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استفاده از روش چیدمان فضا در سلسله مراتب ورودی خانه های تهران اواخر قاجار و پهلوی اول با تأکید بر حریمیت
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Original Research Article

The Use of the Spatial Arrangement Method for the Hierarchy of Entry in the Houses of Tehran Over the Late Qajar and the First Pahlavi Eras with Emphasis on Privacy*

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Abstract

Problem statement: The Iranian concept of 'home' goes beyond the physical aspects and is intertwined with the spiritual characteristics of the audience. In the structure of traditional Iranian houses, the design of the small spaces of the house has been based on the needs of the residents, and these needs have influenced the spatial relationships of the house. Investigating the entrance hierarchy in traditional Iranian houses leads to a better understanding of its design principles for contemporary houses.

Research objective: This study attempts to investigate the spatial structure of the entrance in the late Qajar and early Pahlavi traditional houses to extract the most important factors affecting the quality of the entrance through the space arrangement technique. What items are important and practical for the analysis and configuration of the entrance space so that they can answer the residents' need for psychological and identity security?

Research method: In the first step, after selecting and examining 8 houses from two different periods, in the next step, the selected samples were analyzed using the space arrangement technique and by DEPTH-MAP software. This method is based on the use of graphs that describe the relationships between spaces through concepts such as connection, depth, integration, selection, and control.

Conclusion: it shows that the structure of traditional houses provides better solutions in the field of entry hierarchy and deprivation, and the spaces around the entrance, especially the courtyard, play a communicative role in the entry system. This study shows that the entrance and its spatial relationships respond to human needs. The two periods in question are the most important physical factors in the Qajar houses and the Pahlavi period, which has analyzed these spaces to achieve the issue of deprivation, which is one of their basic foundations.

Keywords: *Spatial structure, Entrance, Space arrangement, Traditional houses, Human needs.*

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Introduction

The house represents human identity and needs in the framework of a place for human life. It is possible to show a space with the position of personal and cultural relationships in a place area called a house. The traditional architecture of Iranian houses can be considered rich in identity and culture. One of the most important principles of responding to this place is the arrangement of spaces based on the principles of privacy and the human need for psychological security, which can be seen in the traditional samples of these cases.

A house is a place where people's first direct experiences with space are formed. In traditional Iranian houses, the design of spaces is based on the residents' needs, and these needs affect the arrangement of spaces and spatial relationships (Shahbazi, Bemanian & Lotfi, 2018, 33). In the contemporary era, with the development of technology and the use of analytical software, it is possible to understand the logical analysis of the approaches and methods of designing traditional houses and ancient times. This method, which is developed in the structure of configuration analysis, has obtained a way such as the syntax of space or the space layout. Based on the formation and syntax of spaces according to the principles of identity and human needs of each era, it is possible to analyze the shape of the building and understand the relationships between the existing spaces in each spatial configuration to bring architecture under the title of "space syntax." (Zarghami & Mansouri, 2022, 159-181).

Unfortunately, nowadays, cultural principles, especially the principle of privacy, which is one of the most basic principles in housing construction, have been ignored (Rastjo & Bemanian, 2019). In other words, in the current era, privacy has become a victim of economic and social factors and the priority for the establishment of spaces that preserve privacy has been gradually reduced, and foreign houses with local culture have been built (Babazadeh Uskoui, Tofan & Jamali, 2020). The house as the most private place for a person is one of the main places where confidentiality and privacy are essential (Jabaran, Talischi, Dimari & Dori, 2018).

Therefore, the investigation of traditional houses in which the principle of privacy is well considered can be a way for architects to apply and recognize this principle in today's housing architecture (Zanganeh, Moztarzadeh, Taghipour & Nasr, 2021, 71-85).

In general, by examining the samples of the traditional architecture of Iranian houses, it is possible to observe spaces such as the front entrance, vestibule, courtyard, hallway, and interior and exterior spaces, which oblige the residents of the house to maintain the principle of privacy and psychological security needs. This is related to the theory of human needs in Maslow's pyramid and its relationship with the personalization of space and space security, which have long since brought two complements of architectural design to traditional architecture: the human psyche and spatial relations.

Organizing the building's organs around one or more courtyards is one of the other effective techniques to isolate the building from the outside world (Quchani & Arabi, 2020, 242). This hierarchy in entering the house has now become only one door, which is the border between the city public space and the family private space (Ghafourian, Pey Sokhan & Hesari, 2017, 130). What is defined in the theory of space syntax includes the concepts of space, spatial configuration, layout or syntax, genotype and phenotype, spatial layout, axial lines, convex space and concave space, co-connection, readability, natural movement and justification diagram that express the conceptual structure of this theory. (Zarghami & Mansouri, 2022, 159-181) The core of this theoretical framework shows the spatial effects of social interactions, especially the relationship between residential forms and social forces (Fladd, 2017, 129). This technique was first proposed by Hillier and Hanson in 1984 in the book *Logic of Space* (Alitajer & Molavi Nojoumi, 2016, 345). Based on this theory of space layout, by understanding the spatial relationships of architectural plans, one can understand the social relationships between space users, hierarchy, type of building, society, and historical period (Kiaee, Peyvastehgarb & Heidric, 2020; Zolfagharkhani & Ostwald, 2021). The logic of space layout is based on the understanding of architecture, which is inherently

spatial, logical, and topological, instead of examining architecture from the aspect of formal, stylistic, aesthetic, and geographical features. In general, space layout is based on the belief that plans are more important than views to understand people's way of life and cognitive and behavioral processes in space (Zolfagharkhani & Ostwald, 2021).

