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Comparison of the Components of the Physical Structure of the Residential Building of the Qajar Period in the Degree of Influence from the Western Architecture

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Research Article

Abstract

Residential houses are one of the most important types of Iranian architecture. The history of Iran's architecture shows that traditional houses in various periods almost kept their structural system in the field of their body and mainly stylistic developments were specific to the hidden concepts in their structural field. Looking at the contemporary architecture, it can be seen that the buildings of the Qajar period, while following the past practices, influenced by the western architecture, are subject to changes in the physical structure that have led to the construction of buildings with an eclectic identity. In this regard, the present research, with the aim of extracting the components of the physical structure, tries to investigate the influence of the residential buildings of that period on the principles and concepts of Western architecture. In this article, a mixed qualitative and quantitative research method has been used. First, the components of the physical structure are extracted from the theoretical foundations, and then interviews are conducted to verify the selected samples. After that, quantitative areas will be used to check the effectiveness. It is worth mentioning that interviews are used to collect information in the qualitative stage and questionnaires are used in the quantitative stage. The software used in the quantitative part is JMP and in the qualitative part ATLASTI. The results show that there is a positive and significant correlation between the components of western architecture and the physical structure of Qajar period houses at the level of 0.01. In this regard, first the break from the past and confinement with

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the value of correlation (0.952), then the break from the past and fit with the value (0.932) in the second place and the confinement and the use of rotating and diagonal statue forms with the value (0.925). In the third place, they have the highest correlation between physical structures and western architectural components. The lowest correlation is between severe criticism of objects and imitative and structural schools with a value of (0.112).

Keywords: Physical Structure; Residential Building; Qajar Era; Western Architecture; Mixed Method

1. Introduction

Paying attention to various components in the periods of architecture is sometimes accompanied by extremes and pursued with different goals, which are sometimes used as a tool to seek superiority and stabilize fanatical ideas and extreme nationalism, and sometimes in order to moderate the negative consequences of the modern period in recent years in order to face the phenomenon of globalization. followed Contemporary architecture has seen various influences based on time, place and social, cultural and educational trends, each of which has reflected the specific political, social and cultural conditions of its era. At the same time, it is impossible to ignore the many and distinctive structural changes of this era on Iranian architecture (Shayan and Dezfuli, 2013: 9). A review of the history of Iranian architecture shows that architecture has had a clear and consistent process, in a way that has a logical relationship with its previous and subsequent periods; But during the Qajar era, we see a break in the architecture of this land. In fact, the domination of the new western civilization on the ancient Iranian culture can be seen (Bani Masoud, 2013: 73). What has caused this transformation and rupture in architecture is the intellectual and cultural transformation of Iranian society that began in the Safavid era and reached its peak in the Qajar era and especially the first Pahlavi period. Safavid era was born, but since these changes have not yet been very influential in architecture, the beginning of the transitional period in Iranian architecture should be considered the Qajar period (Safari, 2008: 14). From the perspective of spatial creativity, the architecture of this period is considered a valuable period and is placed in a superior and more evolved position than its previous periods, because spatial creativity increases in this period (Mirmiran, 2000: 54-56). The variety of spaces increases and new spaces are created. Spaces become more open and light, and traditional architectural patterns evolve in line with expanding the space. But when we look from other angles such as sizes, proportions, shapes and decorations, the architecture of this period shows a lower status than its previous period (Farhad and Kashani, 2018). Therefore, Qajar architecture rightly promoted the principles, foundations and old patterns of Iranian architecture and created innovation in terms of space. But it seems that it did not have the necessary strength to create a new architecture (Bani Masoud, 2013, 75). In the traditional architecture of Iran, building a house and residence is a cultural thing that is directly related to the tradition, climate and social cultural attitude of the people, in such a way that the house is considered to be a manifestation of the human being and the manifestation of the cultural traditions of that society (Pourmand and Jedgaran, 2005: 46). In the early Qajar era, the traditional style and style formed the majority of residential buildings (Safari, 2008: 13), but with the rise of the influence of western culture and civilization from the middle of the Qajar period, the use of western architectural art in the design of houses increased and gradually the field of houses appeared in it provided a fusion style and polarization of popular styles. The trend towards western architecture did not end here and in the last three decades of the Qajar era, houses in a completely

western style were created by wealthy and influential Qajar men (Qabadian, 2003: 245). According to Rapaport's opinion, the environment is defined as a set of relationships between objects and also between objects and humans, and he considers its organization based on a systematic pattern (Najumian, 2008: 115). A pattern in architecture is a combination of design principles that are known to form a larger group or set of design solutions. In fact, it can be said that it is a flexible framework that shapes the body (Shahbazmir, Omidari, and Begzadeh, 2014: 26). Architectural patterns are the result of human experience and are a tool to produce form, and in a holistic view, they are considered to be the effect of architectural space (Soltani, Mansouri, and Farzin, 2011: 4). Since the research in the field of fundamental concepts of architecture in order to identify patterns and components, it is necessary to examine the physical and spatial characteristics of buildings, by studying and examining case examples of historical houses as part of the golden pages of the identity of the people of this land, the principles and concepts of Iranian architecture can be extracted from them (Zandieh and Karimi, 2014); Therefore, considering the changes in the physical area of buildings of the Qajar era following the developments originating from Western architecture, despite the growth of traditional architectural patterns from a spatial perspective, this research with a case study in the area of traditional houses of the Qajar era, with the aim of extracting the components of the physical structure and their adaptation to architecture Contemporary West tries to answer the question, which components were more influenced by Western architecture?

2. Research Background

Regarding the history of contemporary architecture in Iran during the Qajar era, except for the writings that express most of the theoretical base and taste of the authors about essays about the influence of the architecture of that era on the architecture of the West in physical and spatial aspects, it seems that there is no documented research that relies on innovation in There are few areas that have investigated the effectiveness of the structural components of this era of Western architecture. Most of the researches are in the form of qualitative approaches and in the form of descriptive analysis, which this research uses both approaches to achieve more substantiated results. In order to be brevity and to avoid prolonging the writing as well as summarizing the results, the background of the research is given in the form of Table 1, separated by books, articles and thesis;

Table 1 Background of the research (source: authors)

Topic	Researcher	Year	Description
Books			
Contemporary architecture of Iran	Bani Massoud	2013	Examining the way, we face the new world and its influence on Iranian architecture, from the Qajar period to three decades after the Islamic revolution, along with the classification of architects of these periods and some of their works.
A look at the emergence of new architecture in Iran	Cyrus Baur	2009	It specifically discusses architectural events, architects and their works from the constitutional revolution to the present day.
Architecture in Naseri Palace (Tradition and Modernity in Contemporary Architecture of Tehran)	Vahid Qabadian	2014	It refers to the description and development of the architecture of the period of Naser al-Din Shah Qajar, especially in Tehran.

Articles			
A look at architectural trends in Tehran	Behrouz Pakdaman	1994	Investigating developments in Iranian society since the middle of the Qajar era and at the same time as creating wider connections with European societies.
Comparative study of architecture and contemporary urban planning of Iran with Europe	Iraj Etisam	2004	It examines and compares four periods of Iran's contemporary history from that time until now. He considers the industrial revolution to be the main cause of changes in Western architecture and urban development, which coincides with the rule of the Qajar dynasty.
Survey of architecture and urban planning of the Qajar period	Farhad and Kashani	2009	First, the architectural features of the Qajar period and the different currents of this period have been briefly discussed. Then, the backgrounds and characteristics of Qajar architecture are determined and categorized, and then each group is analyzed.
Adapting the role of the model and concepts based on experience in the space architecture	Mehrdad Soltani	2012	Examining the concept of pattern with some other concepts and interpretations in the architectural space
Comparative study of contemporary architectural approaches in Iran (recognition of theory in the works of three generations of architects)	Shayan and Dezfuli	2014	Analyzing the signs and currents of thought in the text of the works and recognizing the tendencies of the generations of contemporary architecture
The relationship between today and the past in works of contemporary residential architecture in Tehran	Khaqanpur-Khoei	2016	Understanding the approach of designers in the path of connecting with the past, recording joint efforts and answering the question of how far these designers have come close to the principles of Iranian architecture, considering the architecture of the past.
Thesis			
Comparative study of the architecture of traditional and contemporary Iranian houses from the perspective of physical-spatial organization (study course: Pahlavi and Qajar houses)	Sacrifice-merciful	2021	In order to investigate the impact of the physical-spatial organization of Qajar and Pahlavi historical houses on European architecture, this research aims to investigate and read the structural system of the houses of these two periods. In this way, he has used the library method to collect qualitative information and the historical-interpretive approach based on the comparative strategy in order to analyze the content of the obtained documents.

