

Original Research Article

An Investigation of Spatial Transformation of Historical Houses in Kerman Qajar Vs. the First Pahlavi

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Received: 27/09/2021 ;

accepted: 06/04/2022 ;

available online: 23/08/2022

Abstract

Problem statement: House architecture is an important topic in the study of architectural styles, and the study of its evolution can provide lessons for architectural knowledge. This paper focuses on the spatial transformation of historical houses by comparing the courtyard houses of the Qajar and the first Pahlavi period in Kerman. The research questions are as follows: 1) what geometric and spatial transformations occurred in Kerman between the Qajar and the first Pahlavi periods? 2) what changes took place in the structural role of the courtyard in these two periods?

Research objective: Determining the differences between Qajar and the first Pahlavi houses in the spatial and geometric arrangement of spaces, indicates the changes between the two periods.

Research method: This paper used a descriptive-analytical method and after selecting the houses, the criteria for the analysis of the houses' plans were developed. By comparing the samples with research indicators, the spatial and structural similarities and changes of the two types were determined through logical reasoning, and then qualitative results were provided.

Conclusion: Based on the analysis of samples, although there are similarities between the houses of the two periods in terms of geometric features in the facades and the second spatial layer in the plan, more freedom in designing houses of the first Pahlavi than in the Qajar is observed. This increases the variety of the second layer placement in the plan, the arrangement of the spaces around the courtyard, the lack of emphasis on using harmony in opposite facades, and the decrease of symmetry. The rotation of the courtyard axis and the change of organization pattern around the courtyard indicate the gradual transformation of the role of the courtyard in the first Pahlavi houses, the fading of the basic role, and the centrality of the courtyard.

Keywords: *House, Courtyard, Arrangement, Qajar, The first Pahlavi, Kerman.*

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Introduction

In the study of historical architecture, buildings can be classified into houses and public buildings. Because of their functional nature, houses, both ancient and contemporary, have always been considered by researchers. Some of them consider it the most important space made for humans, others consider it a manifestation of humans, and some consider home and non-home as the main division of geographical spaces (Soltanzade, 2017, 9). At the macro level, in a coherent and generally continuous collection, the house forms urban textures, and on the other hand, it has been considered a single-unit building.

An analysis of house architecture at both macro and micro levels can have implications for knowledge. It reveals the knowledge and skills of its predecessors as well as the architectural features. The data that is provided is based on the nature of the house in various social, cultural, etc., or architectural features and measures. In this way, the house is investigated by the way it is formed, climatic issues, the function of materials, or its typology, which rely on the formal and geometric aspects (in line with this paper), etc. These studies show how historical architecture has been able to find appropriate answers to the user's demands and environmental constraints, and all of these creative issues are embodied in house form and specifically its plan.

This paper considers the study and comparison of houses related to the two historical periods of Qajar and the first Pahlavi in Kerman. The choice of these two was due to the availability of the documents and their plans for changes in social, physical issues, construction methods, and materials, etc. Therefore, as a widespread change occurred between the two eras, the architecture of the house would have been influenced. The ultimate goal of this paper is to promote knowledge about the architecture of historical houses, discover the possible effects of the "time" indicator on the changes associated with them, and study and express some of their features and characteristics. The secondary goal is to identify the common features between the samples by studying the mass, including the arrangement of

the elements in the plan and organizing them, reaching possible patterns on the one hand, and also considering the relationship between the courtyard and the structure of the house. The paper assumes that because of using the courtyard, the houses of both periods have used similar patterns in the arrangement of elements and plan combinations, and in this regard, tries to answer the following questions:

- 1) What geometric and spatial transformations occurred In Kerman between the Qajar and the first Pahlavi,?
- 2) What changes took place in the structural role of the courtyard in these two periods?

The paper defines indicators and uses them to compare the samples (plans) and, consequently, to correspond to the research questions.

Research background

The central point of the research is the important issues in the house (and any architectural design), and it is necessary to notice that the researcher focused on which aspects. Apart from some research such as Karapetian's (2006), which only describes houses and their parts and has less affinity with the orientation of this paper, we can refer to Haeri's (2008), which has a comprehensive view of the house in Iranian architecture and emphasizes "... the way space organization of the city and the house ... considers the way of life and its spatial reflection ..." (ibid., 31). While stating "conscious organization of space based on culture and lifestyle", he offers a hierarchy of space and the formation of the house based on it. Diba, Revault and Stierlin (2013) studied the houses of Isfahan in different aspects and some parts of the analysis with emphasis on the form; they have also provided patterns of the spatial composition of the houses. Memarian (2007) has classified the houses into two types, extroverted and introverted, with the focus on the courtyard. Khakpour, Ansari and Tahernian (2010) have introduced three types of houses by introducing indicators such as neighborhood, zoning, orientation, proportions, materials, etc. Farahbakhsh, Hanachi and Ghanaei (2017) have paid attention to the form features, climate, structure, and functional

features to identify and classify houses. Ghasemi and Memarian (2010) have followed a similar process (with different components) in their research and have introduced the types of houses. Some studies have considered indicators such as climate or religion and their impact on the layout or proportions of the plan, details, etc. (Memarian, Hashemi Toghr-oljerdi & Kamalipour, 2012; Yazdi, Mofidi & Etesam, 2021).