In this research, the spatial structure and hierarchy of entrances in eight houses from the late Qajar and first Pahlavi periods have been investigated to analyze the view and access in the entrance space of these houses, each of which has a different form. The basis for choosing these two historical periods is the outstanding examples of these periods in Tehran in the process of field studies and data collection. The main hypothesis in this research is the need for a hierarchy of entry into the house, especially in modern houses. In this regard and to check the quality of the entrance hierarchy in traditional houses, the research questions are:

- How does the spatial configuration of traditional houses respond to the principle of privacy and the human need for security?
- How can space layout criteria affect the shape of an Iranian house in terms of privacy?

Research Background

In the research about house spaces, the researchers addressed it from different aspects; Most theories are based on the three main subjects of the climate situation, cultural perspective, and the role of traditions and beliefs. Social Architecture; Iranian house, research by Bemanian and Amini showed that the house as an indicator element of Iranian architecture under their cultures and spatial order indicates the social relations of the people living in the environment. Iranian house, as the social life of humans, has interaction and is related to other aspects of their lives, in such a way that they influence each other and are influenced by each other. (Bemanian & Amini, 2017, 4).

Heidari, Peyvasteh Gar, Mohebi Nejad & Kiaee (2019), entitled "Evaluation the methods of confidentiality in three Peymoon of large, small and breack in the articulation of Iranian-Islamic housing using space

syntax techniques," showed the configuration of Iranian-Islamic housing by using the space syntax technique. They compared the level of privacy in Kashan and Isfahan traditional houses on three scales, large, medium, and small, using the space syntax technique, and concluded that there is more privacy in small module houses than in large module houses, but privacy in large module houses was created based on the different depths of the spaces. Furthermore, Rastjo and Bemanian (2019) examined two indicators of privacy and hierarchy by relying on privacy and hierarchy from the 50s to the 80s in contemporary Iranian houses based on the space syntax method and concluded that in the 50s and 60s, due to the cluster structure, the space hierarchy and privacy in the houses were not provided, but from the 70s on, by creating a node

Zangeneh et al. (2021) used A-Graph software, to examine the mathematical relationships and spatial syntax of eight Qajar houses, and as a result, based on the degree of privacy and communication between spaces, they achieved models for privacy, also, research by Fatah Baghali, Maqsoodi & Hedayati Marzbali (2021) based on the survey of traditional and contemporary houses in Tabriz city and using Depth Map software and mathematical relationships analyzed and arranged the space, and as a result, the values of privacy and residents' needs were achieved in both periods, and finally, scientific research by Zarghami and Mansouri (2022) investigated the geometric structure and perception of space, as well as readability and configuration, and as a result, the theory of space syntax was used to express the desirability of space.

Ding and Ma (2020), examined traditional houses in three provinces of eastern China, including Anhui, Jiangsu, and Zhejiang, with diverse local cultural contexts. In this research, they used the method of space syntax, which includes the correlation of depth and integrity, to examine 6 houses that reflect the behavioral patterns of living in these three areas. In this research, the interaction between space and different fields of culture and behavior is one of the key issues.

In the research by Abed, Obeidat and Gharaibeh, (2022) privacy and its impact on the spatial layout of traditional

Jordanian houses have been studied. This study showed that the residents changed the spatial structures over time according to human needs. In this analysis, A Graph was used to evaluate the level of visibility, access, privacy, and hierarchy.

In the research conducted by [Salah AL-Mohannadi & Fular \(2021\)](#) the impact of social-cultural patterns on the spatial form of traditional houses in Qatar using the spatial syntax method was discussed. According to the time changes in social and cultural patterns in it, including privacy, the separation of spaces for residents and guests is considered. The change of shape and spatial configuration of houses is analyzed according to the mentioned factors using the theoretical tool of spatial syntax.

Based on these interpretations, the present research attempts to determine the index of privacy and hierarchy at the entrance of traditional Tehran housing in two different periods. By investigating the effect of the principle of privacy and the sense of security at the house for residents using Maslow's theory (human needs), this study hopes to provide a better understanding of the principles of space from the perspective of architecture and human culture in these two periods. The syntax of the space method includes theories and methods for analyzing the configuration of spaces. It uses analytical and simulation methods to investigate the prioritization and establishment of space in traditional houses, as well as the principle of privacy.

Research Method

The entrance spaces of these houses were analyzed in this research to find common principles or special characteristics in design in the historical context of Tehran, the ones whose structure was formed in the late Qajar and first Pahlavi periods and preserved their main elements. However, by physically documenting the elements of the entrance spaces, it is possible to further examine the research and analysis of the hidden dimensions.