2.1. Theoretical

The evolutionary course of Iranian architecture has taken place in a continuous and gradual movement, from within previous traditions and experiences; This is the reason why, despite all the sudden changes and transformations caused by military invasions and cultural shocks, the traditional architecture of Iran has achieved a distinguished individuality from the architecture of

other Muslim countries (Kamali, 2008). The developments of the Qajar era were endogenous at first. It had a slow rhythm and maybe similar to other artistic and social phenomena and it had artistic and social factors and phenomena and was influenced by the internal factors and phenomena of the society (Ikhaka, 2003). The peaceful ideas and material manifestations of the West had ended, in the middle of this period it turned into a serious battle and confrontation between tradition and modernity (Pakbaz, 2000). In this way, the architecture of Iranian buildings, which was formed in the early Qajar period in connection with the principles of traditional architecture and in the form of the structures of a traditional city, gradually lost its ancient forms in the middle of the Nasrid period and took on a western appearance (Hashempour and Kaynejad, 2011). In this regard and according to the researchers, due to the fact that they shaped the architectural structure and decorations of many buildings of the Qajar period in a different way from the previous traditional ways, therefore, they can be cited in the study of the influence of Qajar architecture from Western architecture. Therefore, in the following, we will examine the characteristics of the residential architecture of the Qajar period in order to extract and understand it better than the physical structure component. Then, in order to understand the principles and concepts of Western architecture and to examine the effectiveness of them, we take a brief look at their styles and characteristics in the periods at the same time as the Qajar period.

2.2. Physical Structure of the Residential Buildings of the Qajar Period

According to Cooper, the house has two different components; The interior space consists of the enclosed and private space and the exterior which includes the open and public space (Aminpour et al., 2014). Building a house is a cultural phenomenon and its shape, organization and spatial order are influenced by the cultural environment to which the house belongs. Factors such as climate, art and technology are also in the next layers of shaping the body of the building (Rapaport, 2012), so that Hillier described the socio-cultural logic of the space as follows; The social and cultural dimensions in the spatial configuration, like the grammar rules in the shaping of literary texts, in fact, the social and cultural characteristics of the residents of each region are among the important factors in the formation of the spatial structure of the settlement (Hillier, 2007: 77). This theory in the buildings history that was built in a native way was more intense and the building elements and geometric coordination in the construction were more carefully controlled and implemented, which itself caused the socio-cultural stability of the space (Ronn, 2011: 114). In fact, the house is an institution that was created in line with a series of complex purposes and is not a simple structure, but the space is a systematic structure, a structure that has order and hierarchy in such a way that the organization and combination of spaces and elements are formed based on some physical principles. One of these principles is axes and symmetry. In houses, confrontation with the outside has always followed the organization of the inside, and it has had a significant impact on the geometric structure of the house (Wigley, 1994). The role of the house is to create a social unit. The house cannot be studied separately from the society or its context and must be studied as a part of the social and spatial system of the city, including the house and lifestyle, biological complex and landscape. In the traditional architecture of Iran, the house is the most important architectural space, which in combination with the culture, climate, native art in each geographical region and had special spatial elements. In general, the evolution of Iranian houses has a special structural order that has not had significant changes throughout history; But from the Qajar period, due to the fundamental changes in the political and social structure of Iran, fundamental changes took place in houses (Ronn, 2011: 115).

2.3. Architecture of the Qajar Period can be Divided into Two Part

A) Buildings of the first period 1207-1266 AH. 1800-1850 AD, which is the same time as the reign of Agha Mohammad Khan Qajar, Fath Ali Shah, Mohammad Shah and the beginning of the reign of Naser al-Din Shah.

Among their features, the following can be mentioned:

1. Mainly introverted buildings 2. Breaking of internal facades with the retreat of the second floor 3. load-bearing walls, convex arches, cruciform arches, traditional structures such as arch and toise, arch of music, arch of Colombo and four sections 4. Using building materials and wooden beams to build the body of buildings 5. The use of brick, straw, plaster, stone and tile in the facades of buildings (Meshbaki Esfahani and Meshbaki Esfahani, 2018).

The architecture of this period was the continuation of the traditional architecture of the periods of the past kings of Iran and continued until the middle period of the Qajar rule (Soltanzadeh et al., 2018: 18-19). The residential buildings of this period include the entrance, vestibule, central room, porch with two columns in front of it and smaller rooms located around the central room, all of which were in the style of authentic Iranian architecture in the past periods, but in this period, with newer initiatives and the influence of architect elements. The west has been completed in details and construction (Sarikhani, 2004). Among the elements of western architecture, it is possible to create an entrance hall, i.e., stairs that start from the middle of the hall and continue to the fork in the opposite direction up to the top (Nasiri Ansari, 1971), creating a window facing the street with decorative railings and a sloping roof. Instead of flat and domed roofs and the decorations of columns and capitals, he pointed to the Ro-Coco style (Itsam, 1995).

B) Buildings of the second period, 1266-1344 AH. 1850-1925 AD, at the same time as the rule of Naser al-Din Shah, Muzaffar al-Din Shah, Muhammad Shah and Ahmad Shah.

The beginning of the period of eclectic architecture begins with the Naseri period. The first changes were small and insignificant, and in the beginning, the legality of Iranian architectural patterns dominated the building, but over time, the flow of changes in the form of a wide wave affected important cities (Soltanzadeh et al., 2018: 7). In this period, architecture and urban planning, like other manifestations of Iranian life, were influenced by Western modernism, and the form and manner of building design and construction tended towards the Western world (Meshbaki Esfahani, 2018). The influx of new elements started in the fork: 1. Decorative elements and factors 2. Spatial patterns. Simultaneously with the rule of Muzaffaruddin Shah, Muhammad Ali Shah, Ahmad Shah until the end of the Qajar dynasty, the most important historical event, i.e., the collision of tradition and modernity and the occurrence of the constitutional revolution, had taken place. Changes in urbanization and urban planning regulations have started with the departure of traditional architects and the arrival of Iranian educated architects abroad, under the influence of the new western thinking of "modernism" characterized by individualism in the creation of architectural spaces (Soltanzadeh et al., 2018: 6). The following are the features of this course: 1. Buildings with a neoclassical symbol 2. Symmetry in the main view and plan 3. The use of sloping roofs, sometimes with the Centauri symbol 4. Semi-circular arches instead of traditional architectural cross arches 5. Classical columns and decorations and realistic images 6. The balcony above the entrance 7. Creating volumetric compositions in the walls and corners of buildings (Meshbaki Esfahani, 2018).

