

Application of the Central Courtyard of Traditional Architecture in Modern Architecture

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Abstract: Time constraints have separated the architects from traditional architecture. These constraints can be economical, social, cultural and political. However, the existence of constraints in the above cases is due to time. Art and architecture have always been under certain known rules and regulations and are strongly and constantly connected to culture, behavior patterns and values of society. This is why the architectural styles of each period reflect the culture and art in that period. This study, entitled "Application of the central courtyard of traditional architecture in the modern architecture" studies the effect of local culture in regions, Western culture, and social factors on the morphology and position of the courtyard in traditional, modern and Iran's current houses. In this regard, a number of traditional structures, including Rasoulian and Arab homes and modern structures with a central courtyard including the building of Khavaran culture center were compared. The results show that although architects have tried to be inspired by the structures of modern architecture, but many do not adhere to the principles and concepts of traditional designs.

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1. Introduction

Traditional houses in Iran have a kind of beautiful interior structure that is based on beliefs and culture which have long been of interest to architects. Space flexibility, readability, introversion, spatial hierarchy and respect for family privacy have a special place in Persian houses' architecture, which is replaced by extravert architecture (Nosratpour, 2012). Traditional houses and buildings, due to observation of climatic criteria have had a good performance in the face of inclement weather, and naturally have kept man from hot and cold weather conditions. But due to human technological development since the Industrial Revolution and access to fossil fuels, climate criteria in housing construction and building have been forgotten. However, the limited resources of fossil fuels and environmental problems since the mid-twentieth century caused the tendency of humans to observe nature and climatic criteria in building which was followed by development of various climate techniques (Aspmany 2004). In the traditional buildings the use of natural resources and energies was one of the space construction principles. Old houses in the desert texture were typically directed to Mecca. This kind of orientation provided a climatic condition for summer spaces and winter chambers to reasonably surround the central courtyard (Tahbaz, 1995). The central courtyard has been the main environment in desert houses (Robinson, 1991). Water pond in the middle of the courtyard, which was in its maximum size, would store the energy of sun. Thereby a cool air conditioning for each residential unit was provided by guarding deep yards and providing the possibility for

compressed house to breathe into the courtyard. Courtyards which are enclosed on all sides with indoor spaces absorb the cool night air such as a cool pit and use it on the hot day (Asad Pour, 2006).

On the other hand the negative effects of modern architecture on the structural organizations of cities in Europe and spread of its consequences to other countries including Iran became a dilemma which is seen as space displacement. According to the expert views on morphology issues, such as the Carrier brothers, Christopher Alexander, Roger Trancik, the most appropriate solutions to avoid and confront the history gap is utilizing the experiences and values before Modernism (Edwards, 2008). Early examples of Iranian modernist architecture for the first time were emerged simultaneously with the extravagant movement and the focus to create urban spaces, and coincide with the appearance of the street on morphological and anatomical organization of Iranian cities (Zekavat, 2003). But according to the remains of ancient settlements since the sixth millennium BC in many parts of Iran, and the remains of some of the settlements in Mesopotamia, the home is typically made of two parts; one the enclosed space and the other the open space, because in the central and southern regions of Iran and Mesopotamia, during the year the weather was half of the year cold and the other half was mild and warm, and part of the house chores at the appropriate time were done outdoors. Although the role of environmental and geographic phenomena in the formation of open space or courtyard of houses is more or less obvious, some researchers named cultural factors as the main factor

forming various types of courtyards in the traditional houses. Moreover, it seems that the current classification of outdoor spaces and its relationship with spaces built in Iran is very general and are not precise enough (Soltan Zadeh, 2011). Despite the mentioned descriptions, as Aspanany says "climatic design techniques which are derived from climatic indices of traditional architecture were maximally efficient" (Aspanany, 1994). Accordingly, this study sought to examine the status of courtyard in modern homes and the influence of Western architecture on the location and morphology of this part of the building.

