Privacy at home: Analysis of behavioral patterns in the spatial configuration of traditional and modern houses in the city of Hamedan based on the notion of space syntax

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Abstract
The Iranian concept of home goes far beyond physical aspects, and its essence is interwoven with the spiritual nature of humankind. This concept has gained new meanings with the modernization and industrialization of societies. In Iranian architecture, every need is realized in socio-physical systems as well as in design issues. Therefore, spatial relationships are central to architecture, especially residential architecture that addresses a great proportion of an individual's daily life.

Space syntax seeks to explain how spatial configurations express social or cultural meanings. One such meaning is confidentiality, which was mainly introduced into Iranian architecture as a result of religious beliefs. In Iranian architecture, confidentiality is viewed from the aspect of privacy.

This study is a case study that makes use of description, analysis, and logical reasoning. The objective is to analyze behavioral patterns in the spatial configurations of traditional and modern houses in Hamedan. In so doing, library research, software simulation with the UCL Depthmap package, and comparison techniques are utilized.

The findings indicate that the spatial configurations of houses have changed in the course of time. In terms of the indices of spatial configurations, however, the striking difference between traditional and modern houses in Hamedan revolves around the integration and equivalence of all spaces in a house. In other words, the hierarchy of access to spaces and the recognition of...
1. Introduction

Houses have always been built according to the needs of their inhabitants. However, in recent decades, irregular and undesirable changes that are not based on real needs but are mere imitations have been applied to buildings. The beginning of this trend can be traced back to the introduction of western architecture to Tehran by the first generation of Iranian architects during the reign of Naser-oddin Shah in the second half of the 19th century (Alalhesabi and Korrani, 2013). These architects were mainly concerned about promoting modernist architecture in Iran, specifically in the Pahlavi period. Therefore, Iranian modernization in architecture is rooted in the works of these architects (BaniMasoud, 2009). As a result, Iranian architecture, which was closely interwoven with rich Iranian traditions, and the quality of residential buildings were transformed after the return of Iranian architects who were sent to Europe to study architecture (Alalhesabi and Korrani, 2013).

The number of residential buildings has increased because of the urgent housing needs of the growing population. A very good example of a large-scale construction in Iran is the recent project of Maskan-e Mehr. This nationwide project is carried out by the government to build inexpensive residential complexes in large quantities for families with no permanent places of residence. Maskan-e Mehr buildings are representative of the contemporary style of residential architecture in Iran. Mostly constructed in living quarters on the outskirts of cities and towns, these buildings represent an unprecedented experience in affordable housing. The main objective of the Maskan-e Mehr project is to provide housing within a short period and with the lowest construction costs (Nastaran and Rainaee, 2010).

Obviously, the inappropriate design of living spaces may be physically and mentally harmful to inhabitants who spend a remarkable portion of their time in these spaces. A much discussed notion in the field of environmental psychology is the notion of privacy conceived as an urgent need of individuals in artificial environments. To obtain a desirable state of privacy, each individual resorts to certain means depending on their sociocultural milieu. One important means is the appropriate design of living space and environment.

The organizing principles of space signify interpersonal relationships as much as they indicate the general state of mankind (Tuan, 1977). Therefore, lifestyle highly depends on one’s ownership of a private space (Rossler et al., 2005; Hanson, 2008). In addition, the needs and abilities of residents also change in time (Baldwin and Tomita, 2007). Hence, privacy needs vary within individuals at different times and within cultures at different historical periods because of changing social customs and taboos (Newell, 1994). Under this context, a study on the concept of privacy and its influence on the spatial configurations of traditional and modern buildings is important. The basic hypothesis in the present study is that given the current need for privacy in the spatial organization of modern buildings, privacy has not been widely recognized as a behavioral pattern that may influence the spatial configuration of a living space. The research questions are as follows:

1. In what ways do the spatial configurations of traditional and modern residential buildings in the city of Hamedan meet the essential need for privacy?
2. Do the spatial configurations of residential buildings change in the course of time in terms of behavioral patterns? If yes, in what ways?