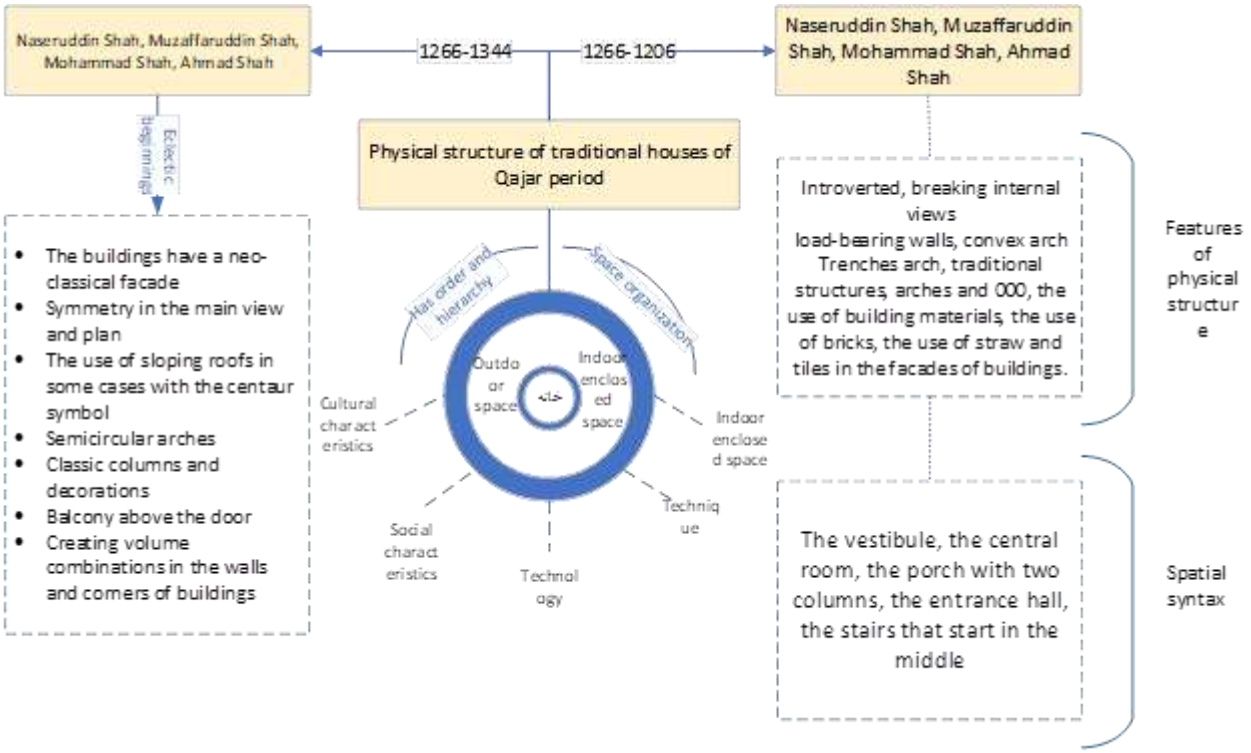


Fig 1 The physical structure of the traditional houses of the Qajar period (source: authors)

2.4. Western Architecture at the same time as the Qajar Period

Late Qajar architecture can be considered as early modern architectural style (Bamanian, 2006: 5). European neoclassical architecture with the combination of Iranian motifs, the first architectural trend in this period can be considered as the late Qajar architecture with the combination of imported elements; which is explained on a case-by-case basis as follows:

Table 2 Characteristics of western architecture coinciding with the Qajar period (source: authors)

Style name	Principle
Chicago School	Designing the building based on the requirements and needs of the new era, looking to the future and using modern materials and artifacts, using a steel frame for the entire structure of the building, showing the structure of the building on the facade of the building, not imitating the styles of the past, very little use of decorations, using windows wide that cover the entire opening between the columns (Curtis, 2009, 431).
New art movement	Strong criticism of imitation objects and schools, separation from the past, inventing new forms, art suitable for the time, using modern products (metal) for the building skeleton and decorations, using decorations inspired by natural, romantic or geometric forms (Shahbazi, Yeganeh, and Bamanian, 2018: 161)
Expressionism	The design expresses the imagination and inner feelings of the designer, the use of rotating and diagonal sculptural forms, the display of spiral movement, no return to the past, the use of modern materials and technology (Roth, 2001, 39).
Futurism movement	Paying attention to the science and technology of future worlds, the impact of high-speed transportation on modern life, breaking with the past, removing decorations, building high-rises, revealing functional components and building technology (Hersey, 1985, 63).

3. Research Method

This research is of applied type from the objective point of view. The research method is a combination of mixed qualitative and quantitative type, which consists of two parts in its data analysis. In the qualitative stage, an attempt is made to reduce the data by using grand theory techniques (open coding, axial coding). The collection tool at this stage is a semi-open interview with short questions that ask experts about the physical structure of the Qajar period building in Tehran, as well as the extent of its influence on the different structure of the selected building from the western architecture. The coding approach uses interpretation, description and live coding; At this stage, ATLASTI software is used. Credibility of the questions and its verification by means of Delphi prospective research with phase (brainstorming, limiting, selection) after selecting the components of the body structure and extracting them according to the selected samples, a quantitative stage is done. In the quantitative stage, first, a questionnaire with a Likert scale is compiled, each question represents a component on the degree of influence of a modern architectural movement, then it is distributed to each of the space users, the sample size is selected by Morgan's table, the upper limit of which is 384 people. This stage is done by using causal-comparative method and by using inferential and predictive statistics to present the physical indicators and factor contribution of each of the influential principles of modern architecture and verify the extracted ones. The validity of the instrument was obtained with the formula CVR=0.75 and reliability was obtained by Cronbach's alpha, which is 0.74.

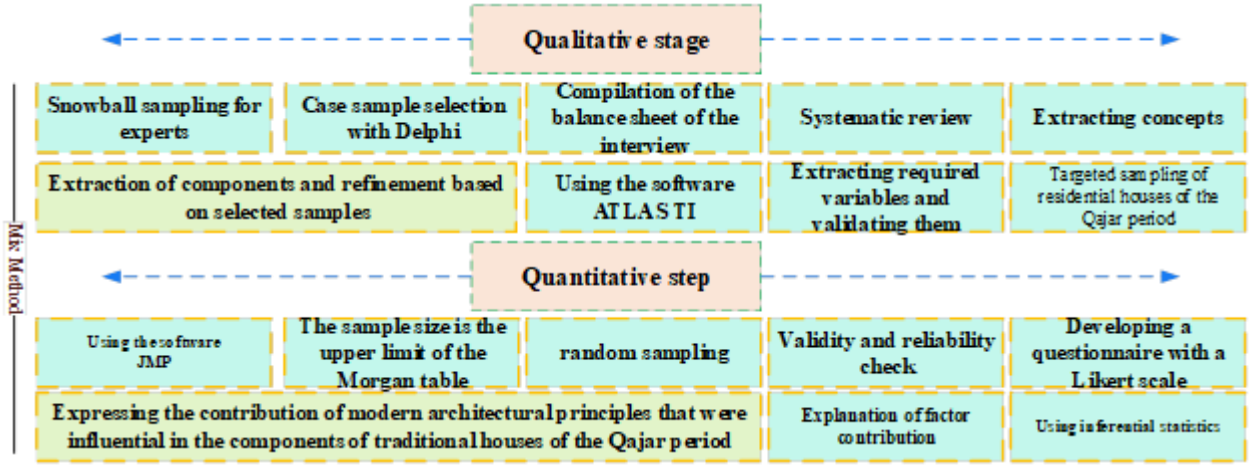


Fig 2 Research process (source: authors)

3.1. Sampling

The introduced examples of traditional houses of the Qajar period have been introduced to the research based on the entry and exit criteria, and the expert panel is selected as follows:

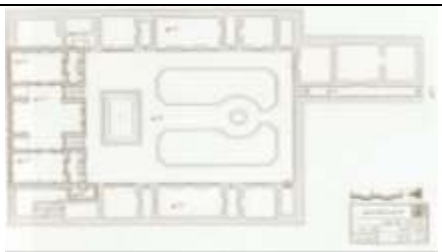
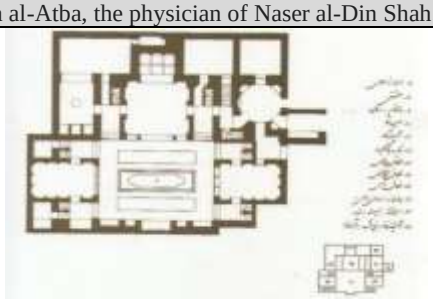
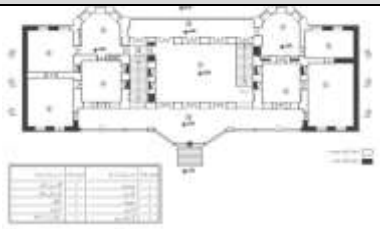
Table 3 Entry and exit criteria in qualitative research