2. Research Background

Soltan Zadeh in 2011 in a study examined the role of geography in shaping a variety of courtyard in traditional houses. He states that although the role of environmental and geographic phenomena in the formation of open space or courtyard of houses is more or less obvious, some researchers named cultural factors as the main factor forming various types of courtyards in the traditional houses. Moreover, it seems that the current classification of outdoor spaces and its relationship with spaces built in Iran is very general and are not precise enough. The aim of this study is first to focus on the impact of geographical factors in formation of open spaces in houses, and then is to provide a comprehensive classification of the species of the courtyards in the houses. In this research historical interpretation method has been used. Geographic phenomena were independent variables and types of open space or courtyard were the dependent variables in this study. Data collection methods were both attributive and field study. The theoretical framework of this research is based on the fact that geographical and climatic phenomena play a significant role in the formation of courtyard in traditional houses. The results indicate that the formation of open space or courtyard in traditional houses have been under the influence of the geographical phenomena. Also, a new category has been presented to the courtyard types which seems on which base all types of the open spaces used in Iranian traditional houses can be identified and classified. One of the important results of this study is to provide a new definition and classification of different types of open spaces with environmental application or courtyards of residential units in Iran.

Ahmadi in 2005 in an article titled "City - House Central Yard (Sustainable Town – Home, Ritual City - Home)" express that to refer to the essence of space organization in a plateau of Iran, most certainly the central courtyard can be named, a structure which integrally provided a response to the material and spiritual life of the people. In this paper, according to the Islamic and traditional architecture

principles in Iran, studied applications of the central courtyard in the cities and traditional houses. In this study, it has been tried to review one of the basic elements of the Iranian plateau cities (central courtyard) and evaluate it in terms of sustainability.

Doosti Motlagh in 2009 in an article entitled "The entry history" stated that any new architectural style is based on the principles, methods, and traditions of former styles, and that is why there is a strong relationship between the various architectural styles of the past in a way that their boundaries are not vivid. The proximity of principles between the different styles and methods of architecture is derived from the similar culture, customs and behavioral patterns of society; and with a little change in new ways of life and culture rooted in time, new architectural styles are emerged to meet new demands. The purpose of this study is to evaluate the significance of entry design in the peaceful life in man's living environment. What is the most important in entry is the affect this space can have in physical environment around. The purpose of this study is to investigate how the formation of entry can lead to create a favorable environment and access the invaluable principles in the design of housing. This study more emphasized on documentation and cultural signs in Iran which can be seen in the past architectural and resources. The methodology used in the preparation of this research report is an (analytic - descriptive) method which analyzes the design spaces for entries and examines some past examples of traditional architecture in Iran. This solution presented in this study to solve many problems of contemporary Iranian architecture indicates that Iranian and traditional architecture shall accommodate contemporary technologies and methods, and resolve the today needs, and in other words associate with the pulse of modern life. Therefore, to improve the quality of today's architecture which is an important issue in the contemporary architecture, attention to traditional architecture principles and its implementation in the context of life today can be helpful. The study of history and literature related to this issue can be useful.

Mashaei Shokoohi and Ziapoor in 2009 in a study entitled "the role of courtyard in the yesterday Sustainable Architecture" studied the sustainable architecture and the courtyard elements and its role in sustainable architecture. Finally, they concluded that instead the courtyard is missed in today architecture in Iran. So, the present study tries to find a strategy to use courtyard. At the end they stated that regarding the experience in the design of residential complexes and using courtyard at both sides of the house, it seems that it can be experienced in the city's architecture and segmentation, so that courtyard can be used in today sustainable and green architecture.

3. Research Method

In this study, historical - interpretation research method is used. Cultural factors of different climates in Iran were independent variables, and types of open space or courtyard, as well as morphology of courtyards are dependent variables in this study. Data collection methods were both attributive and field study. The theoretical framework of this research is based on the fact that geographical and climatic phenomena play a significant role in the formation of courtyard in traditional houses.

4. Analysis

One of the physical characteristics and unique requirements of the traditional homes in Iran is that they reflect natural and cultural needs (Nosratpour, 2012). It should be noted that the demand for these kinds of home increases to adapt the climate (warm and dry) in most parts of the country. Today, in dry and hot areas, not much architecture elements are used to reflect potential environmental and cultural needs of houses (Ayvazian, 2005).

In Iran homes with courtyard are the most prominent types of houses (Goh & Nabavi, 2011). The idea of garden and yard fulfills the hot and arid plateau of Iran and significantly reflects the concept of heaven in the Islamic era (Shokouhian et.al, 2007). In these yards (Figure 1) with trees and pool water and shadows by the walls, the heat is greatly reduced and the area is used for recreation during the day (Belakehal et.al, 2004).

