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Original Research Article

The Growth of Empty Space in the Architectural Anatomy of Tehran Houses (From Late Qajar Period to the Beginning of the Islamic Republic)

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Abstract

Spatial quality is one of the features of Iranian anatomical architecture, which, like the legacy of past architects, has been passed down from generation to generation and has been advanced and expanded in the architecture of each era consistent with its needs. This sequence of alteration from the late Qajar period to the beginning of the Islamic Republic has a different procedure that can be discussed according to the other changes in this period of adjustment. Via the interpretive method, processing design documents and field observations of well-known buildings in the Pahlavi area have been processed and, after initial estimation, the hypothesis in selected samples is tested to identify volume processing solutions. In the physical volume processing literature, empty space does not act as a mass in the volume and mass design stages, like the courtyards of traditional houses. In the process of physical space, residential buildings evolve from a continuous space to spots in plan, changes, and porosity in the facade, and finally, the total volume due to the structural systems and the boldness of the architects enter. Spatial quality is one of the features of Iranian anatomical architecture, which, like the legacy of past architects, has been passed down from generation to generation and has been advanced and expanded in the architecture of each era consistent with its needs. This sequence of alteration in the late Qajar period to the beginning of the Islamic Republic has a different procedure that can be discussed according to the other changes in this period of adjustment. This issue is significant when the architects of this era, due to politics, cultural nature, and educational practice, tried to develop creativity by modeling imported architecture and did not hide such an issue. However, compared to the previous era, life experiences in the previous space caused a secret connection in this period. This study aims to understand how sufficient empty space is present in the quality of contemporary housing and residential buildings in Tehran and what changes have been made in the design system from the late Qajar period to the beginning of the Islamic Republic. In this regard, via the interpretive method, processing design documents and field observations of well-known buildings in the Pahlavi area were examined and, after initial estimation, the hypothesis in selected samples was tested to identify volume processing solutions.

Keywords: *Contemporary Architecture, House Architecture, Quality Oriented Architecture, Empty Space, Tehran.*

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Introduction

Iranian architecture experiences various frameworks in the design process in the interaction between tradition and modernity. It has manifested in the contemporary design in the two areas of traditional architecture and modern architecture. However, this area can be clearly seen in the gradual and competitive changes of different products. According to Sadeghi Pey, the traditional architect, although has had more limited options in the process of his design, has observed his ideas in the form of spatial forms or qualitative bodies by maintaining the complex roles and practical conformity to the laws of his predecessors. What is called the “transformation of ideas in a spatial form” in short, has experienced innovations from its own type (Sadeghi Pey, 2010, 48), and it can also be observed in the functional form of housing. Mirmiran believed that the Qajar architecture promoted the old rules, principles, and patterns while preserving innovation, and this evolution, to some extent, led to the decline of discussions such as sizes, shapes, proportions, and decorations relative to the architecture of the previous eras, especially the Safavid era (Sadeghi, Ikhlesi, & Kamelnia, 2018, 14). In the meanwhile, the Qajar era, regardless of its totality of cultural transformations, has had a more traditional nature than the Pahlavi era, and the changes in this subject became greatly important in the intellectual schools derived from the Pahlavi era, which has been the platform for their new life (Fig. 1).

Perception of architecture as a frame for life activities and directing its flow is an indication of the events and components that both influence life and are influenced by it (Winters, 2017, 217). Contemporary life, regarding the container and contained structure of architecture, and due to the lifestyle and the relation between the culture and social structure of the man, has an identity that indicates the dominant values and explains

the tendency values, and reveals the factors of the cultural identity of its originators. Attachment to or detachment from this matter creates effects with or without an identity (Bemanian, Gholami Rostam, and Rahmat Panah, 2010, 57). Naturally, the policies of Qajar and Pahlavi rulers, as well as their relations with different countries in this era, paved the way for numerous diverse, opposite, and polar thoughts in the area of culture, and naturally, in the flow of finding the relationship between the architecture and culture, it can be expressed that this subject itself relies on the appearances, bodies, and even the function of architectural spaces in this period (Asgari & Mohammadi Salek, 2021, 120). The trend of changes in what is called the subjective foundations and pluralistic events of the contemporary era in the contemporary culture, from the traditional context of Qajar to the post-modernistic view of the second half of the Pahlavi era, has been so rapid that besides the changes, did not allow for an opportunity to criticize it, and it seems that the channels of criticism and investigation of these buildings in the morphology of research processes on its study platform, still require different species that have not been born, and many views on this period are limited only to admiring views or even completely formalistic attitudes. In this literature, the existing architecture

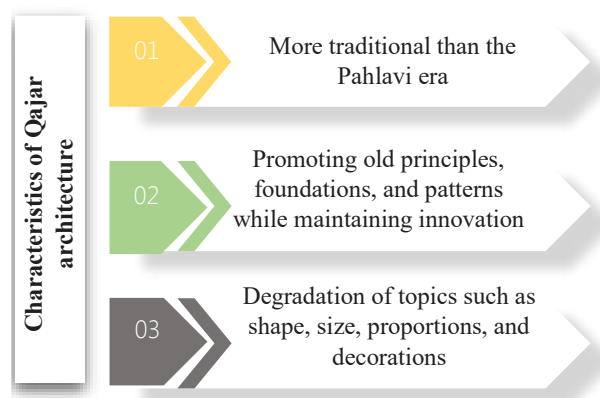


Fig. 1. Investigation of the architectural characteristics of the Qajar era.
Source: Authors.

has been called the “mass” in the buildings, while these masses themselves contain various void spaces which can be observed through objective and subjective walls. The type of spaces can be observed and considered by expression of the subjective walls and their proportions (Haeri, 2009), which is valuable and investigable in a sematological view.