Selection criteria for interview	Criteria for leaving the building research	Entry criteria for building research
Be a faculty member	Not located in the city	There should be a theoretical consensus in choosing it
Be familiar with the topics of body	Its residents do not have	The house is a villa

structure	enough information about it	
Have an article about one of the title variables	have certain limitations in design	Its information is available
Have a residential building design	Part of it is designed by someone else	Score 5 or more in the preference system
The sub-field of architecture or urban planning or civil engineering	be restored	Various materials are used in it

Also, their selection is based on purposeful sampling and on the researcher's observations. The snowball sampling system is used in the interview and selection stage of the expert panel in future research Delphi. The result of the selection for the correctness of the action and the formal validity of the questions from university professors. In the quantitative stage, questionnaires were randomly distributed. The characteristics of the selected buildings are as follows;

Table 4 Characteristics of selected buildings

		Trusted House of Doctors
Manzil Motman al-Atba is a historical mansion in Tehran and related to the Qajar period, which belongs to "Mirza Zainul Abdin Khan Danbali Zarrabi" nicknamed Motman al-Atba, the physician of Naser al-Din Shah.		
		Kazemi's house
Kazemi Mansion or Kazemi Mansion, whose new name is "Old Tehran Museum House" is one of Tehran's old houses, located in Chaleh Maidan neighborhood, in the neighborhood of Imamzadeh Yahya. The current location of the Kazemi building is one of Tehran's old houses, on Khordad Street 15, in Imamzadeh Yahya neighborhood, Abolqasem Shirazi alley.		
		The mansion of the lord of Hormuz
Arbab Hormoz Mansion is one of the monuments of the Qajar period and the sights of Tehran. In this two-story building, you can see a combination of traditional architecture with western architecture. This mansion was renovated in the 90s and finished in 2014.		

4. Research Findings

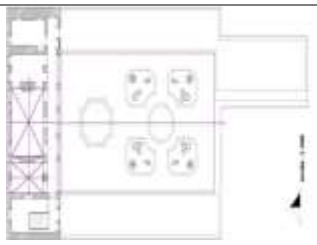
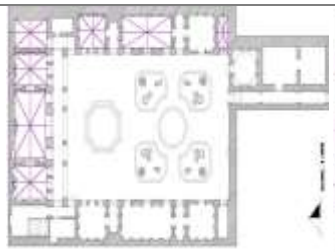
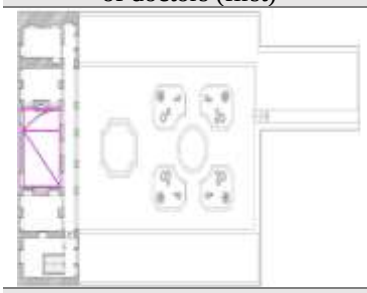
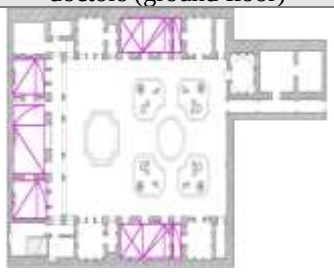
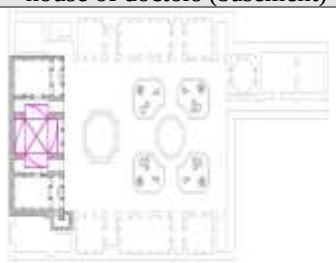
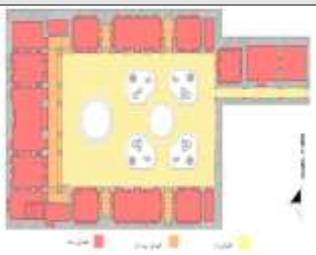
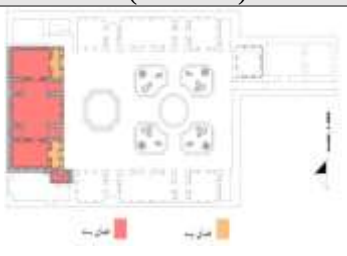
A summary of the interviews conducted regarding the Mutman al-Atabah House

The total volume of the reliable house consists of rectangular spaces. The circular form of one of the ponds and the octagonal form of the gardens and the other pond are built in a complementary

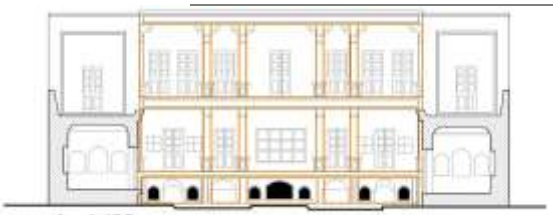
way. Mesh windows in the basement of Motaman al-Atabah house are for attracting light and air flow and seeing the scenery outside. Mesh windows create a balance between outside and inside light. This balance makes the person who looks from inside to outside not tired of the sunlight. The designs used in making mesh windows are often designed to regulate the light inside the room. The windows in this house include doors that have windows due to the bottom being closed and the light passing through them. Symmetry, repetition and rhythm are observed in the north, east and west facades. The large halls and entrances along with the central stairs in the house of Motman al-Atba have created an elongated plan along the facade. The spatial confinement in the house of reliable doctors is such that about a quarter of the building is a closed and semi-closed space and about three quarters of the building is an open space.

There are turquoise-colored tiles in the form of Fakhrumedin mesh in the basement windows. Plaster decorations can be seen on the capitals and fronts in the north facade of the Weber on the fireplaces inside the building and are seen in the form of slime motifs. Brick decorations are used in the basement ceiling. There are wooden decorations on the basement doors as well as inscriptions on the top of the cupboards.

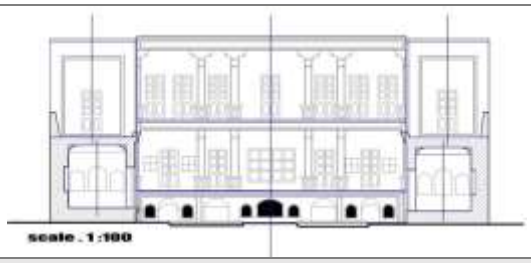
Table 4 Examining the characteristics of the trusted house of doctors

			**symmetry**
Symmetry in the reliable house of doctors (first)	Symmetry in the reliable house of doctors (ground floor)	Symmetry in the reliable house of doctors (basement)	
			**Proportions**
Proportions in the reliable house of doctors (first)	Proportions in the reliable house of doctors (ground floor)	Proportions in the house of the reliable doctors (basement)	
			**confinement**
Confinement in the house of trusted doctors (first)	Confinement in the house of reliable doctors (ground floor)	Confinement in the house of trusted doctors (basement)	

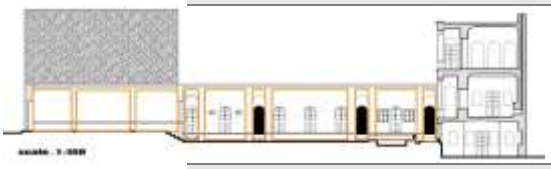
Symmetry, repetition and rhythm in elevation



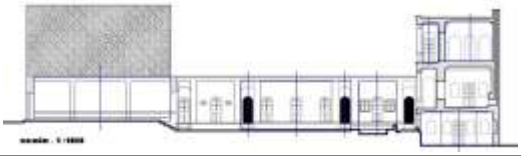
Repetition and rhythm in the north view



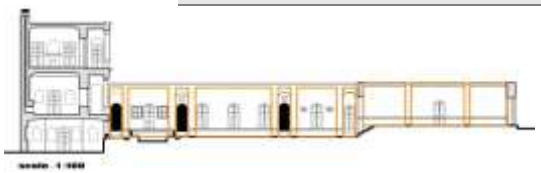
Symmetry in the north view



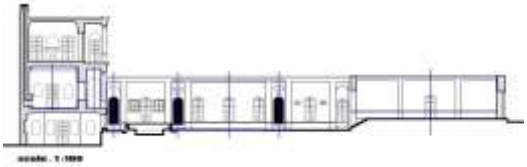
Repetition and rhythm in the view and the western section