2. Review of literature

Thus far, much research has been conducted into the meanings of privacy and its determining factors. However, in terms of architecture, accessing the interior environment of private houses to improve design quality comes with serious limitations. A solution to this problem is using specialized software packages for analysis and simulation.

The idea of space syntax was first introduced in Iran by Abbaszadegan (2002) and Memariani (2002). Subsequently, this concept was applied to research into the urban structure in Iran (Yazdanfar et al., 2008; Rismanchyan and Bell, 2010, 2011; Mokhtarzadeh et al., 2012). Kamalipour et al. (2012) categorized the formal composition of native houses in Kerman and studied the spatial configuration with regard to the arrangement of land for the parlor in traditional houses in Kerman. However, a gap exists in the application of this approach to architecture with a special emphasis on environmental psychology.

3. Definition of key concepts

“Housing is a crucial site in the day-to-day life of most individuals for the distribution of wealth, control over life circumstances, access to social resources, important factor in processes of social identity formation, and the establishment and maintenance of social relationships” (Dunn, 2000). Hayward identified nine meanings of home by asking the study subjects to sort statements related to home. The meanings include social relations, social networks, self-identity, privacy, continuity, personalization, activity base, childhood homes, and physical structures (Shin, 2014). According to Hanson, a house is a dynamic structure that grows and changes in size and configuration according to
changes in the household (Omer, 2011). In summary, a home entails a physical space that influences the emotional and mental needs of individuals (Saruwono, 2012) and is organized according to a certain order of social principles (Reis, 2003). Thus, spatial relations must be considered in the design of living spaces, especially in houses where individuals perform many of their daily activities.

3.1. Space syntax

Space syntax, which is based on graph theory, is mainly used to analyze spatial configurations (Jeong et al., 2014). This theory was developed by Hillier and Hanson in 1984 in London. In this year, Hillier and Hanson published The Social Logic of Space, in which they outlined a syntactic theory for the organization of spaces in buildings and settlements. In the book, they argued that buildings, towns, and cities exhibit particular spatial properties that translate to sociological rules, which affect how people relate to one another. Within this framework, the spatial configuration of a dwelling or settlement is believed to present a fairly precise map of the economic, social, and ideological relations of its inhabitants (Hanson, 1998; Dawson, 2002).

This theory assumes that space is the primary core of sociocultural events. However, as space is in turn shaped throughout social, cultural, and economic processes, it is usually regarded as invisible, and its form is not taken into account (Makri and Folkesson, 2000). In the theory of space syntax, spatial and social forms are in such a close relationship that a certain spatial configuration may define a number of social patterns, including the distribution pattern of land use, movement, urban crimes, and location of immigrants (Hillier, 2007).

Previous methodologies based on space syntax initially neglected all design traditions, and by providing quantitative solutions, these methodologies restricted the applications of the theory. However, scholars such as Kasemook illuminated various methodological aspects of this theory and proposed qualitative approaches to society, human beings, and to the relationship between humans and the physique of a city (Kasemook, 2003). A considerable number of research and publications have indeed shown that previous space syntax studies focused on real environments and identified the intrinsic nature of man-made environments (Mustafa and Sanusi Hassan, 2013). A prominent showcase of the use of space syntax for buildings is the evaluation of design proposals for the Tate Britain in London in 2002 (Dursum, 2007).

3.2. Privacy and space configurations

Privacy is vague and ambiguous (Margulis, 1977), and a precise conception cannot be determined because any such conception is bound to reflect the ideas of a particular society at a given time (Westin, 1970; Fischer, 1971; Kelvin 1973; Mellors, 1978). This term is usually used in at least four different senses: freedom to select seclusion, freedom to engage in undisturbed intimacy with a group of selected individuals, freedom to remain anonymous to others, and freedom to remain protected by not revealing any personal information (Forgas, 1994). Consequently, sustaining one's privacy can help counterbalance the power imposed by other individuals in a high social status (Kelvin, 1973).