In the architectural studies about the concept, the assumption of primary and secondary resources can be generalized to the influence of architecture on the architect and the construction of new works. This important matter, which is named “iconic architecture” by Geoffrey Broadbent, has itself separable conscious and unconscious modes and states (Lazio, 2009, 144-147). It is not specific to one country and has been considered in different ways from a model to a latent revelation in the design process of the architects from the 19th century (Ghobadian, 2013, 170), and looking at the later architectures of Safavid and Qajar era architecture can be considered the design experiences influenced by the architecture of the past.

From the scientific and philosophical queries, it can be inferred that space is more of a subjective thing than an objective. The personal perception and experience of the space indicate that space is not the thing or body itself, but it interprets the relationship between the two.

The subjectivity of a space, like enlivening it, is influenced by the ideas that grab the designer's attention, and regardless of the objectivity the subject of the building has had, has promoted the space from a mere shelter to a house (Miller, 2008, 46). It is not focused on form play and is manifested in the formation of spaces, molding, distribution, composition, interference, morphology, etc. Form of space and its features also naturally depends on its constituents and the type of organization and relationship between these elements. Space,

through these elements, can be static, dynamic, narrow, or wide, and the change in these characteristics can also transform the quality of space. Also, the presence of man, light, etc., plays a role in the influence and definition of space (Arabi, 2018, 45).

Therefore, it can be inferred that the perception of space is influenced by its presence and based on its subjectivity, and through the overlap of the phenomenological perspectives, it can be continued in wider aspects of perception, however, in the present study, the subject has been limited to the visual level due to non-comprehensibility of realization.

What is meant by the void space in the literature of the present study is to some extent influenced by an interpretation manifested in modern training, and as Arnheim asserts, “by the increase in the distance between the buildings, the density of middle spaces is reduced and sometimes, it is totally eliminated. In such a condition, it can be said that the space in between is void (vacuum)” (Arnheim, 2009, 33).

Also, the void space, in the phenomenological and mystical interpretation influenced by the Iranian-Islamic architecture, also has a position that complements the previous interpretation. In this definition, the void space, in traditional architecture and the city, plays the main role in the structural and conceptual manifestation of space and is the factor that connects other the space to other spaces. In other words, it can be said that void space is one of the unifying factors of Iranian architecture (Zafarnawaei, 2017, 71).

The architecture of the transformation era, like that of the past, is filled with concepts mixed with culture, environment, and many other issues, which are integrated into a final body and are transferred to future generations based on the needs of the residents (Mahdavinnejad, Mansoorpour & Hadianpour, 2014, 45). The fundamental pillar of

this research is based on focusing on the residential architectures of the transformation era as high-quality designs with rational views. Therefore, the present study, regarding the fact that it contains a ring of cultural, political, and educational thoughts in its design flows, and due to the subjective learning from previous architectural trends and its evident effort in recognizing and reviving the qualitative spaces of the past, and finally, due to its quality and recognition in Iranian architecture, which is the realization of repeating the style and sequence of architectural ideas of the past with today's architecture, has been considered by the authors.

It is an applied and essential study in terms of rereading and primary reading of the architecture of the past and attachment of the physical identities of contemporary architecture. What has been repeatedly emphasized in contemporary literature is that quality-oriented Iranian architecture is totally forgotten in today's experiences and the necessity of reviewing the function of design and investigating the processes and views of pioneer architects of the past in this regard can be considered a shining light for today's designers.

Regarding the research question, the author has tried to deal with the course of void space intervention in Iranian architecture through the achievement of an analytical trend, and explore it in valuable buildings with residential use in the transformation era. Thus, the research questions can be enumerated as: To what extent is the void space effective in the quality of contemporary residential buildings of Iran (transformation era) and considered in the design? What are the conditions of the changes in void spaces from the late Qajar to the early Islamic Republic era, and what issues affect it?

The primary estimation, as the research hypothesis, is that the Iranian house spaces, during the transformation era, have adapted to

new conditions through the effective variables in quantitative and qualitative processing of house dimensions and the presence of housing in the modern urban structural platform, and found new qualities in the formation and embodiment of positive and negative spaces.

The present study aimed to find the approach and role of the architects in the representation and recreation of void space in the physical quality of Iranian residential buildings. Since this subject itself contains latent and visible ideas, process- or experience-oriented, total or partial, or even influential on the past architects' context, and indefensible minds, and provide estimation and hypothesis testing to give a firmer response than what is perceived in the research process.

Research Method

Regarding the effective components and the thoughts of Iranian architects in the contemporary era, the present study, has a fundamental nature. However, regarding the feasibility of the use of research results for contemporary design and the continuation of the solutions to strengthen the design identity of the architects, it is applied and practical research. Regarding the research process, it is conducted in the qualitative paradigm with an interpretational-historical method which leads to the exploration of available or missing spaces, dependent on the estimation instrument for recognition of the design rules.

The present study, due to its dependence on the processing of events that have occurred in the past, and the trend of being affected by history with the presumption of Hegel's approach, has considered the spirit of works to be dependent on the cultural and social changes (Ghayyomi Bidhendi, 2004, 77), and in the stage of identification, organization and analysis of the evidence collected from the documents of the buildings, which were affected by the pictures and maps taken from them before

their destruction or the possibility of viewing the works at the time of writing the article, has abstracted the physical spaces.

The sampling in the present study was done in two stages. The logic of sampling in its first stage was based on the “adherence to the timeline of discussion”, “having void space”, “access to accurate and documented information about the building”, “residential use”, and “health of the building from the aspect of changes until the time of documentation”, in three periods: “Late Qajar to early Pahlavi”, “Early Pahlavi to early Pahlavi II” and “Late Pahlavi II to Islamic Republic”. Finally, by carrying out the second stage of sampling, the top six residential houses were obtained, which had the most diversity in their era, conforming to the research subject, which was the existence of void space in mass anatomy. These samples were reanalyzed in a case study method.