The research that has been done on houses in Kerman is not very extensive. Memarian, Hashemi Toghr-oljerdi & Ranjbar (2011) demonstrated how different features in Kerman houses can create different types of privacy. Kamalipour, Memarian, Faizi and Mousavian (2012) studied the spatial zoning of guest space in traditional houses of Kerman using space syntax. In summary, firstly form of the building was the base of the study of many research (mainly plan and sometimes facade and section), and secondly, in most research, due to the reference to various features, it is difficult to control and study the role and effectiveness of each of them. In other words, as the variables of the research expand, its depth and accuracy have decreased; thirdly, the comparison of the houses of the two periods (in terms of style and type) has also received less attention in research¹. Based on this, it seems necessary to conduct research on the historical houses of Kerman with constraining other indicators and emphasis on one (form).

Theoretical foundations

The comparison of buildings in the two different periods can be done based on different aspects that are influenced by the objectives of the research, the type of data, the research approach, etc. Some argue that architecture, environment, people, facilities, sizes and standards, spatial order, and artistic and visual qualities should be considered (Chermayeff & Alexander, 2015, 26). Others have referred to climatic, formal, historical, spatial, socio-cultural, and semantic approaches in their studies (Memarian, 2017). On the other hand, some believe that architectural observation (and the house) can fluctuate between the two ends of a spectrum from objective to subjective view (Haeri, 2008; Chermayeff

& Alexander, 2012). Among these approaches, an analogy based on the form is one of the most common methods and has been referred to as Durand². He has carried out numerous studies on a typology that are still noteworthy today. Durand's method is based on spatial and graphic diagrams, which in short are called graphic diagrams (Jacoby, 2015). Durand uses abstract architectural plans that express structural ideas and the organization of architectural space and believes that the essence of architectural history arises through structural analysis and form (Vidler, 1977). Durand's method often relies on the analysis of plan features, and sections and facades are of subsequent importance. In plan analysis, the relationship between parts with parts and parts with the whole is investigated (Madrazo, 1994). In summary, in plan typology, issues such as formal-geometric appearance and spatial arrangement are mainly focused on (Schneider et al., 2013). On the other hand, considering the shape and the geometry of the building eliminates the possibly inaccurate data and controls the disturbing indicators, and gives a kind of positivist approach to the research in which the researcher's involvement in the conclusions is reduced. This is especially true in historical research and is important in the present paper because the resources are scarce and data validation is difficult.

Research method

The present study is a case study and it was carried out in three steps. In the first step, samples (houses) in Kerman were selected in accordance with the objectives of the paper. In the next step, to study and compare the samples of each period, indicators related to geometric properties, and spatial arrangement were identified, and then relationships among parts and with the whole were determined in such a way that it is possible to compare data and identify similar and different characters. In the third step, based on the descriptive-analytical method, the samples were analyzed based on the indicators, a comparative study of the structures, and their transformations were conducted, and finally, with logical reasoning, qualitative results were reported. One of the advantages

of this method is that with the possible addition of samples with any number and at any time, re-testing the results would be possible, another advantage is that the same analogy can be made with houses from other periods or other regions and cities, and in a way introduces criteria regardless of time and place for analysis.

• Samples

The samples (houses) were selected by studying the available documents. Unfortunately, the historical context of Kerman has suffered irreparable damage due to negligence and ignorance. Some of these damages are due to urban development, and some are related to the damages that have been inflicted on the houses and other parts of the texture due to negligence in their maintenance or restoration. Most of the houses are not physically stable due to irreparable losses and just a few houses can be explored. Except for the research project of Tehran University ACECR (1989)³ and Golijani (2007), little research and documentation have been done on houses in Kerman, which was another obstacle to research. As the accuracy of the samples was important for this paper and to avoid the process of control and verification of the documents, samples were selected from those registration documents that were available in the Kerman Cultural Heritage Organization. Of the available plans, 28 houses belonged to the first Pahlavi and Qajar periods, based on the objectives of the study (plan compositions and the role of the courtyard), 13 of the samples whose plans were available, and had only one courtyard, and had close spaces on at least two sides of the courtyard, were chosen for the research. Of these, 7 houses belonged to the Qajar period and 6 houses belonged to the first Pahlavi period (Tables 1, 2, & 3).