The privacy of individuals is a fundamental characteristic of all human cultures. This privacy should not be violated without reason (Hanson, 2008). The concept of privacy in Islam refers to the segregation between males and females. It involves the segregation of private and public spaces to provide security for family members. Islam only allows free social interaction between males and females who are known as mahram, which refers to a family member (Mortada, 2003).

As a result, achieving privacy in a house requires the interior space to be invisible to strangers and the spatial configuration to be appropriate to provide efficient communication within the house (Naghi Zadeh, 2008).

To this end, people usually tend to use various behavioral mechanisms, including verbal, non-verbal, or environmental (such as marking a personal territory) behavior, as well as cultural norms and actions (Altman, 1975). Environmental mechanisms are the topic of the present work.

An environment can either facilitate or inhibit certain behaviors, cognitive processes, moods, and so on (Rapoport and El Sayegh, 2005); such effect is obvious in the case of a house, which is a primary territory for most individuals in relation to daily activities, privacy, and social interactions (Rahim and Hashim, 2012). In fact, the architectural privacy configuration of physical factors contributes to how individuals establish and maintain control over their accessibility (Laurence et al., 2013).

Buildings, especially traditional ones, are basically organized on the basis of people’s beliefs; one such belief among Iranians is respect for private life and self-esteem (Pirniya, 1987: 35).

The entrance of Iranian houses has a particular spatial character and is not usually connected to the yard and interior houses directly but by means of intermediate spaces (Haeri Mazandaran, 2009). One of these intermediate spaces is called ‘hashti’ which usually has an octagon shape (as the Persian word hasht means ‘eight’). Hashti comes out of the interior space and is the only place which is connected to the outdoor space (Pirnia, 2005). This space prevented the ‘sacred’ interior from being seen by strangers. Among the interesting functions of hashti are spatial division, pause, and a waiting room (Memariani 1386). After hashti, one had to go through the yard, parlor, and andaruni and then through twisty corridors which were called dalan (Pirnia, 2004). In fact, it is undeniable that, in an architectural arrangement, weaker connection of a space to other spaces and, thus, greater depth of a space compared to other spaces denotes that the accessibility of that space is more difficult and its spatial intimacy is higher.

In space syntax theory, the following indices are used to study the social aspects of subjects (Jiang et al., 2000; Klarqvist, 1993; Lima, 2001).

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2"Mahram means a person who is in a degree of consanguinity, affinity, or fosterage precluding marriage (Hussin and Zawawi, 2012). In Moein Persian Dictionary, mahram is defined as follows: (1) a close relative to whom marriage is prohibited; (2) wife; (3) kin, relative; (4) an acquaintance (Moein, 2010).

3As some traditional houses were small, they did not have hashti, and one would enter the dalans immediately after the entrance.
3.2.1. Connectivity
It is defined as the number of points at which a space is directly connected to other spaces. For instance, the connectivity of a room with two entrance doors to adjacent spaces is equal to two according to Eq. (1):

\[ C_i = K \]  

where \( k \) is the number of points that are directly connected to the intended point and \( C_i \) refers to the connection at the \( i \)-th point (Khalesian et al., 2009).

3.2.2. Control
It is a parameter that specifies the degree of privilege of one point over its immediate neighbors. In other words, a lower degree of choice of one point with regard to a specific point means that the former has a lower amount of control over the latter (Kamalipour et al., 2012). According to Eq. (2),

\[ Ctrl_i = \sum_{j=1}^{k} \frac{1}{C_j} \]  

where \( k \) is the number of points immediately connected to point \( i \) and \( C_j \) refers to the connection at the \( j \)-th point. \( Ctrl_i \) denotes the amount of control at the \( i \)-th point (Khalesian et al., 2009).

3.2.3. Choice
It is a general measure that can be best understood as “water flow in space.” In fact, space offers a high-degree of choice when a large number of shortest connection paths intersect that space (Jiang et al., 2000; Klarqvist, 1993; Lima, 2001).

