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Lessons from Old Iranian Climate Architecture for Modern Architects

Ahmad Fathi Najaf Abadi[1], Mina Pakdaman Tirani[2]
[1]Architecture Department of Sepher Isfahan Institute of Technology
[2] Art University of Isfahan
E-mail: afna63@yahoo.com

Abstract

Iranian traditional Architecture reveals the conception of the past generations from climate and ecological issues and their efforts to improve living conditions. This architecture has always inspired architects in case of environmental factors and control strategies for them to develop their living conditions. Thus, the present paper attempts to recognize the observed climatic and environmental issues in Iran's historical architecture via a descriptive–analytical approach and to explain the way contemporary architecture communicates with these issues. Finally, some strategies for the optimal use of climate and environmental issues of historical architecture is provided for contemporary architecture. Selecting examples discussed in this paper, we tried to pay attention to the most frequent traditional buildings in the historical contexts; notifying the tips which the majority of these houses have been observed.

Keywords: historical/traditional architecture, climate, contemporary architecture, climatic factors, renewable energies

Introduction

Iran possesses one of the most ancient civilizations and has always been a favorable habitat for humanity throughout history due to its climate variability. Qobadian (2010) explains this diversity in this way: "There is not any rainfall for over half a year in a large part of the central plateau of Iran, while the Caspian sea coast experiences about two meters of annual rainfall and above 80% humidity. This climate exist along with the hot southern coast of Iran which Shamsuddin Moqaddasi (4th century AH) has called it the Hell Gate due to the area intense heat and finally highlands where snow and extreme cold in long winters threat the livings in the region" (p. 10).

To set conditions for more desirable life, human beings lived in each of these different climate employed the methods based upon the use of renewable energies that after a while, were gradually replaced by approaches established on the basis of non-renewable energies. Nowadays, due to reasons such as the expensive price of non-renewable energies, decline of the resources, environmental pollution caused by the use of those resources and also, lack of fair access of all human beings to this type of energy resources throughout the world, scientists are searching for solutions to make use of renewable energies. In this course, Iran's historic architecture can act as a mirror that reflect climate changes of a region and the way its residents adapt themselves with the special climate. To this end, this paper aims to scrutinize a part of historic architecture of Iran to provide lessons for today's architects.

Focusing on Historical Architecture from climatic view: A Necessity

Optimal architecture should respond to the beauty and performance of a building simultaneously. Unfortunately, whenever we talk of historic architecture, it is expected to emphasize only on aesthetic aspects of historic buildings or specific events and dates attributed to them. However, the historical architecture in addition to the visual aesthetic values possess functional and physical values that can be utilized in the contemporary architecture. "It means Iranian monuments,

which often find their importance in terms of aesthetics aspects, factually have incorporated much of national values in its contexts and thus, can be considered as the most reliable evidences to take advantage of them in the present and also future times" (Beheshti, 2007: 81).

On the other hand, historic architecture reflects the climate change that occurred in different regions of Iran and also, suggests some strategies that the natives in the region utilized to adapt with the newly emerged conditions. The use of windcathers in Yazd province is one of the great examples of the inhabitants' conformity of a region with the climatic conditions (see figure 1).

Figure 1. Yazd wind catchers (symbol of climatic architecture)

Observed climatic principles in Iranian historical architecture

In this section, some climatic features of historic architecture in Iran were recognized and its principles have been compared with the principles of contemporary architecture. Furthermore, it should be noted that "the purpose of climatic design is to fix or minimize costs to maintain favorable and comfort conditions in the interior' of the building " (Watson and Labz, 2010: 29). Throughout Iran, techniques can be seen used by local architects to create comfortable living conditions.

Use of Panam (Insulation)

Panam/Insulation in architecture means "the insulator or barrier to achieve something of one to the other" (Pirnia, 2004:352). The historic architecture of Iran has made use of insulations in various forms. For example, thick walls in warm and dry areas were used for less heat conduction through the wall into the building. Also, dual-layer domes and roofs was built to hold the air between their layers to act as a thermal insulation (Figure 2).