Research indicators

to analyze the samples, indicators have been defined based on the questions and objectives of the paper and then used to study and compare the samples. It should be noted that the spaces of each of the houses

are classified into two categories: room and corridor. The room can have different types of functions and the corridor has a communication role. In this classification, as the research is based on form typology, spaces regardless of their function have been analyzed.

A- Mass: The organization and composition of house elements in the plan are examined, also to achieve a clear and measurable understanding of the possible order or arrangement of elements on different sides of the courtyard, the plan is analyzed based on the following 4 indicators:

Space layering, in houses with a courtyard, the spaces are arranged around it. To expand the spaces of the house and the number of rooms, it is not possible to place all of them around the sides of the courtyard, so some of them are located behind the rooms which are adjacent to the courtyard. In other words, in addition to the first layer which is near the courtyard, there is another layer of space which is behind the first one. In this indicator, the placement of the second layer and how it is formed are studied. Rhythm is used to examine the order of placement and arrangement of rooms (main spaces) and the corridors (sub-spaces) on the sides around the courtyard and to study the possible patterns or relationships between them.

Symmetry examines the presence or absence of symmetry in the facades around the courtyard, these facades reflect the composition of the spaces behind them.

Harmony of the opposite facades, by this indicator the connection between the opposite facades around the courtyard is studied by comparing the number or dimension of the spaces of each facade. By this indicator the following question can be responded to: is there any connection between the spatial arrangement of opposite sides of the courtyard or not?

B. Courtyard structure: while the previous indicator emphasized the details of the plan and its composition, this indicator focuses on the house organization at a holistic scale. Since the courtyard

Table 1. List of houses. Source: Authors.

| No | Qajar period | Address | First Pahlavi period | Address |
|----|--------------|-----------------------------|----------------------|-----------------------|
| 1 | Azami | Te Bagh lallahNeighbourhood | Ghaffari | Motahhari Street |
| 2 | Amrollahi | Seh Rah Chamran | Farrokhzad | Zaridf Street |
| 3 | Aminian | Te Bagh lallahNeighbourhood | Kazemi | Zaridf Street |
| 4 | Nejad Masoom | Motahhari Street | Karimnejad | Fath Ali Shahi Street |
| 5 | Nafisi | Bazaar - Madani Alley | Yazdani | Zaridf Street |
| 6 | Pardakhti | Zaridf Street | Hakak | Golbazkhan |
| 7 | Soroushian | Zaridf Street | | |

Table 2. Plans of Qajar houses. Source: Authors.

| Name of homeowner | Plan image | Name of homeowner | Plan image |
|-------------------|---|-------------------|---|
| Azami |  | Nafisi |  |
| Amrollahi |  | Pardakhti |  |
| Aminian |  | Soroushian |  |
| Nejad Masoom |  | ---- | |

plays a significant role in the houses, the study of the house structure is done in the form of two indicators related to the courtyard:

1. The elongation of the courtyard, also incidentally shows the geographical orientation of the house.
2. The courtyard proportion: which is measured by dividing the length by the width of the courtyard

Analysis


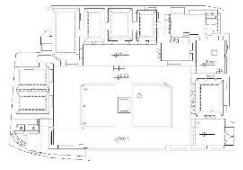
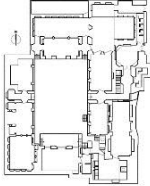
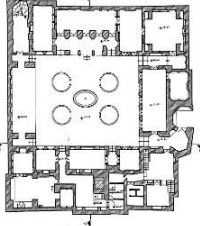
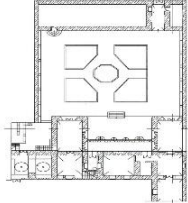
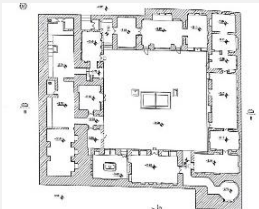
Based on the previous section, the analysis is based on two indicators: the arrangements of the spaces and the structure of the courtyard.

• Mass

- Space layer

To study the spatial layers, several features are considered: whether there is more than one spatial

Table 3. plans of the first Pahlavi houses. Source: Authors.

| Name of homeowner | Plan image | Name of homeowner | Plan image |
|-------------------|--|-------------------|--|
| Ghaffari |  | Kazemi |  |
| Karimnejad |  | Farrokhzad |  |
| Yazdani |  | Hakak |  |

layer around the courtyard, and on which sides of the courtyard more than one layer has been used. Table 4 shows that in Qajar houses out of 7 houses, 6 cases have at least 2 layers on one side and in 5 cases on more than one side 2 layers have been used. Therefore, according to the samples, the arrangement of spaces in more than one layer has been common in houses of the Qajar. By comparing the plans of the houses that have two spatial layers, it can be observed that the second layer is generally located on the north side (5 houses out of 6 samples) and the expansion of the Qajar house is often placed on the northern side of the courtyard.