Symmetry in the facade and western section



Repetition and rhythm in the facade and eastern section



Symmetry in the facade and eastern section

visual elements

The inscriptions above the closet in the king's room

Plaster on the head

Decorations of Fakhro Madin with tiles

A summary of the interviews conducted regarding the mansion of Arbab Hormoz:

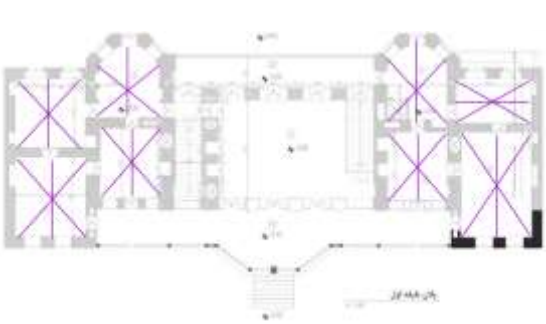
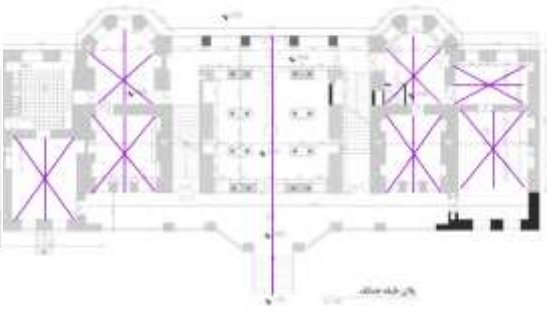
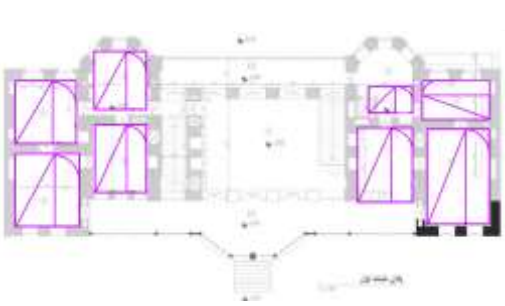
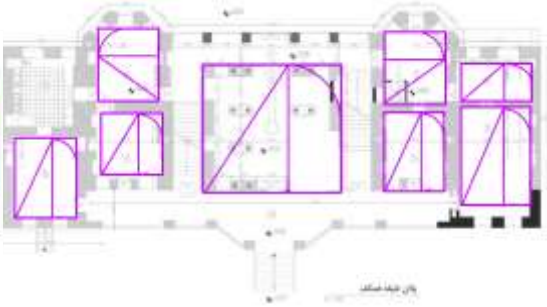
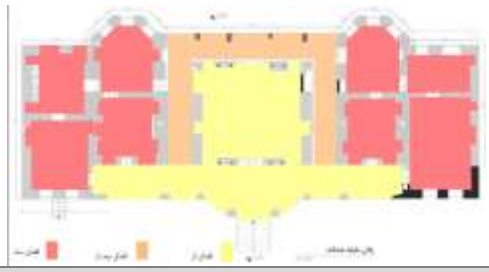
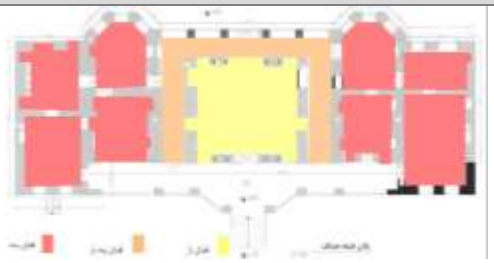
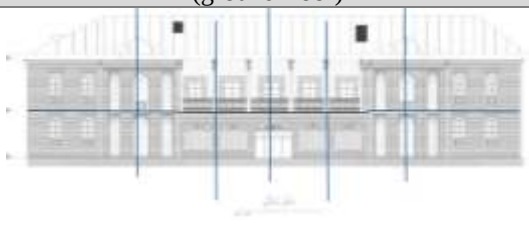
In the entrance area, there is a large shallow rectangular pond (it was deeper in the past). A two-story building, both of which have a large long porch. Full symmetry is seen. The lower porch has eight rectangular columns and the upper porch has two rectangular columns and six elongated and long plaster hexagonal columns with Corinthian leaf capitals. On the left side of the building there is a small door with five steps leading to the basement and two windows can be seen on the sides of the door. The entrance stairs are located right after the pond and in the middle of the building (this part is outside of the facade of the building).

There are two entrances for two rooms on the sides of the main door, and each of the rooms leads to another room, which is made of eight small rooms, i.e. in human dimensions. But from the main door that has been explained, we enter the main middle room or Hozkhaneh. A square room with a brickwork basin in the center with pathways that show water entering and exiting it.

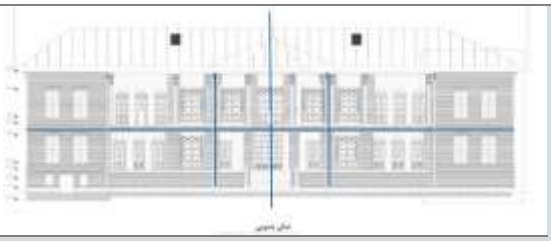
When we go up the stairs, we enter a small corridor, from the left side we reach four rooms that are located on the lower four rooms, and from the right side we enter a king's house, which is a room with three doors that sits on the pond and opens to two porches from the north and south. and the eastern corner is another staircase. There are three niches on the west wall. Shahneshin's roof is also wooden and framed (in the form of a mesh) in pea color and brown, which is worked in the

middle of each flower frame and in the center is decorated with an octagon with a rich and prominent wooden slime.

Table 5 Examining the characteristics of Arbab Hormoz mansion

symmetry		
	Symmetry on the first floor of Arrab Hormoz mansion	Symmetry on the ground floor of Arbab Hormoz mansion
Proportions		
	Suitability on the first floor of Arbab Hormoz mansion	Suitability on the ground floor of Arbab Hormoz mansion
confinement		
	Confinement in the mansion of Arbab Hormuz (first)	Enclosed in the mansion of Arbab Hormoz (ground floor)
Symmetry, repetition		
	Repetition and rhythm in the northern facade of Arbab Hormoz mansion	Symmetry in the northern facade of Arbab Hormoz mansion