This research is based on the descriptive-analytical method, taking into account the spatial background and the time position of the research and using the

method of field studies to identify the physical elements analyzed. By dividing and identifying the houses into five types of houses in the late Qajar historical period and three cases in the first Pahlavi period, we were able to examine the view and access in the spaces related to the entrance. In addition, items related to the research's background, work, and research methods were gathered by referring to documents and sources available in Latin and Persian writings. In the following section, the entry hierarchy was examined using the space layout technique and depth map specialized software. In the meantime, the methods and techniques were comprehensively explored and analyzed. Finally, the results were shown in the tables and graphs of syntax space and the extracted results.

In general, the process of this research (conceptual model) is summarized in [Fig. 1](#).

Theoretical Foundations

Traditional house: It is a type of house that was built before the changes given by the influence of contemporary architecture based on the principles of spatial organization and traditional architectural techniques. ([Memarian & Madahi, 2021](#)).

Principle of Hierarchy: The existence of hierarchy determines the public, semi-public, and private territories and reduces accessibility and as a result increases spatial privacy ([Heidari & Taghipour, 2018, 81](#)). The principle of hierarchy plays a very important role in defining the components and the whole of a collection and gives them identity. In other words, this principle is one of the criteria that can play a fundamental role in defining the order governing the collections and the relationship between their components, as well as the relationship of each component with the whole collection, as well as defining the coordinates of each component ([Qare Baglo & Mesgrani, 2016, 1-15](#)).

The Space Syntax theory: in its essence, it is an attempt to establish a causal relationship between human society and physical architecture; in a sense, it is the visual and movement characteristics of the human being in the architectural space that shape the architectural space and at the same time create and shape social relations. The

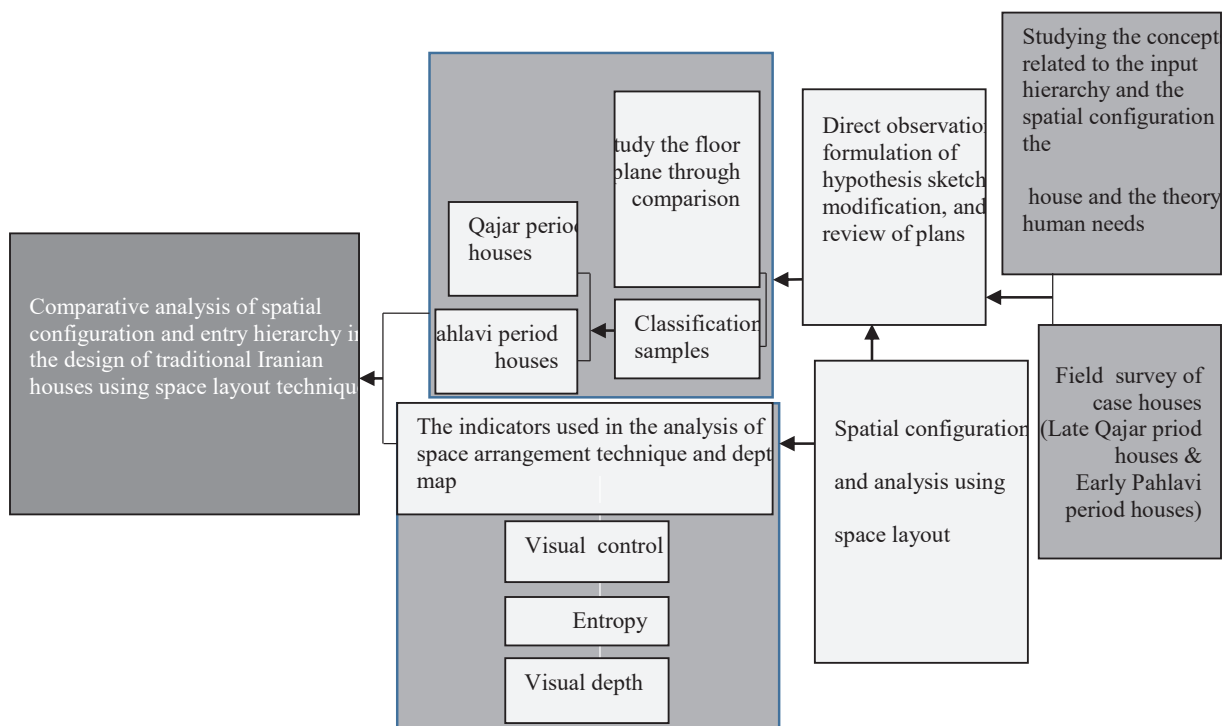


Fig. 1. Conceptual model of research. Source: Authors.

first base of the theory, which is space as an inherent characteristic of human activity, originates from this attitude. In this theory, space and human activity are not two independent and different natures, but they are a single nature that has two different manifestations. This unitary nature is hidden in man and his movement and visual characteristics. The essence of the formation of space and human relations is both humans and their movement and visual characteristics. Therefore, focusing on these human characteristics leads to the emergence of a single concept of architectural space and social relations (space). The second basis of the theory is spatial configuration and its distinct role in shaping human activities. To put it more simply, the characteristics of the configuration of space, in contrast to the physical characteristics of space, have a more prominent and important role in shaping human activities (body and physics of space) (Bartlett Faculty, 2020); (Zarghami & Mansouri, 2022, 159-181).