All the first Pahlavi houses have at least two layers on one side and in three cases the second layer is used on more than one side. In these houses, the use of two layers is seen equally (4out of 6) on the north and south sides.

The Rhythm of Rooms and Corridors: The arrangement of spaces on different sides of a

house with a courtyard can be formed in different ways. Table 5 shows the arrangement of rooms (R) and corridors (C). For example, (R-C-R) shows that the rooms are located on both sides and the corridor is between them. Based on this table, in most of the facades of Qajar houses (22out of 27 facades), the corridor is used as an important part of the facade. Also, the number of spaces in 21 of the 27 facades is odd. Then the facades that had the intermittent rhythm of corridors and rooms are focused. According to Table 5, in each of the plans, the number of facades in which this rhythm is used is different in Azami House (2), Amrollahi (4), Aminian (1), Nejad Masoom (2), Nafisi (3), Pardakhti (3), and Soroushian (0). In most of the houses (5 out of 7), this rhythm can be seen at least on two facades.

In the first Pahlavi houses, out of 21 facades, a combination of corridor and room can be seen in 15 cases. The number of spaces is even in five of the 21 facades and odd in the others.

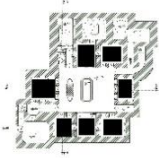
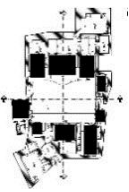


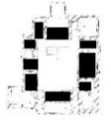

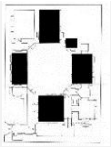
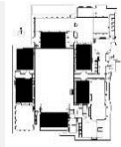
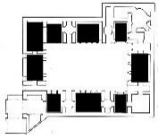

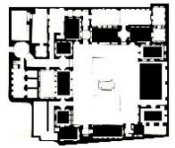


Table 4. Comparison of space layer around the courtyard. Source: Authors.

| Qajar | | | | | | The first Pahlavi | | | | | |
|--------------|---|------------|------------|-----------|-----------|-------------------|---|------------|------------|-----------|-----------|
| Name | Plan | North side | South side | East side | West side | Name | Plan | North side | South side | East side | West side |
| Azami |  | 2 | 1 | 1 | 1 | Ghaffari |  | 2 | 2 | 1 | 1 |
| Amrollahi |  | 1 | 1 | 3 | 2 | Farrokhzad |  | 2 | 2 | 1 | 1 |
| Aminian |  | 2 | 2 | 1 | 1 | Kazemi |  | 2 | | 1 | 1 |
| Nejad Masoom |  | 2 | 2 | 1 | 1 | Karimnejad |  | 2 | 2 | 2 | 1 |
| Nafisi |  | 1 | 1 | 1 | 1 | Yazdani |  | 1 | 2 | | |
| Pardakhti |  | 2 | 1 | 1 | 3 | Hakak |  | 1 | 1 | 1 | 2 |
| Soroushian |  | 2 | 2 | | 2 | |  | | | | |

The number of facades in each house that have the intermittent rhythm of the corridor and room

in Ghaffari House (1), Farrokhzad (4), Kazemi (0), Karimnejad (4), Yazdani (1), Hakak (1). So

Table 5. Rhythm of the rooms and the corridors around the yard. Source: Authors.

| Qajar | | | | | | The first Pahlavi | | | | | |
|--------------|---|------------|------------|-----------|-----------|-------------------|--|------------|------------|-----------|-----------|
| Name | plan | North side | South side | East side | West side | Name | plan | North side | South side | East side | West side |
| Azami |  | R-R-C | R-R-R | C-R-C | R-C | Ghaffari |  | R-R-R | R-C-R-R | R-C-R | R |
| Amrollahi |  | R-C | C-R-C | R-C-R-C | R-C | Farokhzad |  | R-C-R-C-R | R-C-R-C-R | C-R-C | C-R-C |
| Aminian |  | C-R-R | C-R-C | R-R-R | R-C-R-R | Kazemi |  | R-R-R | R-R-R | R-R-R | R-R |
| Nejad Masoom |  | R-R-C | C-R-C | C-R-R | C-R-C | Karimnejad |  | C-R-C | C-R-C | R-C-R | R-C-R |
| Nafisi |  | R-C-R-C-R | R-C-R-C-R | C-R-C | R-R-C | Yazdani |  | R-C-R | C-R-R-R | | |
| Pardakhti |  | R-C-R-C-R | R-C-R-C-R | R-R-R | R-C-R-C-R | Hakak |  | R-R-R | R-R-C-R | R-R-R | R-C-R-C-R |
| Soroushian |  | R-R-R-R | R-R-R-R | | R-C-R-R-C | | | --- | | | |

in most of the houses (⁵ out of 6), this rhythm is used at least in one facade.