3.2.4. Depth
It is not a main parameter in space syntax, but it is central to the calculation of integration at a specific point. It is basically illustrated as the number of steps one must take to pass from one point to the other points. A point is considered deep when a large number of steps lies between this point and the other points (Jiang et al., 2000; Klarqvist, 1993; Lima, 2001). For example, if \( d_{i,j} \) is the shortest distance between points \( i \) and \( j \) in Graph \( G \), then the following equation holds (Jafari-Bahman and Khaniyan, 2012: 292):

\[ MD_i = \frac{\sum_{j=1}^{n} d_{i,j}}{n-1} \]  

where \( MD_i \) is the average depth from the \( i \)-th point, \( n \) is the total number of points, and \( d_{i,j} \) is the shortest path between points \( i \) and \( j \) (Khalesian et al., 2009).

3.2.5. Integration
The integration of a point indicates the degree of connection or separation between one point and the general system or the subordinate system. A space exhibits a high-degree of integration when it is assimilated with other spaces. This index is linearly related to connectivity; hence, high-integration equates to high-connectivity (Kamalipour et al. 2012). Integration can be measured by relative asymmetry or real relative asymmetry as follows:

\[ RA_i = \frac{2(MD_i - 1)}{n - 2} \]  

and

\[ RRA_i = \frac{RA_i}{D_i} \]  

where \( D = 2(n \log[(n + 2(3^{1/2}) - 1)](n - 1)(n - 2)) \), \( n \) is the number of points, and \( MD_i \) is the average depth from the \( i \)-th point (Khalesian et al., 2009).

In addition, space syntax is related to three concepts: convex space, isovist field, and axial line (Hoeven and Nes, 2014).

Convex space is a space where no line between two points goes outside the perimeter. Axial space is a straight sight-line and possible path. An isovist is the field of view from any particular point.

4. Methodology

Given the limitations in the direct access and observation of the interior spaces of inhabited houses, a useful method can be used to simulate and model such spaces.\(^4\) UCL Depthmap is a specialized software package that contributes to the identification and evaluation of spaces. Depthmap was created by Alasdair Turner at University College London. It is used to perform visibility analysis in architecture and urban planning.

The systems of syntactic analysis include the following:

(1) **Axial line analysis:** in this system, elements are linear when the subject of study is movement (Hillier, 2004). A connection graph is defined depending on how each line connects to its surrounding lines. This system is usually used in the analysis of structures in cities, villages, or neighborhood units (Jiang et al., 2000; Montello, 2007; Klarqvist, 1993; Penn, 2011).

(2) **Convex space analysis:** when dealing with social interactions, spaces are convex (Hillier, 2004). Convex spaces are analyzed from two aspects: (a) spaces exhibiting non-linear behavior and the (b) buildings and common spaces among them, as well as the interior arrangement of houses (Jiang et al., 2000; Klarqvist, 1993).

(3) **Visibility graph analysis (including single isovists and isovist fields):** visibility graph analysis is utilized in cases in which the subject of study shows complicated patterns of behavior (Hillier, 2004). Underlying this analysis are fields of view that are visible from a particular point. Therefore, this model of analysis is based on the reflection of light and determines the patterns of motional behavior of people in the environment (Bendikt and Burnham, 1985; Gibson, 1979; Jiang et al., 2000; Turner and Penn, 1999; Montello, 2007; Wineman et al., 2006).

(4) **Agent analysis:** in agent-based analysis, virtual “people” (called agents) are released into the environment, and they make decisions on where to move within such environment.

\(^4\)The simulation and modeling of spaces are performed using various software applications and different approaches. The output can then be presented either graphically (e.g., by UCL Depth Map) or through diagrams (e.g., BDSR). These two types of output differ; that is, graphical analysis exactly specifies the cause and the number of the factor in question and illustrates conceptual ideas in a qualitative form, whereas diagrammatical and numerical analysis only evaluate the number of factors compared with other spaces and do not reveal the cause (for example, spatial boundary may not be evenly distributed in an entire space to be described by numbers and diagrams).
Among the types of analysis described above, axial line analysis is the most common one. However, given that our objective is to perform an analysis on an architectural level, visibility graph analysis is adopted to study space syntax. The outcome of the analysis is a map of color spectrum, in which each index is represented by a color from red (i.e., the maximum value) to blue (i.e., the minimum value).