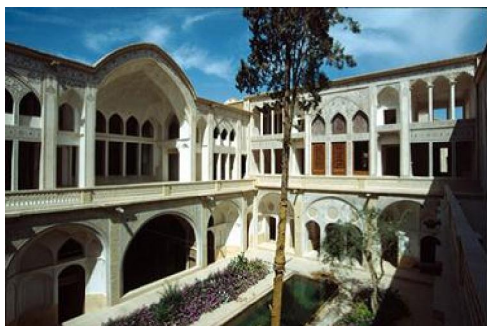
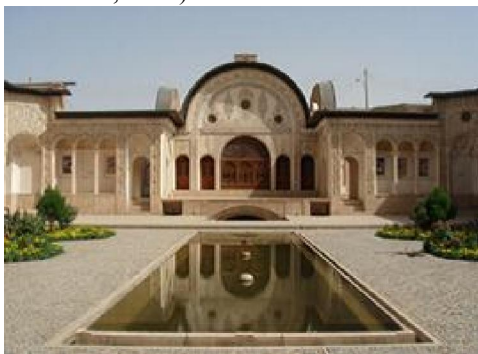


Figure 1: The courtyard in houses traditional in Iran (Source: Nosratpour, 2012)

The Iranian architecture first was formed in Iranian plateau and then was influenced by the Iranian culture. Like all architectures that are rooted in local culture, it considers the climate and has left valuable monuments to the end of the Qajar period. Samples left shows that the colors used in the decoration of buildings have been influenced by the hot and dry climate features (Roaf, 2009). Even in the decorative motifs there are footsteps of the sun as the main climate factor, named as Shamsheh and sun wheel (Parsi, 2010). As noted, in the past interior life was based on special tradition and culture, solidarity among family members, climatic status, economic underlying, and religious factors. But the imported western architecture in the first step presented single element housing with the yard or open space exactly the opposite, in other words it circle around the residential building, and then this open space was surrounded by high walls, and actually it represents a whole different way of life. Then another yard was designed behind the house and then the urban life turned to design of terraces and balconies (Robinson, 1991). Then by municipal legislation for civil rights, terraces and balconies were removed from the buildings and people took refuge inside their homes.

Life in the past, especially in tropical regions of the Iran desert was going on inside enclosed yards that defined a life called the "interior" and porches and rooms were circled around the courtyard. Yard at the old house was the center and heart of the building (Mirmoghtadaee, 2009). Central courtyard with balconies on each side was a feature of Persian architecture presented since the long past. It was possible that the courtyard does not geometrically located at the center of the house, but it was the center of the house in terms of life and activities and the link between the various parts of the house, vision and other such factors. The yard was a place for various events such as religious festivals, weddings and family gatherings, and it was usually rectangular (Nosratpour, 2012). The number and function of spaces around the yard would determine its aspects. Usually, every yard had a pool and some gardens which depending on various local conditions such as climate and cultural factors may have different shapes. Courtyard enclosed spaces were organized in a manner to be consistent with the seasonal changes and the various functions of nearby rooms (Nosratpour, 2012).

In modern homes with Western conception of it, the land size is closed and often is small and limited to rectangular shapes. Private homes (villas) have been replaced by buildings and structures. Since the land size is smaller, the buildings are located in the north or south. The new construction laws have allowed the buildings to occupy 60% of the land and the yard and open space occupy 40%, and this has largely affected

the modern house design. The central courtyard in traditional houses has been replaced by front yard is commonly used by all residents (Arjmandi et.al, 2010). As we see in western examples of modern houses, now this kind of yard is also slowly dying out. Another important difference between traditional and modern house in recent years, especially in large cities is very tall buildings instead of short building in traditional houses (Goh & Nabavi, 2011). This change in height has changed shapes and style of yards in modern house. This factor brings other consequence that leads to failure in modern homes which is by no means negligible. Figure (2) shows the trend of change in the height of the building.

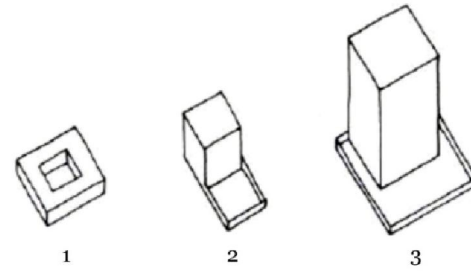


Figure 2: The changing pattern of courtyards (Source: Goh & Nabavi, 2011)

Table 1: Ratio of open to closed space in the sample native home of the Research

Building	Full and empty spaces in plan	The filled area (closed)	The empty area (yard space)	Filled to empty area ratio (close to open)
Rasoulia House		1008.5 square meter	Total yard: 392 square meter	2.5725
Arabs House		995.2343 square meter	Total yards: 329.2034 square meter	3.231
Mortaz House		1137.8301 square meter	Total yards: 520.6663 square meter	2.1853
Lariha House		1753.5129 square meter	Total yards: 637.8757 square meter	2.7489
Golshan House		1697.3175 square meter	Total yards: 531.3121 square meter	3.1945