Space Syntax: Memarian translated the term "Space Syntax" and added this explanation: "Term of syntax" means the arrangement of words in a sentence in literature. It divides the relationships between words into two categories:

Syntagmatic: refers to the different roles that words play in sentence structure. (Syntax) association: the role of the word is outside the sentence. (Morphology) Therefore, it is possible to choose a syntactic word for this word in Persian (Memarian, 2002, 75; Memarian & Madahi, 2021, 41-61).

• The application of the space layout method in examining the input hierarchy

The theory of space layout was founded by Hillier and Hanson in London in 1984, and it is based on research on the relationship between social and spatial forms. This theory believes that space is the primary and main core of how social and cultural events occur (Rismanchian & Bell, 2010, 49). Hillier believes that space is not placed in the background of activities, but is one of its inherent aspects which is done in three ways: moving in the space, interacting with other people in the space, and seeing the space from one point (Estaji, 2014). The space layout technique considers space as the core of social-cultural events (Alitajer & Molavi Nojoumi, 2016). The arrangement of spaces next to each other and their mutual relationship is referred to as spatial configuration. In this way, we can conclude that any change in the way spaces are arranged will create

changes in the overall level of spatial configuration (Fath Baghali et al., 2021, 50).

The three analysis systems that exist in Fig. 2 in the layout of the space:

• The human need for the principle of privacy and spatial hierarchy

The famous psychologist Abraham Maslow established his hierarchy of human needs in 1943 (Maslow, 1943, 358–379). In fact, in the present research, we will focus on the second stage of the need for security, so that the **principles** of privacy and respect for cultural values seen in the fourth stage give meaning to answering the questions of the present research. Human needs are **at** five levels, as shown in Fig. 3. The hierarchy of the spatial territory with fields that create solitude is important for the feeling of well-being and contributes to the feeling of human security (Lang, 2012, 171). To measure security, the general and internal feelings of people towards this feature in **their** place of residence **are** important. and then, based on the definitions and examples, which include organizing the physical environment in line with people's perception of space, real and symbolic obstacles of the environment, identifiable space, and control of activities and uses compatible with residential environments, readability hierarchies, and the ease of access and transportation, the amount and quality of social interactions in the neighborhood environment are examined to measure the sense of security at home (Ali Tajer & Asadi, 2014, 65-74).

• Features of space layout

One of the most effective ways to analyze space layout is to use the Depth Map software, which makes it possible to obtain qualitative and quantitative results simultaneously. The indicators of the space layout that can be extracted from the Depth Map software are presented in Table 1, which are:

Examining the Studied Samples

In the Qajar period, due to the weakness of the government, public buildings were not built in large numbers and on the scale of the Safavid period. During this period, the construction of landmark houses belonging to the financiers began. Therefore, the high point of Qajar architecture, which reflects its characteristics, is manifested in the architecture of houses (Quchani & Arabi, 2020, 241).

The reason for choosing the houses of the Qajar and Pahlavi periods is that most of the old houses of Tehran have been left from the Qajar and Pahlavi periods. In addition, in these two periods, there has been a change in the house-building style from the introverted houses of the Qajar period to the extroverted houses of the Pahlavi period. In addition, since the main spaces of houses are located on the ground floor and most human and behavioral activities take place at this level, this space has access to other open spaces inside and outside (Haghlesan, 2020). This research examines the spatial structure of this level. In Table 2, the buildings of the late Qajar and first Pahlavi periods have been introduced.

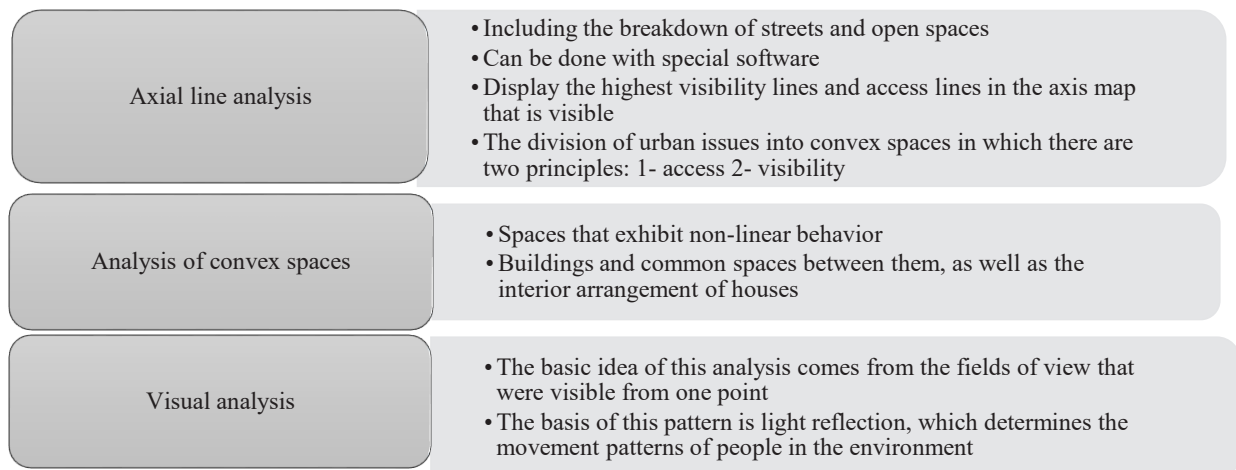


Fig. 2. Space layout analysis system. Source: Haghlesan, 2020.