5. Results

The present research was conducted to examine the traditional and modern residential buildings in the city of Hamedan. Hamedan is a good case because the traditional houses in the center of the city (red parts) have maintained their physical aspects, whereas more recently built fabric (yellow parts) in the outer ring incorporates both traditional and modern buildings (Figure 1).

The history of habitation in Hamedan goes back to thousands of years ago, particularly during the rule of Deioces, the first king of Medes. Developed in 1928 as the first comprehensive urban plan in Hamedan, the structure of the city is a combination of radial and ringed structures. It is composed of concentric circles that are connected by six main radial streets, which all lead to the central square. The streets divide the circles into sectors (Jafari-Bahman and Khaniyan, 2012).

6. Analysis

On the basis of the graphical analyses obtained with the UCL Depthmap, we examined the traditional and modern houses of Hamedan in terms of the indices of connectivity, integration, and depth. A remarkable point in this comparative analysis is the difference in the analytical spectra. As shown in Tables 1 and 2, the traditional houses demonstrate a specific spectrum, whereas the modern houses do not show such spectrum (Tables 3 and 4).

6.1. Connectivity

6.1.1. Traditional houses

In the Ghomi House (Table 1), high-connectivity is observed in the yards and corridors, whereas minimal connectivity is observed in the pastoos and storerooms.

In the Khalabani House, the yard shows the highest connectivity, whereas the seyzan, storeroom, hozkhaneh, room, and dalan show the lowest connectivity.

The outer yard in the Naraghi House shows the highest connectivity, whereas the kitchen, toilet, bathroom, parlor, sedari rooms, and summer rooms show the lowest connectivity.

In the Parsiavashan House, the yard exhibits the highest connectivity, whereas the pastoos, storeroom, and rooms exhibit the lowest connectivity.

6.1.2. Modern houses

In the 30-unit Maskansazan Mehr Complex, connectivity is highest in the living room and lowest in the bathroom and toilet.

In the 1910-unit Mehr Complex, the highest connectivity can be observed in the living room, corridor, and hallway. A lower level of connectivity can be observed in the bathroom, toilet, and kitchen. The lowest connectivity is observed in some bedrooms.

In the 72-unit Mehr Complex of Ma’loolin, connectivity is highest in the division space of the bedrooms, followed by the terrace and hallway. The bathroom, toilet, bedroom, and kitchen show the lowest connectivity.

In the 236-unit Mehr Complex, connectivity is lowest in the bathroom, toilet, and the corner of the kitchen. The living room, hallway, and corridors exhibit the highest connectivity.

6.1.3. Comparative analysis of connectivity in the traditional and modern houses

In the traditional houses, connectivity is maximal in the yards and corridors between andaruni⁵ (the inside) and biruni⁶ (the outside) and minimal in the rooms, lavatories, storerooms, and pastoos.⁷ In the modern houses, the highest connectivity is found in the living rooms, hallways, and corridors, and the lowest connectivity is found in the lavatories, bathrooms, and corners of terraces. Next to the latter spaces, some bedrooms and kitchens show the lowest connectivity.

6.2. Integration

6.2.1. Traditional houses

In the Ghomi House, the highest integration is observed in the yards and corridors that connect the yards. The lowest integration is observed in the pastoos and storeroom.

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⁵Andaruni: In Iranian traditional architecture, it is a part of the house only allocated to the inhabitants and mahrans (i.e., relatives before whom a woman is religiously allowed to uncover her hijab).
⁶Biruni: an area of the house where strangers and non-mahrams are received.
⁷Pastoos: a small space behind the main space of the house that is usually used as a storeroom.
Table 1  Visibility graph analysis based on the indices of connectivity, integration, and depth in traditional houses (performed by the authors).