Filled and constructed space



Open and unconstructed space

Still, the image of central courtyard is used in Persian buildings and architecture and even the modern architecture by nature and generally for beauty. But in modern architecture traditional design parameters are not considered in the central courtyard. For example, the deliberate and purposeful ratio of closed space to open space in local architecture is one of these factors which are not observed. In traditional homes, the ratio of filled

space to empty space is more than 2, and sometimes more than 3, while in modern architecture this ratio varies by different values and is not fixed. Some of the samples are listed in (Table 1).

However, this ratio is ignored in modern design. For example, a modern building constructed in Tehran has been selected. The schematic map of the building is shown in figure (3). As it can be seen in this figure, the filled area to the total yard area

ratio is very close to one. This indicates the absence of traditional architecture. However the created plan was a good idea and has helped the beauty of the building.



Figure 3: The schematic plan of a modern house with a central courtyard, in Tehran, Iran (Source: Researcher)

In indigenous architecture the construction materials are selected regarding the natural resources, environmental resources, and ecological and environmental characteristics. The above considerations which are the key criteria of sustainable architecture have been realized through the central open spaces. In these areas soil is the most abundant local element, and local manufacturers very wisely have turned it to clay and brick and used it as the main construction material. This local element is recycled, available, with long life, transferable and consistent with climate, and not only has not damaged the natural environmental cycle, but provided a construction with minimum environmental degradation and no construction waste. Due to the central courtyard in the heart of the building, most of the construction material, without added costs of transportation and energy, provided the soil from the construction site of the excavation pit yard and garden, has been provided from the building site, because the soil from the excavation of yard and garden pit has provided much of the material. However in modern architecture there is no place for local construction materials, and almost all buildings with any architectural design use concrete and steel as building materials. Besides these cases, design angle has also impressed. Maximum angle a building can create with the controller is 27 degrees, or in other words the controller stands at a distance twice the height of the building (Tavassoli, 1989, P. 116). A more conceptual form is shown in figure (4).

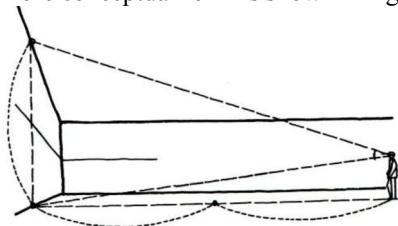


Figure 4: The schematic plan of the optimum design of angle in open spaces

The angle was studied in the traditional examples. Findings show the consistency of proportions and dimensions of the central courtyard and its surrounding walls with the above principle. Some of the studied examples are listed in Table 2.

Table 2: The values of the controller view angle design in the central courtyard in Ayarn traditional buildings

House	Longitudinal angle (degree)	Lateral angle (degree)
Mortaz	17	25
Golshan	20	21
Lariha	12	18
Rasoulia	16	22
Arabs	17	19
Akhavan Sigariha	17	23

According to Table (2) in most of the houses, the building height to courtyard width ratio is typically 1 to 3. For example, the view angle in Rasoulia house building is 22 degrees. This is better shown in figure (5).

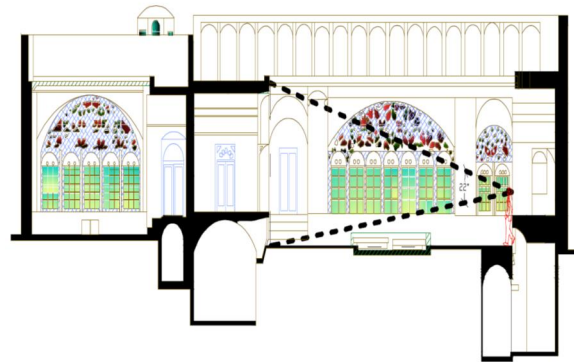


Figure 5: The view angle in cross section of Rasoulia Home is 22 degrees

However in modern architecture the controller view angle has changed and its values have dropped. For example, Khavaran Cultural Center building in Tehran can be considered. Khavaran Cultural Center was built between 1993 and 1994 with design and observation of the Cultural Center's technical office. Khavaran Cultural Center is located in the old Mesrabad neighborhood, located in the southeast of Tehran, district 15. In the architecture of the complex it has been trying to be inspired by Islamic architecture, and focus on the layout of spaces and forms. Geometry and symmetric spaces add a special order to the complex which shifts the focus to the main spaces. The high official building with an arc setback to the street created an attractive entrance to the complex. The marketplace is inspired by sunken gardens in Persian architecture, and with a central courtyard is located below ground level,

therefore the central building of the cultural center looks like a palace. In general, in spite of its scholarly nature, and unlike the rest of the world, the cultural center building does not represent an advanced architecture technology. The schematic plan of the structure is presented in Figure (6).