Figure 2. Two-layer Dome of 72 martyrs mosque in Mashhad (Memarian, 2012:582)

Vaults and light hedge that have been created around the windows have the function of the canopy as well as being a decorative elements (Figure 3).

Figure 3. The location of vault and light hedge on building facade

On the other hand, the porch has been designed in such a way to prevent the summer sun light from entering the building, rather to allow maximum entrance of winter sun to the building (Figure 4).

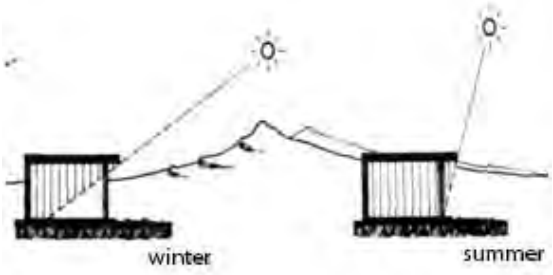

Figure 4. Illustration of the impact of a porch on the amount of sunlight entering into a house in summer and winter depending on the radiation angles of the sun (Qobadian, 2010: 5)

Planting deciduous trees in the courtyard craft is another way to manage entering the sun light and heat into the house. In summer, the solar energy encounters foliage which preclude sun light from entering into the building. Conversely, in winter when the leaves are shed, sunlight enters the building and creates a warm atmosphere (Figure 5).

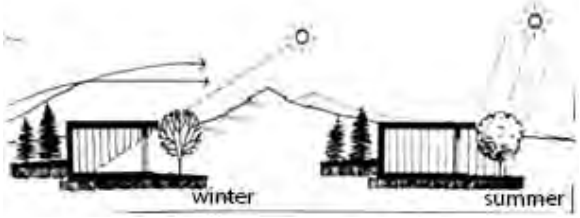

Figure 5. Illustration of the impact of deciduous trees on the amount of sunlight entering into the building in various seasons (Qobadian, 2012:6)

Additionally, the deciduous trees in summer prevented sunlight reach the floor of the courtyard that leads in a lower reflectivity to the building.

In some historical monuments in Iran, there are doors that have been structured and decorated by small colored glasses and tiny pieces of wood. Those small pieces in addition to making a beautiful exterior facet for the building, would reduced the intensity of solar energy and entered a moderated sunlight into the house (Figure 6).

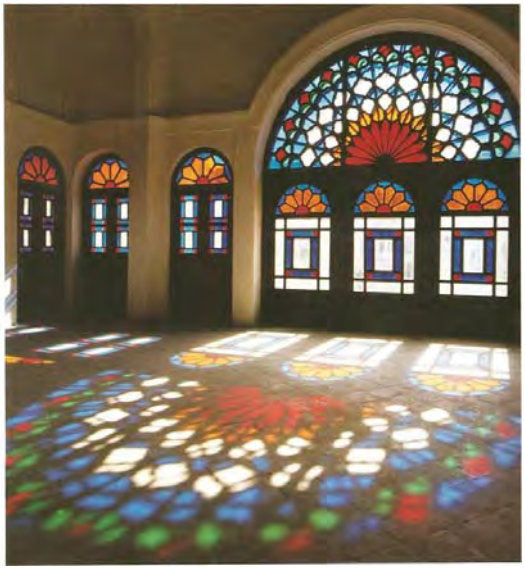

Figure 6. A sash window

In urban scale, erecting archways on the public pathways was common which acts as a barrier to light, cold and rainy weather. Such structures as well as creating beautiful view, have had other functions such as casting shadows, path construction between the two houses through the roof, and also as an abutment of the bearing walls of the house (Figure 7).

Figure 6. An archway with a room on top

From what was described in this section, there is a little or even no trace in today's architecture. Currently, buildings with glass or metal facades are seen everywhere that in addition to

bringing forth the sunlight reflection to passengers, caused severe waste of heat energy inside the building. Moreover, such facades have the potential of changing into cutting blade coming down on passersby when an earthquake happens (Figure 8).