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Depth</th>
<th>Integration</th>
<th>Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghomi House</td>
<td><img src="66x130" alt="Image" /></td>
<td><img src="498x707" alt="Image" /></td>
<td><img src="298x498" alt="Image" /></td>
</tr>
<tr>
<td>Khalabani House</td>
<td><img src="66x130" alt="Image" /></td>
<td><img src="498x707" alt="Image" /></td>
<td><img src="298x498" alt="Image" /></td>
</tr>
<tr>
<td>Naraghi House</td>
<td><img src="66x130" alt="Image" /></td>
<td><img src="498x707" alt="Image" /></td>
<td><img src="298x498" alt="Image" /></td>
</tr>
<tr>
<td>Par-siavashan House</td>
<td><img src="66x130" alt="Image" /></td>
<td><img src="498x707" alt="Image" /></td>
<td><img src="298x498" alt="Image" /></td>
</tr>
</tbody>
</table>

Note: In the above plans, the red color indicates the maximum amount of connectivity, integration, and depth, and the blue color indicates the minimum amount of these indices.
In the Khalabani House, the yard shows the highest integration, whereas the seyzan, storeroom, hozkhaneh, rooms, and dalan show the lowest integration.

In the Naraghi House, the yards and corridor between them exhibit the highest integration, whereas the kitchen, toilet, bathroom, parlor, sedari rooms, and servants’ yards exhibit the lowest integration.

The lowest level of integration in the Parsiavashan House belongs to the storerooms, pastoos, and rooms. The highest amount of integration in this house is observed in the yard.

6.2.2. Modern houses

In the 30-unit Maskansazan Mehr Complex, the highest level of integration can be observed in the parlor, whereas the lowest integration is noted in the bathroom, toilet, bedrooms, and hallway.

In the 1910-unit Mehr Complex, the level of integration is highest in the parlor, hallway, and corridors and lowest in the corners of the kitchen and some bedrooms.

In the 72-unit Mehr Complex of Ma’loolin, the lowest level of integration belongs to the parlor, the division space of bedrooms, terrace, some kitchens, hallway, and corridors.

Table 2  Visibility graph analysis based on the indices of connectivity, integration, and depth in modern houses (performed by the authors).

<table>
<thead>
<tr>
<th>Modern Cases</th>
<th>Depth</th>
<th>Integration</th>
<th>Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Unit Complex of Maskan-sazan</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>1,910-Unit Complex</td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>72-Unit Complex</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
<tr>
<td>Hamedan Mehr Project</td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Note: In the above plans, the red color indicates the maximum amount of connectivity, integration, and depth, and the blue color indicates the minimum amount of these indices.
Table 3  Agent count analysis in traditional houses (performed by the authors).

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Agent Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghomi House</td>
<td><img src="Image" alt="Ghomi House Plan" /></td>
</tr>
<tr>
<td>Khalabani House</td>
<td><img src="Image" alt="Khalabani House Plan" /></td>
</tr>
<tr>
<td>Naraghi House</td>
<td><img src="Image" alt="Naraghi House Plan" /></td>
</tr>
<tr>
<td>Parsaviashan House</td>
<td><img src="Image" alt="Parsaviashan House Plan" /></td>
</tr>
</tbody>
</table>

Note: In the above plans, the red color indicates the maximum amount of movement, and the blue color indicates the minimum amount of movement.

① Hallway, ② Dalan, ③ Sedari room, ④ Kitchen, ⑤ Pastoo, ⑥ Yard (biruni), ⑦ Storeroom, ⑧ Toilet, ⑨ Bathroom, ⑩ Room, ⑪ Corridor, ⑫ Yard (andaruni), ⑬ Seyzan, ⑭ Yard, ⑮ Hozkhaneh, ⑯ Summer room, ⑰ Hall, ⑱ Parlor
Table 4  Agent count analysis in traditional houses (performed by the authors).