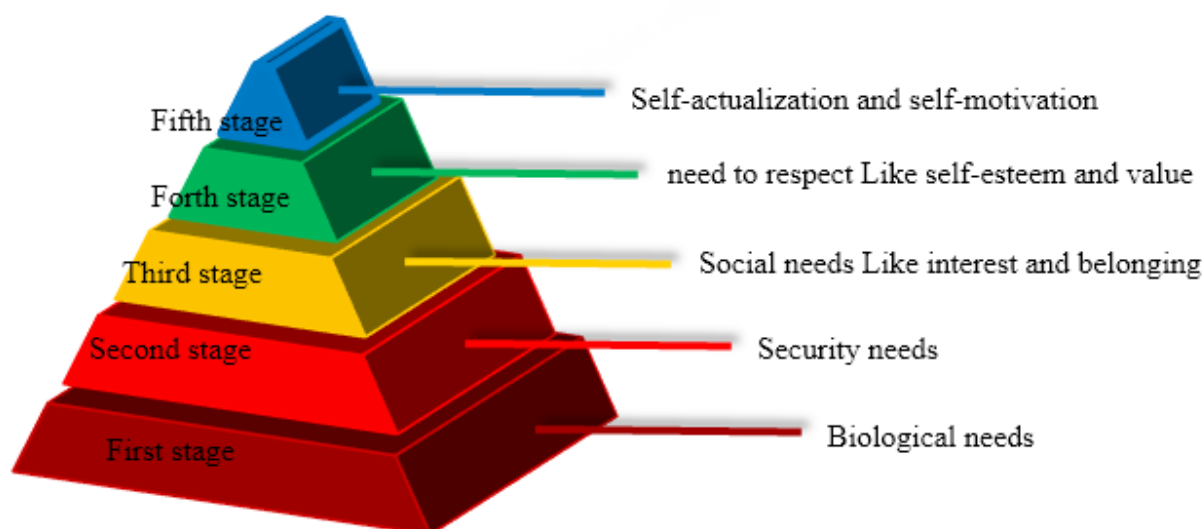


Fig. 3. Hierarchy of human needs. Source: Maslow, 1943, 358-379.

Table 1. Space layout indicators. Source: Authors.

Space layout indicator	Findings
Continuity	<ul style="list-style-type: none"> - It means the number of points in space and has a direct connection with other spaces - K is some points that are directly connected to adjacent points, and C_i refers to the connection of the i-th point: $C_i = K(1)$ (Kiaee et al., 2020). - Continuity of spaces is a good indicator to detect the interactiveness of the space and the ease of movement between spaces (Haghlesan, 2020).
Integrity	An average depth for one to reach from one core to another in a system. In a line map, the average is the number of lines that can be used to reach all other lines in a system. The lower the average of this number, the more nearer and accessible the cores. More average depth means more isolated spaces. Spaces that have a higher degree of integration in a system are usually more permeable (Kiaee et al., 2020).
Control	<ul style="list-style-type: none"> - The degree of control of a space can be calculated by calculating the number of spaces connected to it - The lower the selected frequency of a point, the less control over it and the more isolated the space will be (Kiaee et al., 2020).
Selection	A general measure of the flow rate in a space offering a space a high level of choices from a large number of shortest connecting routes that intersect that space, the user is likely to choose the shortest route to reach the destination. It has a large number of selective routes, among which shorter routes can be identified (Kiaee et al., 2020).
Depth	It should be shown as one of the steps to pass from one point to another. Using it, the degree of privacy or publicness of a space is determined and it is important in studying the space of traditional houses where privacy is important (Kiaee et al., 2020). It is considered a metric depth or the distance between two cores or the number of cores that must be traversed to reach from core A to core B (Hajian, Ali Tajer & Mahdavinejad, 2020).
Visual step depth	The number of changes of direction that must be made to get from one point to another is determined by the color spectrum (Hajian et al., 2020).
Isovist analysis	It refers to the estimated view from a specific point it shows the user's view from a specific point of the surrounding spaces (Hajian et al., 2020, 46).

Discussion and Analysis of Qualitative and Quantitative Data

To analyze the spatial structure and configuration of the mentioned examples, all the houses were analyzed quantitatively and qualitatively. In these analyses, the physical changes in the plans were examined. Depth Map software and space layout technique were used to create graphic analyzes and quantitative analyzes in the form of

tables. In the first stage, the three main indicators of visual control analysis, entropy, and visual depth were examined and the results were presented in the form of graphs and numerical data. Numerical data was extracted in the form of a table from the Depth Map software and after summarizing in the Excel software, it was converted into the format of comparative charts to check the minimum, maximum, average, and standard deviation of the values.

In this research, two Isovist and step depth analyses were also used to examine the field of view of spaces (the visual connection between each space and other spaces) and spatial aristocracy. In general, it can be said that the points that are more visible and have a better connection with other areas are in the warm color spectrum, and the points that are less visible and have less connection with other areas are in the cooler color spectrum.

The most important factor is the level of visibility and accessibility of spaces, the examination of this index is responsible for the degree of coherence and integrity of spaces, privacy, and physical and visual accessibility, and it is directly related to the degree of readability and the way of the hierarchy of spaces. Therefore, the field of view graph analysis provides the best answer about these indicators.