Theoretical Foundations

In *Amid Dictionary*, space is defined as a part of the borderless three-dimensional world in which things and events exist and occur (Amid, 2011). Plato believed that the nature of space is constant and it is a soft body appearing in different forms in the presence of objects, never taking the form of these objects since its nature is never changed. Aristotle also believed that space is a set of places and precedes everything in a way that can accept quantity and quality. Newton defines the presence of time and space to be independent of the objects and incidents in them. From his point of view, the absolute space, disconnected from any external matters, is always constant and with similar components (Bert, 1995).

The architectural space is generally referred to as the distance between the construction materials whose goal is to create a shelter for human activities in a way that sometimes this space finds special attributes and is known as a work of art

(Falahat & Shahidi, 2015, 30).

From the audience's point of view, the subject of space is understandable in a perceptual and visual range with a contrast between the positive and negative elements. The elements forming the appearance of space are named positive elements, and those that develop them are named negative elements. In this process, the contradictory function of positive and negative elements allows for visual perception and inference. It should be noted that the form (positive elements) cannot grab our attention without the presence of their contrastive background (negative elements), and it is sometimes so combined that the relations between the two become unclear, and various identities are expressed for them at the same time (Ching, 1999, 110). It becomes more ambiguous and complex with defining elements of space and spatial attributes such as form, proportions, scale, light, etc. (ibid., 175), and makes their identification and naming relative.

The distance between the bodies is as important as the different parts of them for architectural creation since these distances create the space for social and cultural activities. Undoubtedly, there is a close correlation between a man's social aspect and his behaviors (Madanipour, 2001, 27). The concept of space is one of the fundamental concepts in architecture. The architects and intellectuals of architecture have long provided various opinions about this concept. Architecture is art expressed by space, so its visual and objective aspect also includes the specific attributes of space. All specific attributes of space belong to nature and follow objective, natural, and physical rules. The content in architecture is the space's function. The function is the space's effect on the man. This aspect (function) is subjective and belongs to the man (Moazzami, 2011, 60).

The mass and space are the basic constituent elements of architecture whose proportion is

set based on architectural ideas. In translating the architecture with the mass-space system, the physical-perceptual and physical-functional structures are created, which are themselves the architectural foundations and principles of manifestation of the place. In this process, the indicators of function, meaning, and structure as the main indicators of an architectural idea, and physical characteristics, concepts, and social relations as the fundamental elements of the place lead to the quality of the architectural place (Falihat & Shahidi, 2015, 34-35).

Findings

As was said, the present study aimed to read the physical space of contemporary houses in Tehran. First, 27 samples were selected, which can be divided into three parts. In the first step, the buildings from late Qajar to early Pahlavi, including the “Hossein Khodadad”, “Malek”, Moataman al-Itibba”, “A’alam-ul-Saltaneh”, Nasereddin Mirza”, “Nasir-ul-Dowlah”, “Fakhr-ul-Dowlah”, “Moshir-ul-Dowlah Pirnia”, “Sadegh Hedayat”, “Ghavam-ul-Saltanah”, and “Kushk Shaghghi” houses were analyzed and investigated. In the second step, the buildings from early Pahlavi to early Pahlavi II including “Khosravani”, “Malek Aslani”, Loghman-ul-Mulk”, “Zand Navvabi”, Tafazzoli”, “Dr. Mosaddegh”, “Dr. Baher”, “Mirdamadi”, and “Ibn Sina” houses and villas were investigated. and finally, in the third step, the buildings from the late Pahlavi II to the early Islamic Republic, including the “Namazi Villa”, “Tanavoli”, “Vozara Villa”, “Shayan House”, “Zartosht Villa”, “Kuhbor Villa”, “Farhang House”, “Afshar House”, and “Alikhani Villa” were investigated. These investigations are based on the documents provided in the registered files of the abovementioned buildings as well as their pictures of pre-restoration or destruction.

In the initial analysis of the system of building

masses and their void spaces, it was observed that the buildings of this era have hosted spaces with a void body and function, first in their plan, then in the façade, and finally, in the volumetric space system (Table 1-3). The type of these masses is followed in three stages with the three views of the plan, the façade, and the volume. In other words, the primary processing of the plans of the initial era (the late Qajar to the early Pahlavi) helped with the separation of five different physical qualities “closed space mass”, “green space”, semi-closed space”, “division space”, and “the pool”.

In Qajar era buildings, the courtyard was common such as the traditional garden pavilion or central courtyard. With the development of the city, this important matter in the building density, as shown in Table 4, led to the definition and emphasis on the entrance, porch, balcony, and terrace, which were also present in traditional architecture. What was notable in this era was the emergence of closed spaces with functions such as a lobby in the plan.

Creating some spaces under the title of ‘lobby’ in the plans of the second era (the early Pahlavi to early Pahlavi II), besides promoting and stabilizing the method, has been also analyzed in the building façade section. In the buildings of the previous era in which the buildings were usually built in the form of pavilions or central courtyards, an element titled ‘the urban view’ or ‘street view’ was meaningless. In this regard, in the investigation of the project views, some developed information is provided in Table 5 with an emphasis on the next two periods. In the Pahlavi I era’s buildings, the buildings gradually start to pay attention to the passage space. The buildings’ approaching the urban walls and the creation of spaces intended to see the street or create a form in the passage platform are done appropriately. As shown in Table 5, the architects first observed this trend through the design of the terrace, and then, this

Table 1. An analysis of the plans of the cases studies from the late Qajar to early Pahlavi. Source: Authors.