<table>
<thead>
<tr>
<th>Building Name</th>
<th>Agent Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Unit Complex of Maskansazan</td>
<td></td>
</tr>
<tr>
<td>1910-Unit Complex</td>
<td></td>
</tr>
<tr>
<td>72-Unit Complex</td>
<td></td>
</tr>
<tr>
<td>Hamedan Mehr Project</td>
<td></td>
</tr>
</tbody>
</table>

Note: In the above plans, the red color indicates the maximum amount of movement, and the blue color indicates the minimum amount of movement.
The highest integration is observed in the bedrooms and bathroom. In the 236-unit Mehr Complex, the parlor, hallway, and corridors show the highest level of integration, whereas the corners of the kitchen and terrace show the lowest degree of integration.

6.2.3. Comparative analysis of integration in the traditional and modern houses
In the traditional houses, the yards show a high degree of integration. In the modern houses, such integration can be observed in the entrance halls, corridors, parlors, and some bedrooms. The least amount of integration in the traditional houses is found in the pastoo and rooms. In the modern houses, the least amount of integration is found in the lavatories, bathrooms, corners of terraces, some kitchens, and some bedrooms.

6.3. Depth

6.3.1. Traditional houses
In contrast to the connectivity and integration in the Ghomi House, depth in this building is the lowest in the yards, the corridors between them, and dalan, and highest in the pastoo, some parts of the kitchen, and rooms.

In the Khalabani House, only the storeroom shows the highest depth, whereas the yard shows the lowest depth.

In the Naraghi House, the corridors that connect the yards exhibit the lowest depth, whereas the pastoo, followed by the sedari rooms, parlor, kitchen, toilet, and bathroom, show the highest depth.

In the Parsiavashan House, the highest depth is observed in the storerooms, whereas the lowest is observed in the yard.

6.3.2. Modern houses
In the 30-unit Maskansazan Mehr Complex, the highest depth is noted in the bathroom, toilet, and corners of bedrooms, whereas the lowest depth is observed in the living room and some kitchens.

In the 1910-unit Mehr Complex, the kitchens show the lowest level of depth, whereas the bedrooms, bathroom, and toilet show the highest depth.

In the 72-unit Mehr Complex of Ma’loolin, the highest depth is observed in the division space of the bedrooms, terrace, hallway, and corridor.

In the 236-unit Mehr Complex, the highest depth is found in the kitchen, bathroom, toilet, and corners of the terrace and bedrooms, whereas the lowest depth can be observed in the living room, hallway, and corridor.

6.3.3. Comparative analysis of the traditional and modern houses
In the traditional houses, the highest depth is observed in the rooms, lavatories, kitchens, and pastoo, whereas the lowest depth is found in the yards and corridors between andaruni (the inside) and biruni (the outside). In the modern houses, the highest depth can be observed in the hallways, corridors, living rooms, terraces, and some bedrooms, whereas the lowest depth can be observed in the bathrooms, lavatories, corners of terraces, and some parts of the bedrooms.

6.4. Agent count

6.4.1. Traditional houses
The highest agent count in the Ghomi House can be observed in the corridor between the yards, followed by dalan, yards, sedari room, and kitchen. It is the lowest around the yards and rooms.

In the Khalabani House, agent count is highest in the yard and lowest in the storeroom, kitchen, and surrounding spaces.

In the Naraghi House, the storerooms show the lowest agent count, whereas the yards and corridors between yards show the highest agent count.

Similar to that in other traditional houses, the highest agent count in the Parsiavashan House is observed in the yard, whereas the lowest agent count can be observed around spaces.

6.4.2. Modern houses
Living room, corridors, bedrooms, and some kitchens shows the highest level of agent count in the Maskansazan Mehr Complex. The lowest agent count is observed around spaces.

In the 1910-unit Mehr Complex, the highest level of agent count is observed in the living room, division space of bedrooms, hallway, and corridors, whereas the lowest agent count is observed in the corners of spaces.

In the 72-unit Mehr Complex, the highest agent count can be observed in the division space of the bedrooms, terrace, hallway, and corridors. No part of the building shows a low agent count.