The human need for mental security and feeling comfortable in the home space can have a significant impact on the factor of visibility and privacy, and the hierarchy of entry into traditional houses is subject to positive criticism in terms of functionality and maintaining the privacy of the residents.

In fact, according to the analysis of the Depth Map software and the use of convex analysis on the three main indicators of the layout technique (visual control, entropy, and depth), we can refer to the following findings according to [Table 3](#).

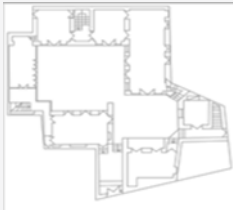

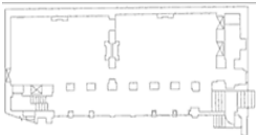

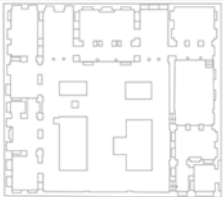



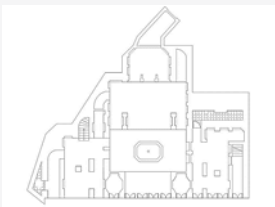

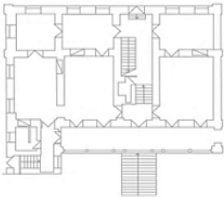

Visual control index: The investigated houses are closely related to the issue of spatial hierarchy and nobility. This index is related to the spatial structure and plan of the houses, and therefore in some houses, such as Imam Juma's house, there is a large space like a yard, which has relative control over other spaces - aristocrats - but in the house of Shahriarfaribers, the spaces that have relative control are the entrance of each and form the space. In fact, in these houses, the spaces that are located in the entrance area of several rooms or have found a central role; have relative control over other spaces.

Entropy analysis: It means the distribution of points based on their visual depth from a point. Therefore, if a large number of positions are visually close to a core, the visual depth of that core will be asymmetric and the entropy number will be lower. In other words, if the visual

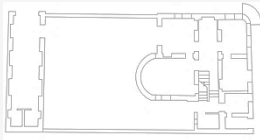

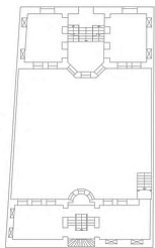

depth is more homogeneously distributed, the entropy will be higher. Entropy analysis shows the availability of space. The higher the entropy index, the more difficult it will be to access other spaces and vice versa. Therefore, spaces with low entropy - which appear in cool colors in this analysis - are the most accessible. The result of this analysis shows that the space of the entrance corridor has a lot of entropy and the view of these spaces is less than in other areas. The central space of courtyards, especially the distance between two entrances or the access route, has the least amount of entropy and is considered the most accessible part of the space. The entropy index is higher in rooms and spaces that have less connection with the surroundings; privacy is higher in these spaces that usually make up rooms. Also, the entropy index shows a hierarchy of accessibility and privacy of space in houses, for example, in Reza Khan's house, a part of the yard appears in yellow, which due to the position of the doors, is less visible and accessible, and creates more privacy and the other yard part is shown in light blue, which has more access to other spaces.

Visual depth: Depth is the opposite of permeability, so the lower the depth, the greater the permeability of the space. As it seems in the analysis, dark blue colors are seen more in courtyards and central spaces in this analysis. This means that the relative depth of these spaces is less, so the visibility and accessibility of these spaces are better. In general, it can be said that the relative depth in the public spaces of houses is less and the permeability of these spaces is higher and their visibility and accessibility are better. The spaces that have the greatest relative depth in the analyzed houses have higher privacy. The relative depth in the entrance space in all houses shows a greater value than other spaces in the house. For example, in Matin's house, the entrance corridor has appeared in red, which shows the highest amount of visual depth. The distribution of the relative depth index in Reza Khan's house is more regular than in other houses because all the spaces around the yard are arranged at the same distance in a regular plan around the yard. In Imam Juma's house, all parts of the wide yard have the least amount of visual depth.

Table 2. Introduction and classification of the case studies of the late Qajar and early Pahlavi periods. Source: Authors (some images used from the archives of the cultural heritage organization of Tehran province).

Case Studies				
Name	Historical Period	Plan	Picture	Summary of Characteristics
Jalal Al Ahmad's house	Late Qajar		 Source of Cultural Heritage Organization of Tehran	Traditional and classical architecture combined design It has two functional yards like an inner one for the use of two families Entrance on the south front Belonged to Jalal Al Ahmad and registered in the list of national monuments
Anis al-Dawlah's house	Late Qajar		 Source of Cultural Heritage Organization of Tehran	Two entrances from the street on the east side
Reza Khan's house	Late Qajar		 Source: authors	The plan is according to the traditional architectural plans of the day in the shape of a rectangle / the shape of a horseshoe plan The length of the building in the east-west direction/entrance in the east view
Malek house	Late Qajar		 Source of Cultural Heritage Organization of Tehran	Two main yards and a side yard The main entrance is adjacent to the Bazaar Sub entrance on the west side
Imam Juma's house	Late Qajar		 Source of Cultural Heritage Organization of Tehran	Imam Juma's house in Tehran during the time of Naser al-Din Shah Qajar It is near Dolatkhaneh and Tehran Citadel Part of the destroyed house / an entrance to the main courtyard
Shahriar Fariborz's house	Early Pahlavi		 Source: authors	It has two main entrances/entrances from rue Neufle-le-Chateau The second entrance is from Goharshad alley

Rest of Table 2.