House's name	Plan	House's name	Plan	House's name	Plan
Hossein Khodadad (Tehran, Zaferanieh)		Nasereddin Mirza (Tehran, Sur Israfil street)		Sadegh Hedayat (Saadi stree)	
Malek (Tehran, across Imam and Jamea mosques)		Nasir-ul-Dowlah (Tehran, Amir Kabir street)		Ghavam-ul-Saltanah (Tehran, 30 Tir street)	
Moataman-ul-Itibba (Tehran, Baharestan square)		Fakhr-ul-Dowlah (Tehran, Fakhr Abad intersection)		Kushk Shaghghi (Tehran, Ferdowsi street)	
A'lam-ul-Saltaneh Mansion (Tehran, Hafez street)		Moshir-ul-Dowlah Pirmia (Tehran, Lalehzar street)			

Pool
Division space
Semi-closed space
Green space
Closed space mass

issue is followed by a break in the skyline and the emergence of spaces that allow physical diversity. In the buildings of the third era (the early Pahlavi II to the early Islamic Republic), the architects try to express two ideas from the past in the building volumes. Therefore, they are content with the open, semi-open, semi-closed, and closed spaces, and in the process of designing, it seems that some framed or latent cubes are reduced or added to the main volume of the building. As noted in Table 6, in the early buildings of the third era, it evolves its form in the continuation of the façade and plan process, and afterward, this form somehow represents spaces such as porches with pillars, volumetric breaks in the building, and framing of void spaces.

In this stage, it can be assumed that regarding the analyses provided in terms of the studied buildings,

the design process is provided at three intervals. This division of the temporal-historical intervals is not accurate, but the physical changes of the void space in the residential buildings, in general, are intended. In the general investigation, the mass and space are considered equivalent to the courtyard and building, and at the same time, the porch, terrace, spatial frames, and full and empty volumes will be taken into consideration (Table 7).

First period: from late Qajar to early Pahlavi: In this period, the central courtyard still makes up a large part of the buildings, and the presence of the porch is also tangible in the body of the building. Among the reasons for this phenomenon, the cheapness of the land, the low population, and the dominant traditional thought in the society can be noted, which have finally led to higher introversion of the buildings.

Table 2. An analysis of the plans of the cases studies from the early Pahlavi to early Pahlavi II. Authors, based on observation of the documents.

House's name	Plan	House's name	Plan	House's name	Plan
Khosravani (Tehran, Enghelab Street)		Tafazzoli (Tehran, Taleghani street)		Ibn Sina (Tehran, Quds street)	
Malek Aslani (Tehran, Enghelab Street)		Dr. Mosaddegh (Tehran, Taleghani street)			
Loghman- ul-Mulk (Tehran, Valiasr street)		Dr. Baher (Tehran, Keshavarz boulevard)			
Zand Navvabi (Tehran, Felestin square)		Mirdamadi (Tehran, Taleghani street)			

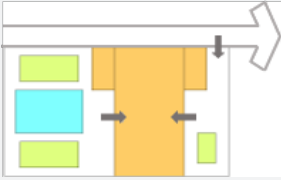
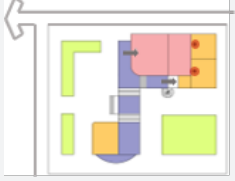

Pool Division space Semi-closed space Green space Closed space mass


Gradually, and with the provision of similar plans from foreign countries, we can see the separation of the entrance and the lobby through the use of the steps (Ghobadian, 2003, 240-241).

Second period: From early Pahlavi I to early Pahlavi II: In this period, and after the entrance of educated foreign architects, modern thoughts entered the design system. Among the main reasons for the entrance of these new thoughts were the establishment of the University of Tehran, and the modeling and orientation of this type of education, which itself was a version of architecture education in Beaux-Arts, France (Etesam, 2008, 21; Hojjat,

2008, 76), as well as the improvement of political, economic, and social conditions of the society which paved the way for the in construction in cities and the shrinking of residential property areas, the increase in the number of two-story and three-story buildings, led to the adhesion of the mass to one front of the land and a change in the pattern of the central courtyard or pavilion in most residential projects, and finally, in the final years of this period, we can observe the emergence of the façade and terraces in the urban area (Mokhtari, 2011, 162; Kiani, 2004, 282). It makes new conditions for the investigated design based on the placement of the project in the urban area.

Table 3. An Analysis of the plans of the cases studies from the early Pahlavi II to the early Islamic Republic (Source: the author, based on observation of the documents).

House's name	Plan	House's name	Plan
Namazi Villa (Theran, Niavaran)		Farhang (Tehran, Ekhtiarieh Neighborhood)	
Tanavoli (Tehran, Dezashib)		Afshar (Tehran, Zaferanieh Neighborhood)	
Shayan (Tehran, Sohrevardi Street)		Alikhani Villa (Tehran, Kamranieh)	
Kuhbor Villa (Tehran, Elahieh Street)			

Pool  Division space  Semi-closed space  Green space  Closed space mass 

Early Pahlavi II to early Islamic Republic: Before this period, most changes in the mass and space configuration were applied to the area and movement of the whole body. However, during this period, with the generation of building rules on the one hand and the entrance of educated Iranian architects and consulting engineers on the other hand, new efforts were made for the growth and providing as many residential projects as possible, which led to the formation of a new and more complete of mass-space combination in the external body and interior space of the residential projects (Bani Massoud, 2009, 336). In this period, we are faced only with the physical changes of the mass and space in the land, but the void space is looked upon as an aesthetical element that meets a specific need. Also, the advancements in the construction systems in this period were in a way that it could be claimed systematic structures created in the prominent projects of this generation led to the

difficulty in separation of the mass and space, and the full and empty bodies (Hojjat, 2006, 104).

In these projects, we are no longer faced with complete cubes as a mass, and spaces were emptied from a complete solid volume to meet needs such as openings, vertical and horizontal communication spaces, skylights, parking lots, spatial framing, etc. Finally, we can find full and void spaces in the walls of buildings as aesthetic elements of space reading (Saremi, 2010, 178). These cases include factors such as monument stairs, consoles and free towers, openings, and multiple spatial compositions.