Repetition and rhythm in the southern facade of Arbab Hormoz mansion



Symmetry in the southern facade of Arbab Hormoz mansion

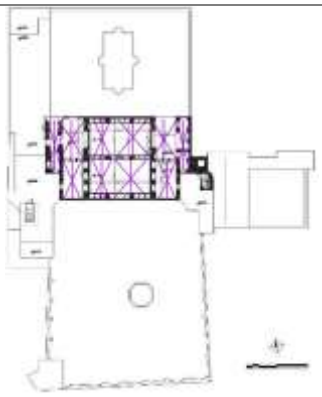
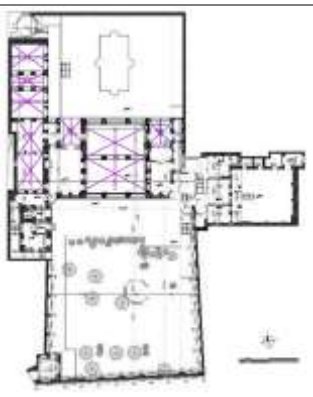
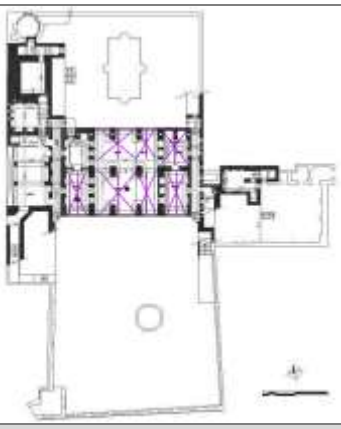
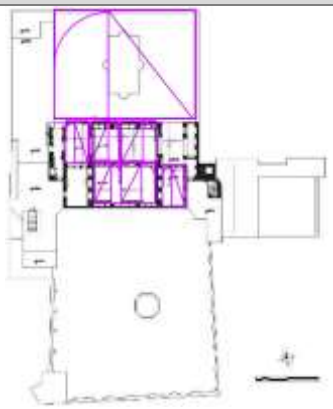
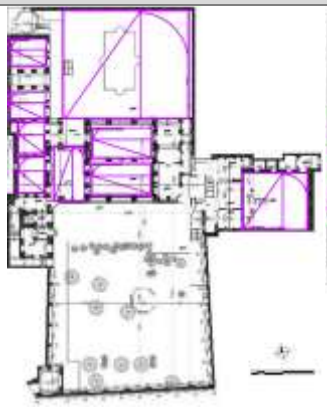
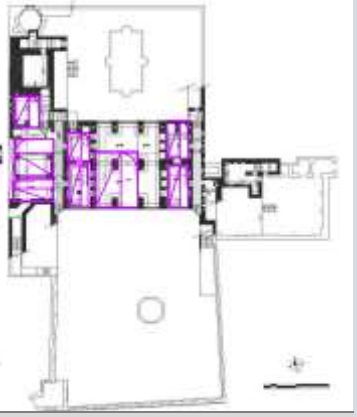
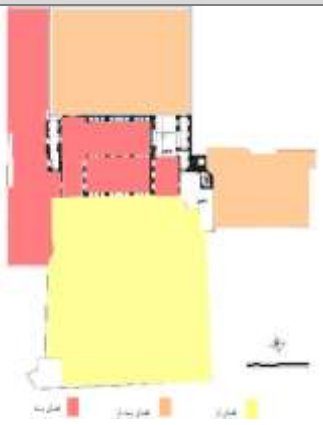
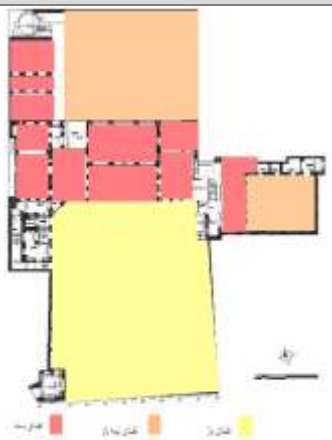
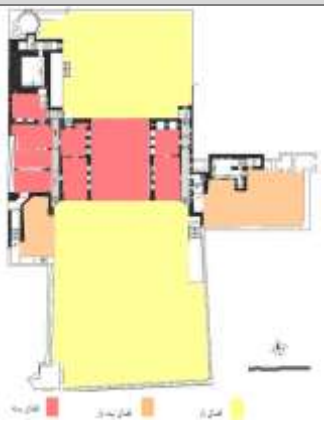
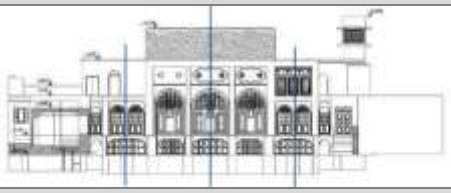
In the windows on the north and south exteriors with colored glass
and sash windows and lattice windows for rooms

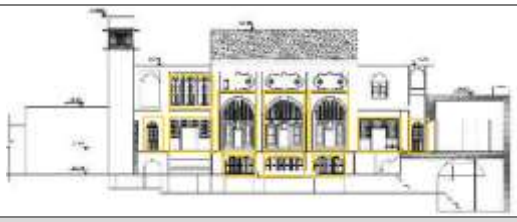
Two internal wooden staircases, which were made of plaster and clay before, and in two earrings

A summary of the interviews conducted regarding Kazemi's house

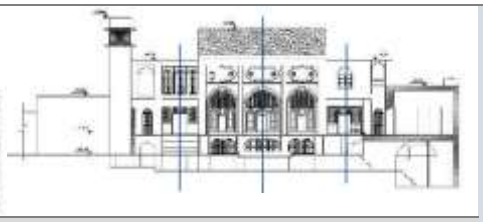
Hierarchy discussion is a conversation between inside and outside, because the sense of outside space cannot be found in the song of inside mood, and in other words, inside lacks these properties and outside conditions cannot be allowed inside. This evolution plays a role in the hierarchy, because the entrance threshold is the condition of entry and transformation, which was placed after the door and in a space such as the vestibule (the main entrance space that is usually placed after the front door), the outer courtyard, the vestibule and the rope; But during the Pahlavi period, this structure collapsed as the inner and outer spaces became more extroverted. Kazemi's house has 3 entrances: the entrance of the crew, the entrance of the north yard and the entrance of the south yard. Designed for all three vestibule entrances. The story of full-fledged color can be seen in the color of the glasses of Iranian sashes, which present an image of heaven to every viewer. This celebration of color, in which no two moments are alike, actually brings joy and happiness to the residents of the house in the colors of red, green, yellow and blue. Kazemi's colored glass is a good example of using color in an Iranian house.

A porch is a roofed semi-open space that is limited on three sides and open on one side. In the houses of the Qajar period, the south porches reveal the view of the house behind its curtain, a view in which usually tanbi (large and main room of the house, which is often located in the heart of the house and has a sash window), kelei (a room located in two On the upper floor, which is formed as a result of the high height of the rope and often overlooks it), there are hozkhanehs (a covered and elevated space that has a pool in the middle and is usually connected with other spaces) and other elements of the house. Of course, in the late Qajar period and the early Pahlavi period, the huge verandas of this decade turn into small verandas that are only for one room and one space, and naturally, the transparency of the space also undergoes changes in terms of area during this period. Kazemi's house has small verandas for the rooms next to Tanbi on the north side and a veranda for the crew.

			**Symmetry**
Symmetry in the upper mezzanine of Kazemi's house	Symmetry on the ground floor of Kazemi's house	Symmetry in the basement of Kazemi's house	
			**Proportions**
Proportions in the upper half of the Kazemi house	Proportions on the ground floor of Kazemi's house	Proportions in the basement of Kazemi's house	
			**confinement**
Confinement in the upper half of Kazemi's house	Confinement on the ground floor of Kazemi's house	Confinement in the basement of Kazemi's house	
		**Symmetry, repetition and rhythm in**	
Repetition and rhythm in the north facade of Kazemi's house	Symmetry in the northern facade of Kazemi's house		



Repetition and rhythm in the south facade of Kazemi's house



Symmetry in the southern facade of Kazemi's house

In the summary of all the codes extracted from the interviews conducted in connection with the components of the physical structure of the residential buildings of the Qajar period, it is presented as follows in Fig 3.

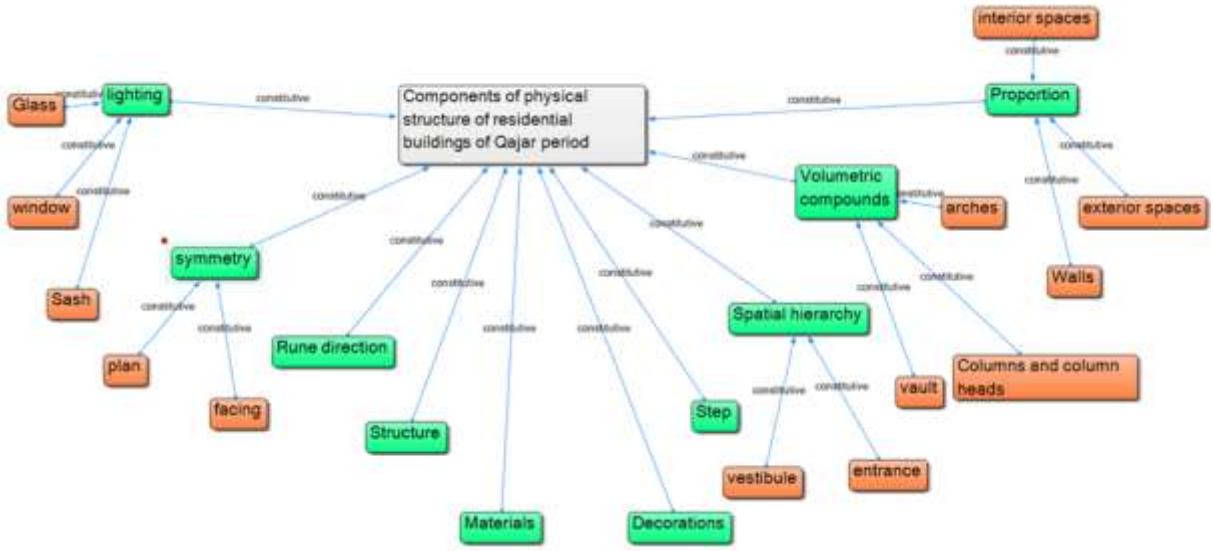


Fig 3 Extracting the components of the physical structure of the residential buildings of the Qajar period with the open and axial coding method

5. Inferential Statistics

5.1. Correlation

The results of the questionnaire are entered into the Spss25 software after numbering. Predictive relationships (regression) and correlation relationships are used for analysis. Two-Sample Kolmogorov-Smirnov Test is used to check the parametric and non-parametric type of data.