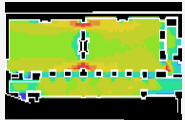


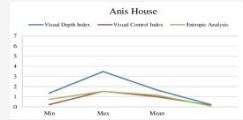
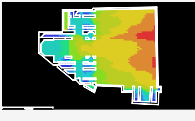
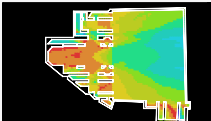

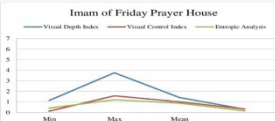


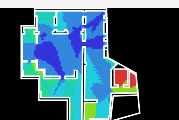

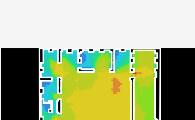








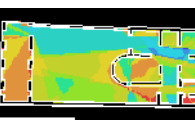



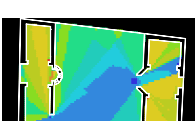






Case Studies				
Name	Historical Period	Plan	Picture	Summary of Characteristics
Matin Daftari's house	Early Pahlavi	 Source: authors	 Source: authors	Combining the traditional introverted style of Qajar and modern architecture The main entrance of the Palestine route / the secondary entrance from Simorgh alley
Lashkarnavis house	Early Pahlavi	 Source: authors	 Source of Cultural Heritage Organization of Tehran	In Odlajan neighborhood, one of the oldest neighborhoods in Tehran Along the north-south axis Yard with Qajar-style landscaping Entrance from the north side

According to this analysis, which is available in Fig. 4, the most linear diagram is related to Anis's house, Imam Juma's house, Metin's, and Shahriarfaribers' house. It seems that the plan of the mentioned houses has created a more regular pattern from the hierarchy of public to private spaces, and this makes it easier for the user to understand these spaces. Although according to this analysis, there cannot be a direct relationship between the input and the ability to predict, the defined input role in the overall hierarchy of these houses is important. Step depth was used in this research to examine the field of view of spaces. To calculate the step depth, a point in space must be selected. Using step depth analysis, an approximate step of isovists from a specific point is calculated. Each point is in view one step from the selected point, i.e. all those points are in the isovist of the initially selected point. In this research, the step depth was investigated for a point of the courtyards of the houses. This analysis shows how the field of view is compared to other spaces from the specified point. The points closest to the selected point have the lowest step depth and therefore appear in cold colors. These points have the most visual connection with the selected point. The step depth analysis with the starting point from

the entrance shows how many steps must be taken for the user to reach the farthest point of the house from the entrance, and therefore shows the hierarchy of the entrance well. Also, the spaces that have the most depth of a step from the entrance have the most privacy. For example, in Malek's house, step analysis shows that most of the spaces are organized in a way that they are placed at the same level in terms of step depth, and in Imam Juma's house, it shows that the path that is placed in the direction of the entrance, after the entrance, has the least amount of step depth in the plan.

In general, the investigated plans show signs of modern house construction in Qajar period houses. Imitation of the western architectural style is more evident in the plan of the houses of the first Pahlavi period. As a result of removing the main spaces of the plan structure, the privacy in the plans of the Pahlavi period decreased. This trend has continued in modern house buildings and has affected the proper access to the main spaces of the house and privacy. Identifying the important spaces around the entrance and equating them in contemporary house building can eliminate the structural problems of the plans and as a result, improve the social and psychological relationships of the residents of the

Table 3. Summary of the analysis of the main indicators of the space layout technique of late Qajar and early Pahlavi houses. Source: Authors.

Periods	Building name (houses)	Visual control	Entropy	depth	Convex analysis of the three main indicators of the layout technique
Late Qajar	Anis al-Dawlah's house				
	Imam Juma's house				
	Jalal Al Ahmad's house				
	Reza Khan's house				
	Malek house				
Early Pahlavi	Matin Daftari's house				
	Lashkarnavis house				
	Shahriarfariborz's house				

houses, the summary of these indicators is presented in [Table 4](#).

Conclusion

First, the theoretical foundations of the study, Maslow's human needs, were examined, and the method of convex analysis of plans using Depth Map software was implemented. The method was based on the three criteria of visual control, entropy, and depth in line with

the method of architectural space layout based on the evaluation hierarchy of entry and the human need for security in the space of the houses of the late Qajar and early Pahlavi periods. After knowing the methods and determining the analysis criteria, the elements and components of the houses of two time periods were examined and evaluated. The elements and components of the input hierarchy based on Maslow's theory of human needs, which are