On the other hand, today, due to various economic and social reasons, the void space and the courtyard as its main representative, are either totally missed or, if present in the projects, have lost their main and functional nature and are produced more out of necessity and ineffective municipal regulations, and due to lack of attention to its intrinsic functions, have

Table 4. A course of the evolution of house plans from the late Qajar to early Pahlavi. Source: Authors.

	House's name	Combination of mass and courtyard	Definition of a visible entrance and counter	Porch, balcony, and terrace	Lobby and closed void space
The late Qajar to early Pahlavi	Hossein Khodadad Malek	*	*	*	
	Moataman-ul-Dowlah			*	
	A'alam-ul-Saltanah		*		
	Nasereddin Mirza		*	*	
	Nasir-ul-Dowlah		*	*	
	Fakhr-ul-Dowlah		*	*	
	Moshir-ul-Dowlah		*		*
	Sadegh Hedayat	*	*	*	
	Ghavam-ul-Saltanah		*		*
	Shaghaghi		*	*	*
	Khosravani	*	*	*	
	Malek Aslani		*	*	
The early Pahlavi to early Pahlavi II	Loghman-ul-Mulk Zand		*	*	
	Navvabi				
	Tafazzoli			*	
	Dr. Mosaddegh		*	*	
	Dr. Baher		*	*	
	Mirdamadi		*	*	
	Ibn Sina			*	
	Namazi Villa	*	*	*	*
	Tanavoli	*	*	*	*
	Vozara Villa	*	*	*	*
	Shayan	*	*	*	*
	Zartosht Villa	*	*	*	*
The early Pahlavi II to early Islamic Republic	Kuhbor Villa	*	*	*	*
	Farhang	*	*		
	Afshar	*	*	*	*
	Alikhani	*	*	*	*
	Villa				

Table 5. A course of the evolution of urban views of the buildings from the early Pahlavi I to the early Islamic Republic. Source: Authors.

	House's name	Outdoor steps	Terrace	Urban view	Visible counter	Break in the skyline	Street-facing window	Extension of the mass toward the open space	Protrusion toward street	Second entrance
The early Pahlavi I to early Islamic Republic	Khosravani	*	*		*					
	Malek Aslani	*	*							
	Loghman-ul-Mulk	*	*	*	*			*		
	Zand Navvabi	*		*				*		
	Tafazzoli	*	*	*	*	*	*		*	*
	Dr. Mosaddegh		*	*	*	*	*	*	*	*
	Dr. Baher		*	*	*	*	*			*
	Mirdamadi		*	*		*	*		*	*
	Ibn Sina		*	*		*	*	*		*
	Namazi Villa		*	*	*	*	*			*
	Tanavoli	*	*	*	*	*	*		*	*
	Vozara Villa	*	*	*	*		*		*	
	Shayan	*	*	*	*	*	*	*	*	*
	Zartosht Villa	*	*	*	*	*	*	*	*	*
	Kuhbor Villa	*	*	*	*	*	*	*	*	*
	Farhang	*	*	*	*	*	*			
	Afshar	*	*	*	*	*	*	*	*	*
	Alikhani Villa	*	*	*	*	*	*	*		*

turned into second and third-degree spaces in the design that are worthless for the owners.

Discussion

As was mentioned, the void space in architecture of the transformation era started to exist again in the plan, and at the end of this era, after affecting the building's façade, it also changed the volume of residential buildings. Also, we found out that most of the void space roles have been manifested in the plans from the late Qajar era to the early Pahlavi in the old spatial manifestations. Although the porch, entrance, balcony, and courtyard (indoor and

outdoor) have been already visible and significant in the architecture of the traditional houses, in this era, due to the trend of development and the dominant construction, they lost their prosperity. In this regard, in addition to the use of the abovementioned cases, the use of void spaces in the center of closed spaces is prevalent.

In the period, from the middle of the first Pahlavi I to the early Pahlavi II, the process of paying attention to void spaces can also be seen on the facade. In the view of architects regarding the use of void space, this time, the higher buildings' approach towards the street has the most effective role in the game of lines

Table 6. A course of the evolution of volumes of the buildings from the early Pahlavi I to the early Islamic Republic. Source: Authors.

	House's name	Creation of void space in the façade	Volumetric setback	Mass play with protrusion	Framing of void space	Background orientation relative to the site	Plait-like becoming of the building's components
The early Pahlavi I to early Pahlavi II	Khosravani	*		*	*		
	Malek Aslani	*			*		
	Loghman-ul-Mulk	*	*		*		
	Zand Navvabi			*			
	Tafazzoli		*				*
	Dr. Mosaddegh		*				*
	Dr. Baher	*	*		*		*
	Mirdamadi	*		*			*
	Ibn Sina	*	*		*		
	Namazi Villa	*	*				
The early Pahlavi II to early Islamic Republic	Tanavoli	*			*	*	
	Vozara Villa	*	*	*			*
	Shayan	*	*	*			*
	Zartosht Villa	*	*	*	*	*	*
	Kuhbor Villa	*	*	*	*	*	*
	Farhang	*	*	*			*
	Afshar	*	*	*	*	*	*
	Alikhani Villa	*	*	*	*	*	*

and hosting the facade for the presence of the void body. What we see in the changes in the skyline and the use of visible openings on the external fronts of the buildings, although partially present in traditional architecture, is aimed at the architecture of the lords and leaders in residential areas, and not everybody could use it. However, in the architecture of this period, we observe a kind of universalization and sharing of these life experiences in our living space. In the influence and effectiveness of the process of intervening in the void space and creating urban experiences, and living in the open and closed space of the architecture of the transformation era, some visible examples and encouragements have been observed in the architecture of buildings, in such a way that in the architecture of the neighborhoods that may have such buildings, this trend has been intensified in other buildings and has become a shared idea.