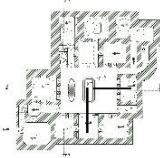
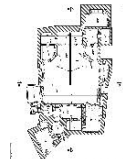




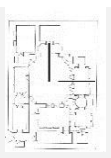


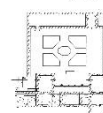

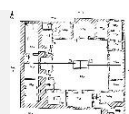

Symmetry

Table 6 shows the result of studying symmetry (based on the plan) in each of the facades. In Qajar houses, symmetry can be seen in 6 cases. In one of the houses, just one facade, and another

house all of the facades are asymmetric, and most of them have at least 2 symmetrical facades.

In the first Pahlavi houses, in just one house all the facades are symmetrical and in another one, 2 of the facades are symmetrical and the rest of the houses do not have symmetrical facades (2houses) or have only one symmetrical facade (2houses), so

Table 6. Symmetry in facades around the courtyard. Source: Authors.

| Qajar | | | | | | The first Pahlavi | | | | | |
|--------------|---|------------|------------|-----------|-----------|-------------------|--|------------|------------|-----------|-----------|
| Name | plan | North side | South side | East side | West side | Name | plan | North side | South side | East side | West side |
| Azami |  | | + | + | | Ghaffari |  | + | | | + |
| Amrollahi |  | | + | | + | Farrokhzad |  | + | + | + | + |
| Aminian |  | | + | | | Kazemi |  | | | | |
| Nejad Masoom |  | + | | + | | Karimnejad |  | + | | | |
| Nafisi |  | | | + | + | Yazdani |  | | | | |
| pardakhti |  | + | + | | | Hakak |  | | | + | + |
| Soroushian |  | | --- | | | | | | | | |

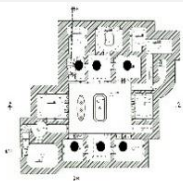
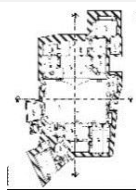
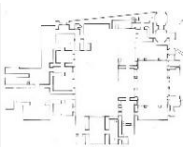
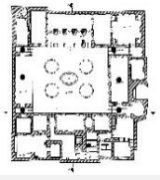
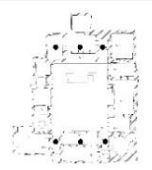
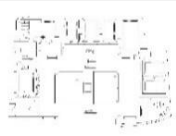
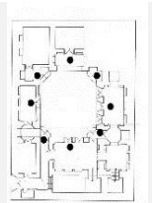
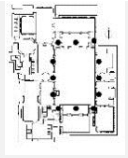
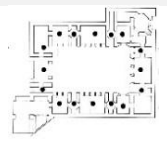
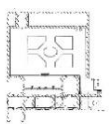
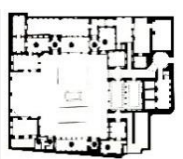
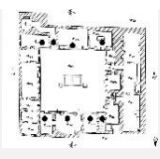

designing symmetrical façade is not common in the first Pahlavi.

• **Harmony between opposite facades**

To study the geometric harmony of the facades, the relationship between the number of elements on the opposite facades is studied. So the number of spaces

(either rooms or corridors) in each of the facades is counted and then a comparison is made between the northern, southern, and then eastern, and western sides. If the number of spaces in two opposite facades is similar, they are called harmonized; otherwise, they are unharmonized. Table 7 shows that in Qajar

Table 7. The rhythm of opposite facades in terms of the number of spaces. Source: Authors.

| Qajar | | | The first Pahlavi | | |
|--------------|---|------------------------|-------------------|---|----------------------|
| Name | Plan | South-North | Name | plan | West-East |
| | | | | | |
| Azami |  | Harmonized | Ghaffari |  | Unharmonized |
| Amrollahi |  | Unharmonized (Both 3s) | Farrokhzad |  | Harmonized |
| Aminian |  | Harmonized | Kazemi |  | Unharmonized |
| Nejad Masoom |  | Harmonized (Both 3s) | Karimnejad |  | Harmonized (Both 3s) |
| Nafisi |  | Harmonized (Both 5s) | Yazdani |  | Unharmonized |
| Pardakhti |  | Harmonized (Both 5s) | Hakak |  | Unharmonized |
| Soroushian |  | Unharmonized | | | Harmonized (Both 4s) |
| | | | | | ... |

houses, there is more harmony between the north-south facades (5 of 7) than the east-west (2 of 7).

