio-cultural point of view, it can be concluded that any of the houses that their designing plan were derived from the public and private spheres (interior and exterior) have the capacity to become Khaneh-Hussainia. Private spaces of these houses including bedroom, basement, kitchen, warehouses and the other private spaces are not used in the mourning time by publican and they are isolated mostly during hussainia function. So, these spaces are distinctive features of the two functions. Some segregated spaces influence access graphs by increasing convective degrees. These spaces which were separated by foursquare zones at figures are accessible only from one place in a lower convective degree. From this we could understand that there is a special social relation which would allow only special persons to use these spaces. Privacy as a socio-cultural factor potentially organizes different spaces in a building that wanted or not may lead to multifunctional spaces.

ENDNOTE

1. Privacy: The concepts of privacy and hospitality have had a great impact on home culture and housing formation. These cultural traditions come from a fundamental Islamic tradition, the control of social interaction between the sexes (Khatib-chahidi, 1993, p.115). Memarian and Sadoughi`s issue had an organizing role play of important patterns: pattern of privacy and pattern of hospitality. Two kinds of arrangements have been developed according to these patterns. One is developed to separate the private and reception areas of the dwelling, which is a pattern of privacy; another provided a special area for guests (Memarian and Brown, 1996, p. 45). Reception area (Birouni) is part of a house into which it is only acceptable for a male guest to enter. The women's world made up of a private realm is segregated from the men's world (Memarian & Brown, 2006 , p.26). Climate and seasonal movement: Climate has had a great impact on the spatial arrangement in Iranian houses. As well as, influencing the overall form of the house, it can also generate seasonal movement between different parts of the house (Beazly and Harverson, 1982, pp. 64-69). Seasonal movement in a house is one of the features of domestic life in Iran, and some neighboring Arab countries.

NOTE

All the presented plans are taken from the book "Lasting heritage, historical monument`s map of Qazvin". Spaces have been numbered by authors through the use of space syntax approach.

All the justified graphs and tables which are presented in this paper are produced by analytic point of view of authors through using space syntax theory.

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