The involvement of ideas with the protruding trend

of construction details and allowing the architects to freely use structural boldness led to a place where the volume in the process of development intends to blend with the surrounding void space. Somehow, the emergence of the void space formed in the conservative spaces during the transformation era reaches a balanced and inseparable combination in the late Pahlavi II era, which is thought to have led to separations and a change of attitude towards the nature of some spaces, in such a way that at the entrance of this space, from a limited platform in the wall, in this period, turned to an area of the project and a height of the sky, which, regardless of its soft nature, hosts other emerging spaces that do not have a functional mission.

In this regard, in this section, the present research tries to prove the hypothesis in the investigation of the researched buildings. Therefore, buildings from among the initial samples, as selected samples, are reanalyzed in this section. According to the

Table 7. Trend of changes in the mass and space in the residential area of Tehran. Source: Fadaei Mehrbani, Mohajeri & Asgari, 2021.

	Effective factors	Results
From the late Qajar era to early Pahlavi I	<ul style="list-style-type: none"> - The cheapness of land - low population - The dominant traditional thinking - Lack of educated architects - Weakness of the construction system 	<ul style="list-style-type: none"> - The large scale of land (residential areas) - Housing introversion (body and mass) - The low height of the buildings - Continuing the traditional design of Qajar
From early Pahlavi I to early Pahlavi II	<ul style="list-style-type: none"> - The arrival of educated European architects - Establishment of the University of Tehran - The beginning of modern thinking - The meaning of the earth becoming valuable - Improving economic conditions and social security 	<ul style="list-style-type: none"> - Injecting new ideas into the design system - Education of academic architects - Structural changes in the spatial composition of the body of an architecture - Shrinking parts and changing the placement of the project on the site - Increasing construction in cities
From early Pahlavi I to the early Islamic Republic	<ul style="list-style-type: none"> - Production of building regulations - Development of construction systems - Establishment of consulting engineers - Increasing the number of educated architects - Increasing oil prices and improving economic conditions 	<ul style="list-style-type: none"> - Protrusion - The use of a console and freedom of action in the design - Variety of building construction and design systems - Maximum construction growth in different areas of the city

classification of void spaces, three indicators have been used in the introduction of the studied buildings, which are presented by different colors in the images and modeling. The green color in the pictures refers to the connection of the mass with the adjacent space through the void space in the design, which inherently overlooks the owner's space and has no connection with the urban space. The blue color represents the protrusions of the design and development of the mass to combine with the outer space, and finally, the red color represents the subjective and objective connection with the urban space and the outer development of the building.

First period: In the review of selected examples from among the selected residential buildings of the

first period (late Qajar to the middle of the Pahlavi I period), the house of Moshir-ul-Dowlah Pirnia and the house of Sadegh Hedayat are discussed again due to the greater variety of void spaces as well as the recency of the period. As can be seen in Fig. 2, the relationship between the mass and the space of the Moshir-ul-Dowlah building is classified at level one, that is, the relationship with the courtyard space. For this reason, in the image, we specify this design experience in green color. On the second level, the house in question has been able to develop the mass space towards the outside only with the help of the counter and stairs so that the interactions between the mass and the void space can be physically improved. In the following, we will examine Sadegh Hedayat's

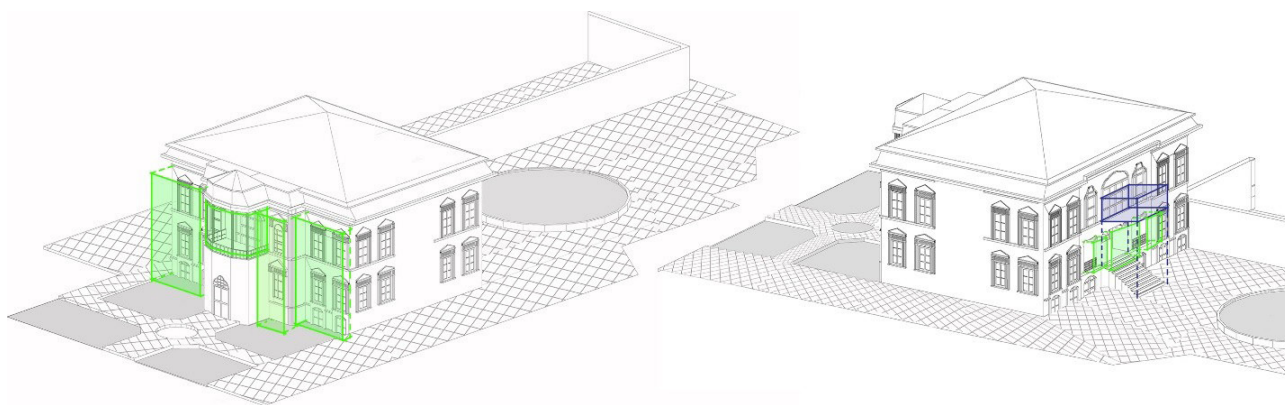


Fig. 2. A physical investigation of the void space in Moshir-ul-Dowlah Pirnia building- First period. Source: Authors.

house. As it is clear in the picture, the spatial body of the Hedayat house, due to the effective connection of the central courtyard with the building's wall and the presence of porches and balconies created to access the peripheral sides, has a visible improvement compared to the Moshir-ul-Dowlah building. The discussion is about the interaction of mass and void space. In fact, it can be assumed that the house has expanded its mass boundary under the pretext of the counter and entrance.

Therefore, in the image analysis of the Hedayat building (Fig. 3), the connection of the mass with the surrounding space and void space can be considered close to the second level (blue color) in addition to the first level (green color). It means that the house has been able to place its surrounding platform under the radius in different axes. But the type of blue color processing must be the same in the whole design, which is obvious and non-negligible.

Second period: In the investigation of the selected samples, among the set of selected residential houses in the second period (middle Pahlavi I to early Pahlavi II), the Tafazzoli House designed by Vartan Avanesian and the Ibn Sina House designed by Paul Abkar have been investigated due to the higher diversity of the void spaces and the recency in the discussed period.