In the first Pahlavi houses, there are similarities in the number of spaces between the north-south (2 of 6) and east-west (3 of 6) facades. This finding shows that just a small number of opposite facades are harmonized in terms of the number of spaces, and approximately the number of similar south-north and west-east facades are the same.

In the next step, the harmony of opposite facades is studied in terms of the size of the spaces by measuring the edge of each space that is adjacent to the courtyard. For example, if in a facade there is a space with a large edge in the middle and two spaces with a small edge on both sides, is such a pattern repeated in the opposite facade or not? Table 8 shows that in the Qajar houses, in 3 cases there is harmony in the north and south facades, and in only one case the east-west facades are similar. In other words, unlike the previous result, there was more freedom to place small and large spaces for opposite facades. In the first Pahlavi houses, as shown in Table 8, there is no harmony between the north and south facades. Harmony between eastern western facades also has not been used. So in the first Pahlavi houses, the architects did not have many obligations or desire to harmonize the rhythm of spaces size in the opposite facades.

• Courtyard structure

- Courtyard elongation

In this study, in addition to the courtyard sides, the elongation of the courtyard is also studied (Table 7). Among the 7 Qajar houses, 5 out of 7 courtyards have north-south elongation which is superior to the east-west (2 out of 7). The significant point in the study of the 6 first Pahlavi courtyard houses is the preference of the east-west stretch (5 of 6) over the north-south stretch (1 of 6).

- Courtyard proportion

Table 9 shows the ratio of length to width of Qajar courtyards. Based on the K-means clustering method, the proportions of the courtyards are near

two means: 1.17 and 1.68. This means for the first Pahlavi houses are close to 1.10 and 1.55.

Discussion and comparison of the findings of the two periods

In this paper, by studying the indicators used to analyze the selected houses of the Qajar and the first Pahlavi, the similarities and differences between the two types of houses were determined. The differences indicate the occurrence of transformations in the architecture of the houses. Based on Table 10, the layering of the spaces around the courtyard was first studied to determine the type of extension of the spaces in courtyard houses. Most houses in both periods have two layers, at least on one side of the courtyard. While in Qajar houses, the second layer is often on the north side, in the houses of the first Pahlavi, the probability of double layering on both the north and south sides is the same.

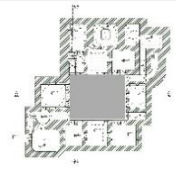
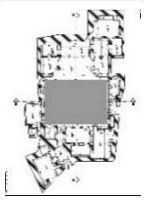
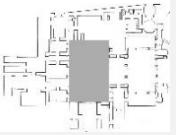

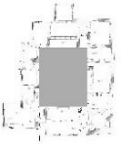

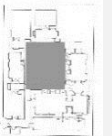

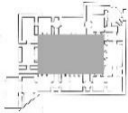


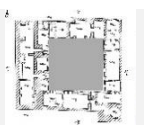


Also, while most Qajar houses (5 out of 7) used the second layer on more than one side, the use of this layer was reduced in the first Pahlavi houses (3 out of 6). Therefore, with the need to expand the house spaces, the Qajar houses were extended on both sides and often on the northern side, but in the first Pahlavi period, this extension was mainly on one side, and no preference was seen on the northern or southern sides.

There are similarities between the two periods in terms of the rhythm of the room and corridor around the courtyard. However, the frequency of applying an intermittent rhythm to the room and corridor in the facades of Qajar houses is twice as high as in the first Pahlavi. The findings showed that the similarity between the opposite facades in terms of "number" and "size" in the Qajar period was greater than in the first Pahlavi period. Furthermore, the obligation to apply symmetry is less in the first Pahlavi houses' facades. The set of these differences indicates a kind of transformation in the house plans of the two periods, in such a way that the organization of the spaces around the first

Table 8. The rhythm of reciprocal views based on the small size of the spaces around the courtyard. Source: Authors.

| Qajar | | | | The first Pahlavi | | | |
|--------------|--------------|---|------------|-------------------|--------------|---|--------------|
| West-East | South-North | plan | Name | West-East | South-North | Plan | Name |
| Unharmonized | Unharmonized |  | Ghaffari | Unharmonized | Harmonized |  | Azami |
| Harmonized | Unharmonized |  | Farokhzad | Unharmonized | Unharmonized |  | Annollahi |
| Unharmonized | Unharmonized |  | Kazemi | Unharmonized | Harmonized |  | Aminian |
| Unharmonized | Unharmonized |  | Karimnejad | Unharmonized | Unharmonized |  | Nejad Masoom |
| Unharmonized | Unharmonized |  | Yazdani | Harmonized | Harmonized |  | Nafisi |
| Unharmonized | Unharmonized |  | Hakak | Unharmonized | Harmonized |  | Pardakhti |
| Unharmonized | Unharmonized |  | Soroushian | Unharmonized | Unharmonized |  | Soroushian |

Table 9. The structure of the courtyard. Source: Authors.