Table 7 Kolmogorov-Smirnov test to check the normality of the physical structure variable of Qajar period residential buildings from western architecture

p	Z Kolmogorov Smirnov	Standard deviation	Average	Variable
0.814	0.393	3.23	27.77	The influence of the components of the physical structure of the residential buildings of the Qajar period on the western architecture

As can be seen in Table 7, the Kolmogorov Smirnov test for the variable score of the influence of the components of the physical structure of the residential buildings of the Qajar period of Western architecture is significant (p = 0.814) and (p = 0.733), so it has a normal distribution and Parametric analysis should be used for it.

5.2. Pearson Correlation

Table 8 shows the correlation between the variables. As can be seen, it shows a positive and significant correlation between the components of western architecture and the physical structure of Qajar period houses at the level of 0.01. There is a correlation between breaking from the past and confinement with a value of (0.952). After that, between the component of break from the past and proportion (walls, interior spaces and exterior spaces) with a value of (0.932) in the second place and in the third place, enclosure and the use of rotating and diagonal statue forms with a value of (0.925) are the highest There is a correlation and the lowest correlation is between severe criticism of objects and imitative and structural schools with a value of (0.112).

Table 8 Correlation of Western architectural components and selected components in the physical structure of residential buildings of the Qajar period

Decorations	Ron (direction)	Lighting (window, sash, glass)	volumetric compounds (columns and capitals, arches, vaults)	the stairs	Spatial hierarchy (entrance, vestibule, etc.)	Structure	Materials	confinement	Proportion (walls, interior and exterior spaces)	symmetry (plan)	
0.518	0.963	0.912	0.576	*0.617	0.684	0.579	0.552	*0.685	0.789	0.617	Building design based on the requirements and needs of the new era
0.457	0.811	*0.745	0.485	0.846	0.711	0.585	0.544	0.551	*0.625	0.425	Looking to the future and using modern materials and artifacts
0.548	0.912	0.653	0.688	0.851	0.825	0.921	0.741	0.537	0.621	0.883	Using a steel frame for the entire building structure
0.579	0.587	*0.587	0.544	0.847	0.558	0.817	0.489	0.747	0.577	0.875	Show the structure of the building in the facade of the building
0.748	0.878	0474	0.672	0.781	0.569	0.524	0781	0828	0.632	0.711	Using wide windows that cover the entire opening between the columns
0.618	0.528	0.582	0.356	0.485	0.872	0.112	0.418	0.772	0.552**	0.756	Strong criticism of imitation objects and schools
*0.748	0.736	0.586	0.455	0.598	*0.540	0.741	0.556	0.826	0.306	0.694	Inventing new forms
0.748	0.627	0.747	*0.778	*0.435	0.743	0.586	0.745	0.587	0.307	0.744	The art of the times
*0.910	0.714	0.805	0.734	0.711	0.745	0.788	0.468	0.885	0.805	*0.742	Using modern products (metal) for building skeleton and decorations
0.645	0.742	0.856	0.541	0.580	0.655	0.665	0.764	0.625	0.605	*0.560	Using

											decorations inspired by natural, romantic or geometric forms
0.778	0.730**	0.788	0.856	0.853**	0.713	0.847	0.725	0.730	0.730	0.582**	The design expresses the imagination and inner feelings of the designer
0.854	0.866	*0.664	0.544	0.454	0.589	0.551	*0.718	0.494	0.119	*0.844	The use of rotating and diagonal cheek statue forms
0.738	0.765	0.349	0.685	0.785	0.834	0.581	0.844	0.925	0.225**	0.742	Show spiral movement
0.548	0.655	0.548	0.518	0.529	0.781	0.487	0.849	0.854	0.841	0.782	Attention to science and technology and the future world
0.574	0.677	*0.711	0.784	0.586	0.566	0.714	0.544	0.952	0.932	0.698	A break from the past
0.625	0.785	0.471	0.882**	0.369	0.748	0.841	0.841	0.883	0.639	0.745	Elevation
0.621	0.621	0.558	0.785	0.582	0.874	0.725	0.476	0.587	0.668	0.851**	Showing functional components and building technology

*P<0.05 و **P<0.01

5.3. Multivariate Regression

To use the type of linear or multivariate regression, the internal correlation matrix diagram of the variables is used. After drawing the correlation matrix diagram, it was found that the factors have no linear relationship, so it is correct to use multivariate regression.

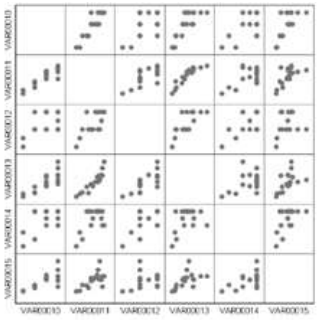


Fig 4 Correlation matrix of factors

According to the results obtained from the regression table, it was determined that the most influential belongs to; Symmetry (plan and view) on break from the past with value (1.000), proportionality (walls, interior and exterior spaces) on the use of modern products (metal) for building skeleton and decorations with value (1.000), confinement on The use of modern products (metal) for the structure of the building and decorations with a value of (0.982), materials for inventing new forms with a value of (1.000), the structure and use of steel frame for the entire structure of the building with a value of (0.964), Spatial hierarchy (entrance, vestibule, etc.) and the use of decorations inspired by natural, romantic, or geometric forms, as well as spatial hierarchy (entrance, vestibule, etc.) with a design expressing the designer's imagination and inner feelings with the value of (000) 1.000), stairs show spiral movement with value (1.000), volumetric

compositions (columns and capitals, arches, arches) strongly criticize objects and schools of imitation with value (0.963) , lighting (windows, sashes, glass) and high-rise building with the amount (1.000), rune (direction) and the use of rotating and diagonal statuary forms with the amount (1.000) and decorations and the use of decorations inspired by Natural, romantic or geometric forms with value (1.000).

But the least amount of effect of the criteria on the pillars of western architecture on the physical structure of the houses of the Qajar period including symmetry (plan and view with a design expressing the imagination and inner feelings of the designer (0.388), proportion (walls, interior spaces and exterior spaces) with severe criticism From objects and schools of imitation with a value of (0.514), focus on science and technology and the future world with a value of (0.246) and materials with a design expressing the imagination and inner feelings of the designer, fire on form with a value of (0.356) , the structure using modern products (metal) for the building skeleton and decorations with a value of (0.401), spatial hierarchy (entrance, vestibule, etc.) on the use of wide windows that cover the entire opening between the columns with a value of (0.213), stairs and design expressing the designer's imagination and inner feelings with a value of (0.388), volumetric compositions (columns and capitals, arches, vaults) showing the structure of the building in the facade with a value of (0.255) and lighting (windows, sashes, glass) on inventing new forms with a value of (0.262). Rune (direction) with a break from the past with a value of (0.417) and decorations on high-rise construction with a value of (0.331).