In the discussion of the coloring of the mass of the Vartan building (Fig. 4), it can be said that this house is the initiation of the combination of mass and void

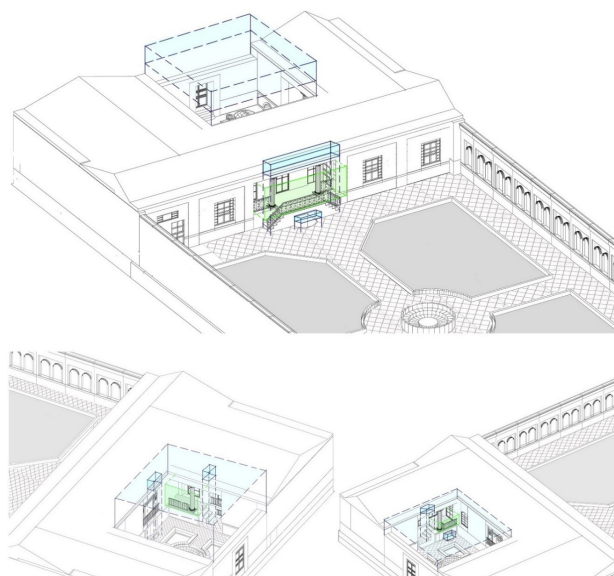


Fig. 3. A physical investigation of the void space in Sadegh Hedayat building- First period. Source: Authors.

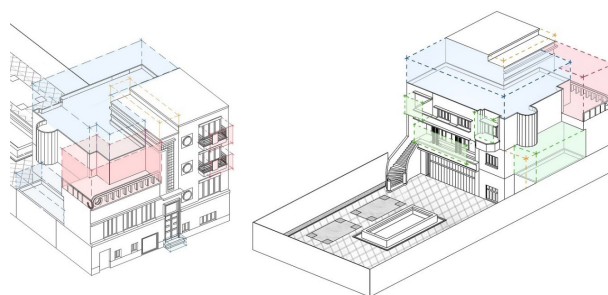


Fig. 4. A physical investigation of the void space in Vartan House building- second period. Source: Authors.

space in the third period. Similar to the houses of the first period, with the help of openings and distance from the surrounding wall, the first level experiences

a void space (green color). On the roof, the lack of construction of the entire final floor has created a platform for the presence on the roof of this building, which has a suitable interaction with the changes achieved with the open space (blue color). On the urban front, the observation making the terraced landscape and anchoring to the entrance of the building (red color) made it possible for the building to make the city like a space in its possession.

Ibn Sina's building (Fig. 5), in terms of using void space, like the Vartan building, a contemporary example, is prone to layering the facade and using the design of new elements such as a pool in the courtyard. It has helped with the extension of mass in the open space through a courtyard-facing terrace in the wall, a brief urban viewpoint towards the street, a break in the skyline, and the design of special openings towards the street.

Third Period: In the review of selected examples among the selected residential buildings of the third period (early Pahlavi II to early Islamic Republic), Kuhbor House, designed by Mehdi Alizadeh Soqati, and Afshar House, designed by the late Seyyed Ali Akbar Saremi have been discussed due to the greater variety of void spaces.

As can be seen in the picture, the relationship between the mass and the space of the Kuhbor building (Fig. 6) is at the peak of mixing and dispersion in all three levels. This feature at level one (green color) has a higher quality than level one in previous buildings due to the building's protrusion into the yard. The second level (blue color), the exploration of the overall volume for the interaction of mass and void space do not end only at the roof of the building like Vartan's building or Ibn Sina's building. On the third level (red color), the building is anchored to the adjacent building, like Ibn Sina's building, and has found a dynamic body whose interaction with the passage acts like a city in a sloped body for the building.

As can be seen in the picture below, the improvement

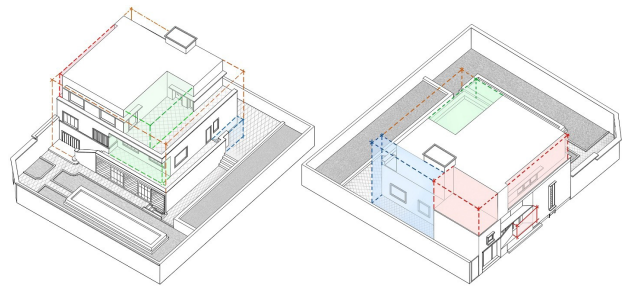


Fig. 5. A physical investigation of the void space in Ibn Sina building-second period. Source: Authors.

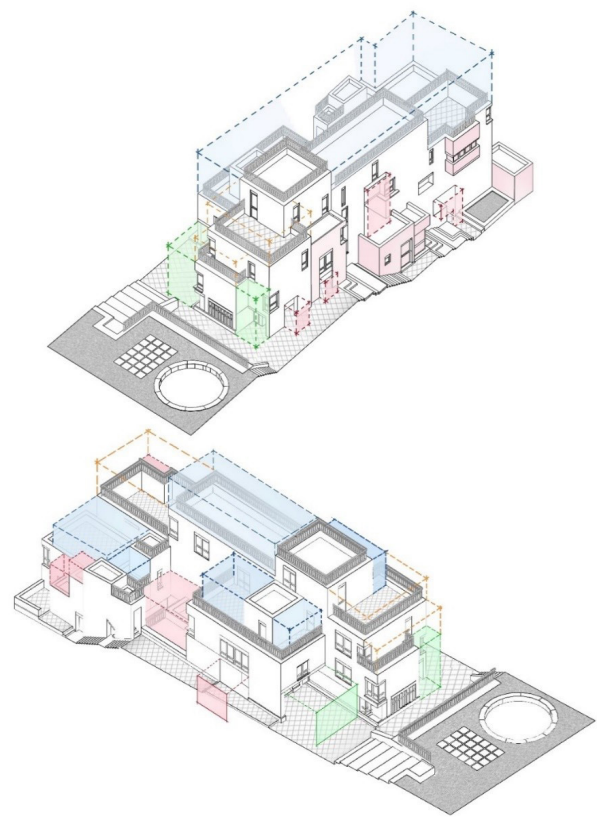


Fig. 6. A physical investigation of the void space in Kuhbor building-third period. Source: Authors.

of the categorized levels of void space in the Afshar building (Fig. 7) has occurred like what was seen in the Kuhbor building. But the masterful hand of the architect has made us observe the interaction of these three levels in the body of the building in such a way that by improving the location of the mass and justifying the fluidity of the design, the architect has created new angles in dealing with the surrounding environment.