In the 236-unit Mehr Complex, the corridors, hallway, living room, and some kitchens show the highest level of agent count, whereas the corners of spaces show the lowest agent count.

6.4.3. Comparative analysis of agent count in the traditional and modern houses
In all the analyzed traditional houses, the yards and corridors between andaruni (the inside) and biruni (the outside) are characterized by the frequent use and movement by inhabitants. The same is true for the hallways, corridors, living rooms, and kitchens in the modern houses. Notably, the presence and movement of a virtual agent are not observed around the spaces in any of the houses.

7. Conclusion

Any architectural structure has in its heart various spaces in which humans spend their lives. These spaces are designed according to a number of factors, such as culture, religion, economy, and politics, and they are transformed over the course of time. The importance of home as a private territory is beyond its use as a mere shelter and is deeply rooted in the psychological and spiritual aspects of human-kind. Spatial relationships, social events, and their inter-relation are issues, which, if carefully explored, may help in achieving realistic conceptions, plans, and knowledge to improve the quality of residential construction. The following conclusions can be inferred from the findings of the analyses performed in this study.
(1) The entrance of a traditional house shows little connectivity and integration in comparison with that of a modern house. This characteristic indicates that the entrance of a modern house carries the same value as the corridors. This equivalence means that the privacy of families is gradually declining.

(2) In modern apartment buildings, the highest connectivity in lobbies occurs in cases in which the doors of apartment units on the same floor directly face one another. In other words, when doors are open, the inside of houses is visible from other apartments and thus affects the privacy of families.

(3) As shown in the analyses, some bedrooms in the modern houses (including those in the 72-unit Mehr Complex) show high integration and connectivity with a low-degree of depth. In the design in which the door of a bedroom(s) is openly exposed and the access route of a quasi-public space, such as a terrace, goes through a private space, such as a bedroom, space configuration and, accordingly, privacy are highly likely to be disturbed.

(4) As expected, in the other private spaces of the traditional and modern houses, the indices of connectivity and integration are minimal, and depth is maximal. The striking difference is that private spaces in the traditional houses show a spectral consistency with regard to the indices, whereas in the modern houses, this consistency disappears with the doors, and depth remarkably decreases. Maps show that modern private spaces are often protected only by a door, which, if opened, reveals the inside of the space. In traditional houses, privacy is equally provided in the entire space given that a mediating space, usually a corridor, stands in the way of the private spaces and prevents them from being exposed to other spaces. In fact, traditional architecture does not limit privacy to physical aspects, i.e., furniture, but it also utilizes spatial configurations to establish privacy.

(5) Traditional houses do not have open kitchens. The kitchen is a closed private space, and its privacy is not protected in the open form that is common in modern architecture. The same is confirmed by our analyses, which show that a kitchen near the entrance area achieves a very high-degree of integration and connectivity, leading to a significant decrease in privacy.

(6) The results of the agent count analysis show that in the past, yards played an important role in connecting different spaces. Nowadays, parlors play the same role because of space limitations and the lack of yards in some cases. The highest amount of presence and movement can be observed in the entrance halls and corridors. Hence, we can deduce that access to interior spaces is more difficult in modern houses than in traditional ones. This evidence highlights the equivalence of all spaces in modern houses.

The above analyses and discussions confirm the author’s initial hypothesis, that is, privacy is not respected in modern houses. Although this change may be due to modern lifestyles and new technologies, a brief consideration of the physical and spiritual needs of human beings over recent centuries shows that many of such needs have been existing all through human history. One such need is privacy. Without denying the fact that needs vary for different ages, it is not true that we totally neglect a certain need. Thus, reviving the architectural quality of privacy concealed in Iranian traditional houses is necessary. A comprehensive examination of this type of architecture to extract and redefine concepts that are lacking in contemporary life will definitely contribute to meeting the essential needs of society as well as increase the degree of confidentiality in the spatial organization of contemporary architecture. We suggest that any building project should be simulated in the initial phase to analyze the indoor behavior of inhabitants and thereby eliminate problems and improve construction quality.

References