According to the longitudinal size to a height ratio of the structure which is less than 1:6, the controller view degree is less than 9 degrees. It is clearly shown in figure (7). It is clear that the observer's viewing angle in modern buildings is different with traditional buildings.

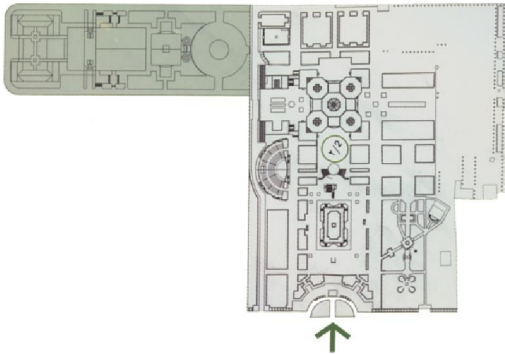


Figure 6: the schematic architectural plan of Khavaran Cultural Center (Javan)



Figure 7: central courtyard of Khavaran Cultural Center with a view angle less than 9 degrees

Another studied architectural design is the modern house design shown in Figure (8). The project is a special dialogue between Iranian traditional architecture and modern architectural space. In this project it has been tried to combine modern architecture and Iranian traditional architecture. In fact, in this plan a form such as central courtyard is combined with a cube form of the modern architecture.

As figure (8) shows, the design do not consider any traditional design principles for the central courtyard. To better understand this subject, it is presented in Figure (9). In this figure it is clear that

the central courtyard design perfectly observes modern design principles. Modern construction material is used and the view angle principles and its personal space are completely ignored.

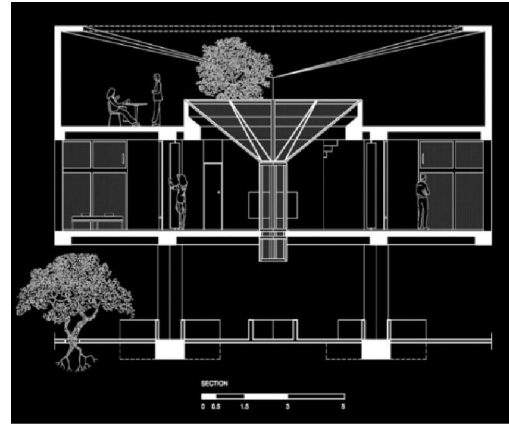


Figure 8: The studied schematic layout with a central courtyard in the cubic form of the modern architecture

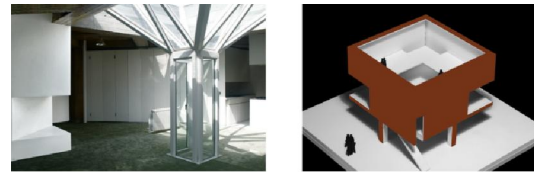


Figure 9: View angle and construction materials of the studied design with central courtyard in cubic form of the modern architecture

5. Conclusion and discussion

With time and changing lifestyle, needs of people have changed, although many physical and psychological needs remained unchanged in the last 100 years. For example, people used to need a broader, freer, and happier perspective, and also they needed to respect privacy and nature. Although traditional architectural has beautiful and precious elements, currently it is not applicable. Some valuable concepts such as spatial resolution, simplicity, diversity, introversion, hierarchy, privacy and etc. are hidden in the heart of this architecture, and architects and developers shall try to use these concepts in modern architecture (Mirmoghtadaee, 2009) The results of this study indicate that although architects have tried to be inspired by modern architecture in their structures, they do not observe many principles and concepts of traditional designs. For example, research shows that building materials in a traditional architecture have been chosen based on geographical location. While today modern buildings benefit from available materials such as steel and concrete. Also, modern designs with a central courtyard do not generally observe traditional

values such as level design, level of access, the height proportion, width and length, and in some cases it leads to structural heterogeneity. Therefore it is suggested that in the design of modern architecture with traditional architecture concepts, it is better to extract parameters relevant to the desired architecture to avoid heterogeneity.

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