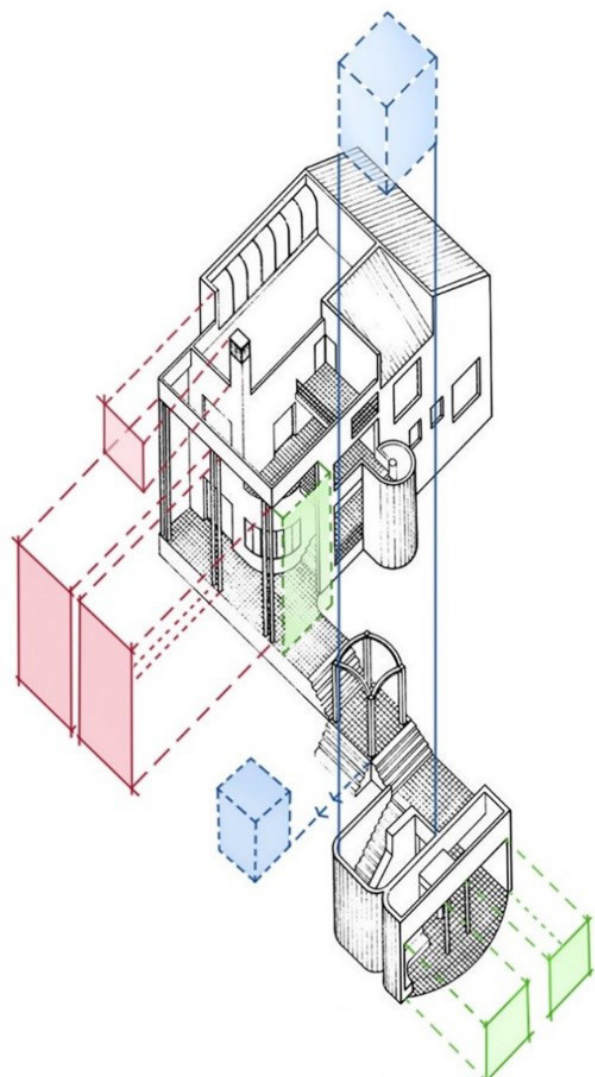


Fig. 7. Physical investigation of the void space in Afshar House building- third period. Source: Authors.

Conclusion

Creating quality in the physical space in the space-oriented and body-oriented architecture of Iran has been a continuous issue, always in the center of focus of Iranian traditional architecture in a way that it cannot be confined to the aesthetics or defined function of modern architecture. In terms of justification of the void space also, the final goal of Iranian architecture can be the enrichment of the qualitative senses of the audience.

The architectural body of the traditional Iranian residential buildings has been always a wide diversity of role-playing of connected, continuous, and flexible spaces, and in this spatial zoning, the void space is a necessary sense to connect the meanings and spaces in the architectural body which allows for internal and external connection and development through evident combination with adjacent bodies.

Finally, through investigations and analyses conducted on the selected case studies, the hypothesis on the promotion and role of void space in the architecture of the transformation era was confirmed (Table 8). The nature of this subject is initially more prominent regarding its connection with the peripheral space and more openings than in the pre-Qajar era. Then, in the second period, with the change in the building's skyline and entering the urban space

Table 8. Evolution course of void spaces in transformation era's architecture. Source: Authors.

	First level	Second level	Third level
Moshir-ul-Dowlah	Strengthening the openings	Development of the counter	
Sadegh Hedayat	Increasing communication levels with the yard	Number of semi-open spaces	
Tafazzoli	Use of the southern courtyard	Void space in height and volume reduction	Ornamenting the facade of the building
Ibn Sina	The development of the yard and communication levels with void space	Anchoring to create a facade and protrude into the street	The use of semi-open spaces in height
Kuhbor Villa	Framing the communication spaces	Filling and emptying the sides of the building with the excuse of the land's slope	Development of the concept of public space and urban communication
Afshar House	Combination of surfaces defined in mass fluidity and void space		

through the façade, the outer wall becomes more dynamic. Finally, in the third period, we observe the highest communication between the mass and space through the division of the void space in the main volume or mass section, and fluidity of the volume on the peripheries, which leads to the creation of a prominent three-dimensional composition that has an innovative continuity regarding the processing, compared to its later examples.

As said, the present study aimed to introduce void space in the residential body of late Qajar to the early Islamic Republic's architecture. In this regard, the achievement of the species of void space in terms of the categorization of samples in the architectural body of this historical period was to some extent realized. However, a review of case studies regarding the location can add to the temporal opinions and other various variables can be considered for re-identifications of these opinions. During the investigations in the present study, void space was investigated until the early Islamic Republic. However, the consequences of the imposed war and conditions of the first decade after the revolution are indicative of a type of life to survive that despite its bitter inner experiences, requires recognition of its architecture based on its oral documents and history, which is undoubtedly a part of history and it is necessary to record it.

After this period, architecture and paying attention to void space are again followed by a mixture of opinions affected by architects of pre- and post-Islamic Revolution, and it can include other studies in the genealogies of existing species and analysis of the design process of each one.

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