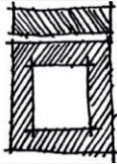
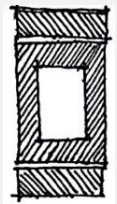

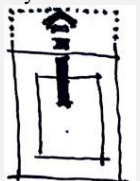
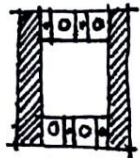

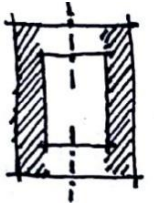
| Qajar | | | | The first Pahlavi | | | |
|--------------|---|--------------------------------|-----------|-------------------|---|--------------------------------|-----------|
| Name | Plan | The direction of the courtyard | The ratio | Name | Plan | The direction of the courtyard | The ratio |
| Azami |  | East-West | 1.24 | Chaffari |  | East-West | 1.44 |
| Amrollahi |  | North-South | 1.54 | Farokhzad |  | East-West | 1.15 |
| Aminian |  | North-South | 1.23 | Kazemi |  | East-West | 1.66 |
| Nejad Masoom |  | North-South | 1.17 | Karimejad |  | North-South | 1.41 |
| Nafisi |  | East-West | 1.68 | Yazdani |  | East-West | 1.67 |
| Pardakhti |  | North-South | 1.24 | Hakak |  | East-West | 1.04 |
| Soroushian |  | North-South | 1.44 | |  | | |

Pahlavi courtyards is less symmetrical, and the opposite facades are less similar in terms of some spaces or the rhythm of their sizes. The architects of the first Pahlavi had more freedom in designing than in the Qajar period, so the first Pahlavi plan is more diverse in terms of composition and also

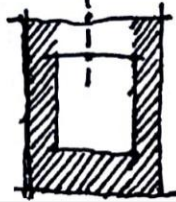
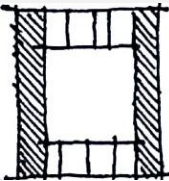
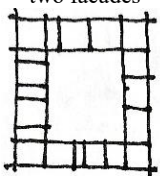
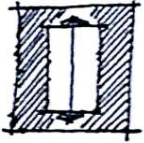
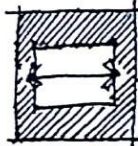
in a spatial organization that provides a different pattern from the Qajar.

The study of the structure and geometric features of the courtyard shows a transformation in the role of the courtyard in the two periods. While the predominant stretch in the Qajar courtyards is

Table 10. Comparison of findings, similarities, and spatial changes of houses of Qajar and Pahlavi period. Source: Authors.

| Indicator | Sub indicator | Similarities | Differences |
|---|---------------------------------|--|---|
| Mass (geometry and arrangement of spaces) | Layering of the space | Applying the second layer at least on one side |  Qajar: Often on the north side |
| | | |  The first Pahlavi: north and south side |
| | Rhythm of the room and corridor | Odd number of the spaces |  Qajar: Often 2 layers on more than one side |
| | | |  The first Pahlavi: use of 2 layers on more than one side in half of the building and preference over using the second layer on one side |
| | Symmetry of facades | |  Qajar: The use of the intermittent rhythm of the room and corridor often in 2 facades |
| | | |  The first Pahlavi: The use of the intermittent rhythm of the room and corridor often in 1 facade |
| | | |  Qajar: Often two symmetrical facades |

Rest of Table 10.

| Indicator | Sub indicator | Similarities | Differences |
|---------------------|-------------------------------------|---|---|
| Courtyard structure | Harmony of the opposite facades | Harmony between two north and south facades in terms of number of spaces |  <p>The first Pahlavi: Often asymmetrical or with only a symmetrical appearance</p> |
| | | |  <p>Qajar: The harmony between the two northern and southern facades dominates the other two facades</p> |
| | | |  <p>The first Pahlavi: The harmony between the two northern and southern facades decreases and is similar to the other two facades</p> |
| | Elongation (geographical direction) | Decreased harmony in terms of compared to the number of spaces | <p>Qajar: the harmony in 3 cases between north-south facades and two cases between east-west facades</p> <p>The first Pahlavi: complete removal of this issue in facades</p> |
| | | The ratio is near two numbers: one close to one and the second close to 1.6 |  <p>Qajar period: often North-South</p>  <p>First Pahlavi period: often East-West</p> |

north-south, most of the first Pahlavi courtyards have east-west elongation. This rotation of direction indicates a change in the concept of the courtyard. In other words, the role of the courtyard in the first Pahlavi period is different from the Qajar. However, in both periods, the ratio of the courtyard follows two relatively similar numbers (1.10 to 1.17) and (1.55 to 1.68). Therefore, the ratios of the courtyards of the Qajar period were similar to those in the first Pahlavi period.