Table 9 Factor contribution of physical structure variables of Qajar period residential buildings and western architecture

Decorations	Ron (direction)	Lighting (window, sash, glass)	volumetric compounds (columns and capitals, arches, vaults)	stairs	Spatial hierarchy (entrance, vestibule, etc.)	Structure	Materials	confinement	Proportion (walls, interior and exterior spaces)	symmetry (plan)	
coefficient of determination (r2)											
0.872	0.755	0.425	0.265	0.855	0.421	0.665	0.756	0.662	0.974	0.855	Building design based on the requirements and needs of the new era
0.932	0.955	0.823	0.727	0.796	0.421	0.483	0.723	0.406	0.711	0.796	Looking to the future and using modern materials and artifacts
0.836	0.714	0.662	0.331	0.511	0.615	0.964	0.745	0.355	0.569	0.511	Using a steel frame for the entire building structure
0.942	0.844	0.406	0.255	0.804	0.424	0.452	0.795	0.646	0.724	0.804	Show the structure of the building in the facade of the building
0.711	0.744	0.355	0.275	0.684	0.213	0.463	0.355	0.262	0.882	0.684	Using wide windows that cover the entire opening between the columns
0.855	0.511	0.646	0.963	0.711	0.425	0.472	0.913	0.735	0.514	0.711	Strong criticism of imitation objects and schools
0.746	0.920	0.262	0.588	0.811	0.414	0.661	1/000	0.881	0.823	0.811	Inventing new forms
0.875	0.529	0.693	0.624	0.784	0.421	0.452	0.522	0.843	0.676	0.784	The art of the

											times
0.863	0.855	0.522	0.646	0.684	0.581	0.401	0.685	0.982	1/000	0.684	Using modern products (metal) for building skeleton and decorations
1/000	0.873	0.365	0.266	0.688	1/000	0.414	0.695	0.274	0.883	0.688	Using decorations inspired by natural, romantic or geometric forms
0.715	0.755	0.652	0.735	0.388	1/000	0.421	0.356	0.374	0.823	0.388	The design expresses the imagination and inner feelings of the designer
0.706	1/000	0.625	0.881	0.711	0.511	0.421	0.425	0.921	0.607	0.711	The use of rotating and diagonal cheek statue forms
0.881	0.866	0.516	0.865	1/000	0.581	0.615	0.706	0.421	0.518	0.789	Show spiral movement
0.865	0.972	0.352	0.727	0.614	0.421	0.424	0.723	0.246	0.685	0.614	Attention to science and technology and the future world
0.727	0.417	0.745	0.331	0.789	0.615	0.423	0.689	0.821	0.575	1/000	A break from the past
0.331	0.533	1/000	0.265	0.455	0.424	0.454	0.951	0.285	0.874	0.455	high-rise building
0.425	0.695	0.913	0.727	0.653	0.423	0.521	0.869	0.675	0.756	0.653	Showing functional components and building technology

6. Discussion

Until the beginning of the period of Naser al-Din Shah, the use of traditional patterns in the geometric planning of buildings can be seen. These plans include;

a) square or rectangular with a central courtyard

b) Rectangular with a porch or a central hall

c) They can be recognized as rectangular without a porch in one or two floors.

Before Naser al-Din Shah's trip to Farang, new geometric patterns were created, including tall rectangular or square towers, which can be identified in Masoudiyeh mansions.

Specifically, after Naseri's first trip to Farang, the use of elongated rectangular geometry design with one-sided and two-sided linear terraces on the ground floor and floors can be seen in the buildings, and semi-open spaces were created around the building (Masoudieh Building and Motman Ataba House).

At the end of the period of Naser al-Din Shah and the beginning of the period of Muzaffar al-Din Shah, the use of volumetric, polygonal and curved compositions is seen in a limited way in the Masoudiye mansion and the Kazemi house.

Until the beginning of the reign of Naser al-Din Shah, the continuation of the traditional way of spatial division (room to room, vestibule, internal corridors, porch around the central courtyard, etc.) is dominantly seen, although this type of spatial division continued until the end of the Qajar period.

After Naseri's first trip to Farang, due to the change in the geometry, the way of spatial division was changed in the form of linear corridors on both sides of the building along with room-to-room

access, and witnessed the appearance of the spatial division arrangement including wide four-sided terraces along with the use of foyers and lobbies to divide We are space.

Although the studied samples indicate the use of extroverted geometrical combinations from the beginning of the Qajar period, it seems that after Naser al-Din Shah's first trip to Farang (1874), most of the buildings built were designed in an extroverted manner. The use of traditional planning forms in the design of terraces and porches including (central porch with two columns, middle porch with four columns, linear porches around the central courtyard, etc.) are present in palaces and buildings until the late 1870s.

In the architecture of the West, the roof of the portal and the doors of the buildings are crescent-shaped, and all the roofs of the portals are smooth and flat, except for some large arches and porches in front of the bazaars, which are covered with a crescent roof. As a result, in the Qajar period, crescent-shaped doors and windows were used in buildings.

In the Qajar period, influenced by western architecture, we see the formation of a new interior space with ceremonial halls (opening and increasing the scale of the interior spaces, including the height, width and number of halls). Also, in this period, the proportions changed and attention was paid to the wide and high interior spaces.

7. Conclusion

By looking at the developments in Iranian architecture and the opinions of experts in this field, we realize that the most important developments in the field of architecture and urban planning influenced by the West began in the middle of the Qajar period, although the cultural and artistic exchanges of Iranians with the West began in the periods before the Qajar and especially in the Safavid period. However, the extent of its impact on the developments in the field of architecture and construction is not as great as that of the Qajar period. Most of the experts evaluate the role of external factors in the formation of Qajar developments several times than endogenous developments. The simultaneity of Qajar architecture with the western industrial and capitalist revolution and the great French revolution followed by the physical changes of European cities opened a new chapter of changing ideals and new thinking for Iranians. Confrontation with the European modernity of that time has gradually had undeniable effects on the various fields of life in this country, followed by its architecture and urban planning. In the picture below, you can see the changes in the physical structure of Qajar houses and their influence from western architecture.

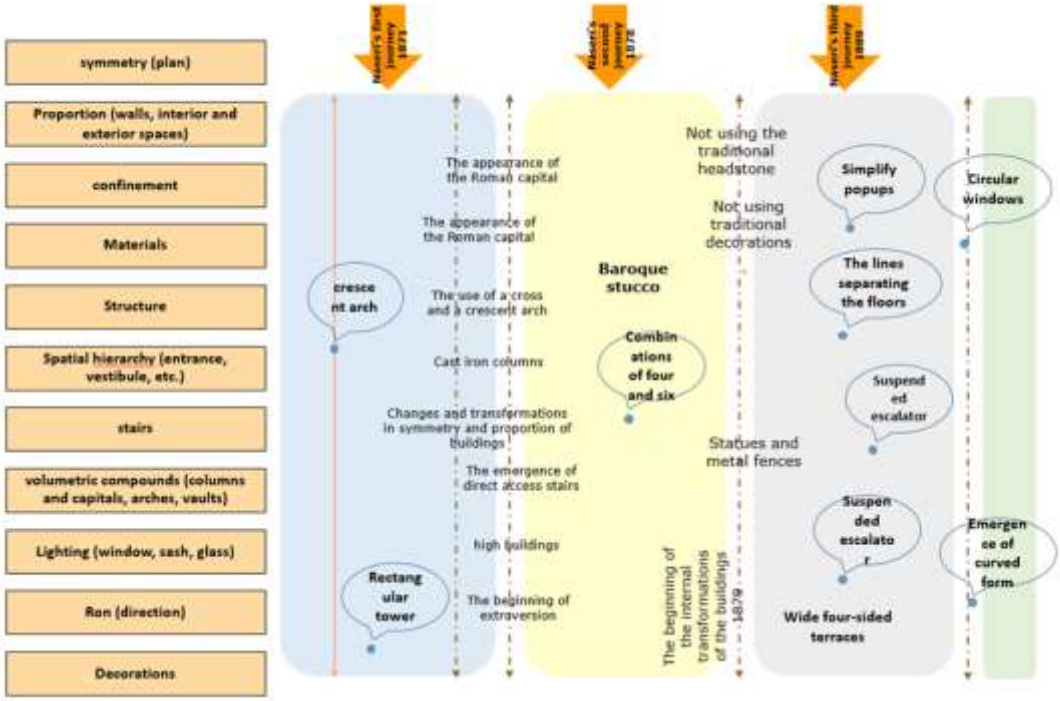


Fig 5 Changes in the physical structure of Qajar houses with influence of Western architecture (source: authors)

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