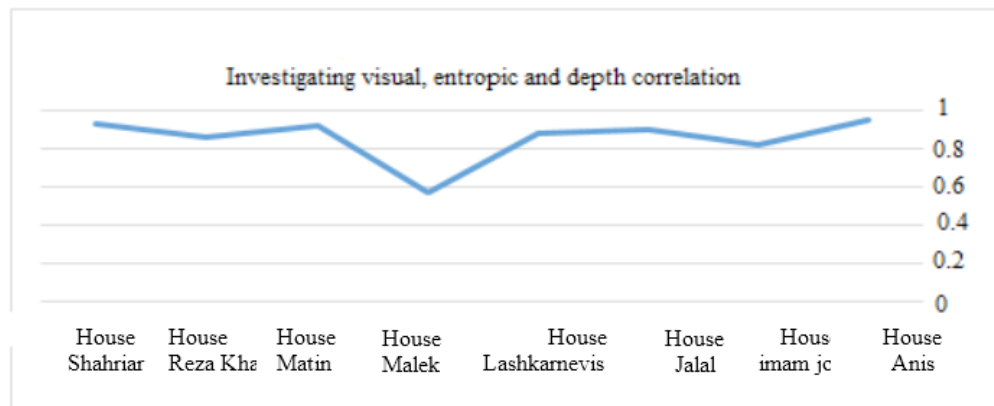


Fig.4. Correlation comparison of visual integration index and continuity. Source: Authors.

the human need for privacy and security, were investigated in the houses of the two research periods. By comparing the typology of the entrance hierarchy and the importance of depth and visual visibility from the entrance to the end space of the house, it has been determined that these types in the two Qajar and Pahlavi periods can provide suggestions or solutions to maintain privacy and need of human to safety in today's housing.

The findings of the space layout are based on the hierarchy of entry into the house in the late Qajar and early Pahlavi types of houses in the pattern of the space. The principle of privacy has been considered in the movement path from the outside to the inside, considering the sequence of the main entrance, the eighth and the hallway until reaching the yard. The main entrance and then the vestibule and the corridor to the courtyard of the house have been identified with the highest principle of privacy during the stages of reaching the buffer space between private and public space.

To achieve a house with more privacy, the interior spaces of a house should be as little visible as possible, and the spatial structure of the house should also create a combination of visible and accessible spaces and hidden spaces. One of the most important spaces in historical houses is the entrance, which plays an important role in privacy and reducing visibility and access without intermediaries and borders. Traditional houses are built based on traditional beliefs, while this issue is usually less observed in modern houses.

In general, the results of the findings show that visibility and access indicators have a direct relationship with the spatial structure of the residential plan and the form of

the courtyard, while the central courtyards have relatively good visibility and access, and they have control over the surrounding spaces, but the surrounding rooms are designed in such a way that there is the least amount of visibility and access and the most amount of privacy for them. The entrance of every house has a significant role in controlling direct visual access to other spaces of the house and in general, it can be said that the entrance controls the penetration to other parts of the house. Houses that have a more asymmetrical structure have more than one controlling space, so access to the spaces is done by passing through the controlling spaces, and the deepest space has the most privacy, which is usually the space of bedrooms and corners. Also, the shape of the yard and its size have a significant effect on increasing the visibility and accessibility of the house and consequently the security of the residential space.

The relationship between privacy and space layout has been observed as follows: the vestibule causes spatial separation, creates a sense of pause, and creates an atmosphere of waiting. After the vestibule, one usually faces the courtyard or passes through the corridor. In fact, in architectural layout, the weaker connection of a space with other spaces and the greater depth of the space indicates that the desired space is less accessible and the space is more private. Finally, according to the mentioned cases, it can be said that in addition to making changes in the spaces, the removal and replacement of some important elements in the house plan of the Pahlavi period caused problems in the entrance hierarchy. These spaces, which are mostly seen in the plans of the Qajar period, include the entrance, vestibule, outer courtyard,

Table 4. Comparison of space layout indicators and their relationship with the entry hierarchy in historical periods and 1-2. Source: Authors.

Summarizing the characteristics of space layout in the context of entry hierarchy in the two historical periods of Qajar and Pahlavi					
Historical period	Visual Integrity	Visual control	Entropy analysis	Depth analysis	Summary
Late Qajar	Higher	Higher	Higher	High	Due to the creation of a better spatial hierarchy and interface spaces around the entrance, the spaces have more depth. Visual access to the spaces of the complex is less and more private spaces can be seen in these plans and privacy is higher. The yard and public spaces of the complex play an important role as a controlling space and interface between the entrance and other spaces.
Early Pahlavi	Fewer	Fewer	Fewer	Fewer	By removing some of the main physical spaces, the hierarchy of entry has been weakened, and because of this, the amount of privacy in the spaces has decreased and the extraversion has increased in these plans. Spatial depth is reduced and visual access is increased, which reduces privacy and increases public access.

terrace, and inner courtyard. In addition, the houses of the Qajar period were mostly built according to the traditional hierarchy. The spatial depth of the houses of this period is more based on the native culture of that period.

The way the space layout is based on the formation of the house plan in each historical period can express a practical pattern of the culture and identity of each period and by using the analysis of plans in the way of arranging the space, it is possible to achieve the application of each element of the plan based on the human needs of each period, or the application of those patterns in modern residential architecture. the analysis of the plans in the way of the space layout to the application of each of the elements of the plans are based on the human needs of each period or the application of those patterns in modern residential architecture, and this is a new step for the identity and human values of each region and each time. Finally, the entrance space in today's housing can be connected with an intermediate space between the entrance and the private and public spaces of the house so that the residents of the house feel safe and calm.

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