Conclusion

Due to the importance of the house and its transformation in the history of architecture, this paper compared the two types of Qajar and the first Pahlavi houses in Kerman. One of the reasons for this choice was the environmental and social changes that occurred in these two periods and increased the possible effect of those issues on the architecture plan. To compare the samples, the paper focused on the characteristics of the mass, including the arrangement and relationships of the spaces of each type. Since the courtyard has a pivotal role in the houses of both periods, the indicators were introduced to compare the arrangement of elements around the courtyard and its' structure.

The analysis of the samples showed that although the second layer is used in houses of both periods to correspond to the increase in space, this indicator reveals some significant geometric changes: in most of the Qajar houses, the second layer was placed in more than one side of the courtyard, and the north side was generally used to add this layer. However, in the first Pahlavi, this layer is less visible and often placed just on one side of the courtyard. In contrast to the Qajar, in the first Pahlavi, there is no geographical preference (north or south). Here, a hypothesis can be postulated that the extension of the house in the first Pahlavi period took place only on one side, and there was no

restriction on choosing a specific geographical side for it. This freedom has caused the houses of the first Pahlavi to have more geometric diversity than the Qajar. The rhythm of the elements of the facade (the intermittent rhythm of corridor and room) and the similarity and harmony of the oppositional facades show that the similarity of the arrangement of the spaces on opposite sides of the first Pahlavi was less than in the Qajar houses. In other words, the difference between the arrangement of spaces on opposite sides in the first Pahlavi houses is greater than those in the Qajar, and the emphasis on the harmony of the north and south facades is reduced. It can be said that the Pahlavi architects did not constrain themselves to follow the same arrangement on opposite sides. In these houses, the intermittent rhythm of the corridor and room has also decreased in the facades, which shows the change in the concept of access between the spaces. In other words, the difference between the houses of the two periods is not only in the placement of the second layer but also in the organization of the spaces and, consequently, the arrangement around the courtyard. Therefore, the tendency to create symmetry and harmony between the two facades was decreased in the first Pahlavi houses, and in the plan composition, there is more variety than in the houses of the Qajar period. This is confirmed by observing the increase in the use of symmetry in the houses of the Qajar, which is twice as much as in the first Pahlavi. In response to the second question of the research, the study of the geometric features of the courtyard in both of the houses

In response to the second question of the research, the study of the geometric features of the courtyard in both of the houses showed that although there is no difference in the proportions of the courtyard in the houses of the two periods, a significant transformation in the geographical orientation of the courtyard occurred, and in the first Pahlavi, the direction of the courtyard

changed from north-south to east-west. This geometric change, with the transformation in the way the second layer is placed around the courtyard, can be a sign that indicates the diminishing of the centrality of the courtyard in the first Pahlavi.

In general, the purpose of this paper is to investigate spatial changes in houses of the two Qajar and Pahlavi in the city of Kerman, and the findings show that while there are some similarities between the two types, we can mention the structural transformation in the characteristics of the courtyard (direction of elongation) as well as its role in organizing the building mass. On the other hand, reducing the harmony of opposite facades and symmetry in the facades around the courtyard and also the freedom to expand the mass (location of the second spatial layer) in the houses of the first Pahlavi has demonstrated more diversity in these houses. So it can be concluded that the first Pahlavi architects had more freedom of action in arranging and configuring the plan than the Qajar. This issue can be influenced by the emergence of modern concepts in the architecture of the first Pahlavi and needs further investigation. This paper tried to look at the characteristics of the two types of houses with a scientific and reasoned look, but the small number of samples was a research limitation. However, the research method used in the paper can provide similar criteria for building analysis regardless of place and time in similar studies, especially for courtyard types, and provide reasonable results.

Endnotes

1. The research of Memarian et al. (2012) is an exception.
2. Jean-Nicolas-Louis Durand
3. Unfortunately, the authors did not have access to this resource.

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HOW TO CITE THIS ARTICLE

Ashraf Ganjouei, M.A. & Soltanzadeh Zarandi, M. (2022). An Investigation of Spatial Transformation of Historical Houses in Kerman: Qajar Vs. the First Pahlavi. *Bagh-e Nazar*, 19(111), 71-88.

DOI: 10.22034/BAGH.2022.293991.4937

URL: http://www.bagh-sj.com/article_153544.html?lang=en