Figure 8. A typical view of the glass facade in contemporary architecture

Also, for the reason of the current high price of the land in the cities, it is attempted to make maximum use of existing space to create the necessary living spaces, thus think less to design and make use of horizontal and vertical conveys and other insulation.

Space Combinations

In Iranian historic architecture, some spaces can be seen which were designed according to their residents' functions in different seasons and various times of the day and were located next to each other. "The space arrangement in Iranian houses is highly flexible to the Iranian life requirements and so compliant with changes in lifestyles. There is no space in the house which blocked in itself and each space while keeping its own independence at the same independence is able to combine with its surroundings" (Haeri, 2009:136).

Iranian historical houses in hot and dry regions encompass two sections assigned to summer and winter stay. The space embarked for summer stay is located in the southern part of the house that has been locally called "Nasram" and the least amount of sunlight shads on this part. Spaces like windward rooms, basement and cellar are located in this section which all counted as the cool places of the old houses (figure 9).

The space for winter stay was located in the northern part and rooms of Se-dari (meaning three windowed room), Panj-dari (meaning five windowed room) and Haft-dari (meaning seven windowed room) placed in this section. This space receives the maximum amount of sunlight during the day and creates the warmest atmosphere of the house (Figure 10).

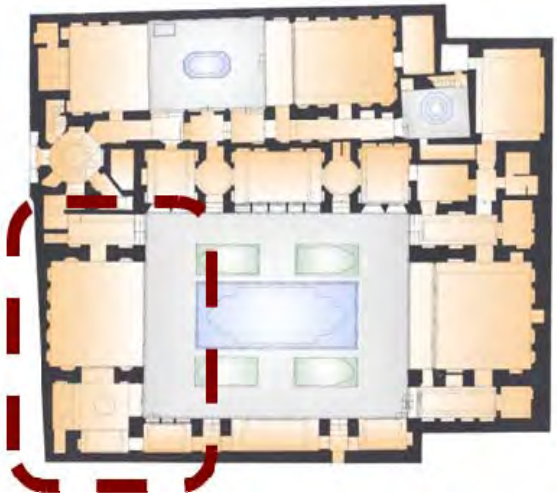

Figure 9. Position of the Nasram space (Ayatollahi, 2006, p. 77)

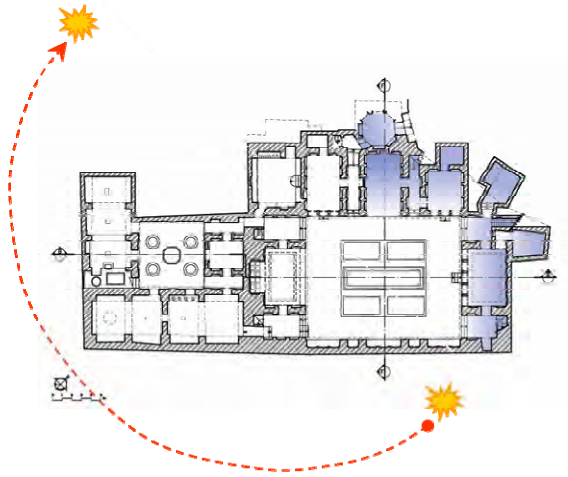

Figure 10. Location of spaces that receive the most sunlight during the day was colored (Ayatollahi, 2006, p. 77)

The sun radiation angle to the building had caused house spaces arranged around a central courtyard alongside each other and both horizontal and vertical migration of the spaces to be made. Vertical migration had happened at summer days. Residents have remained in the hall or windward room till noon. At noon, when the weather was warmer, they went to the basement or cellar. And when the night came they rest on the roof.

All those spaces (e.g. hall, basement, roof, and cellar) had been designed from architectural point of view and were beautiful and pleasant cool spaces which have also had functional aspects (Figure 11).

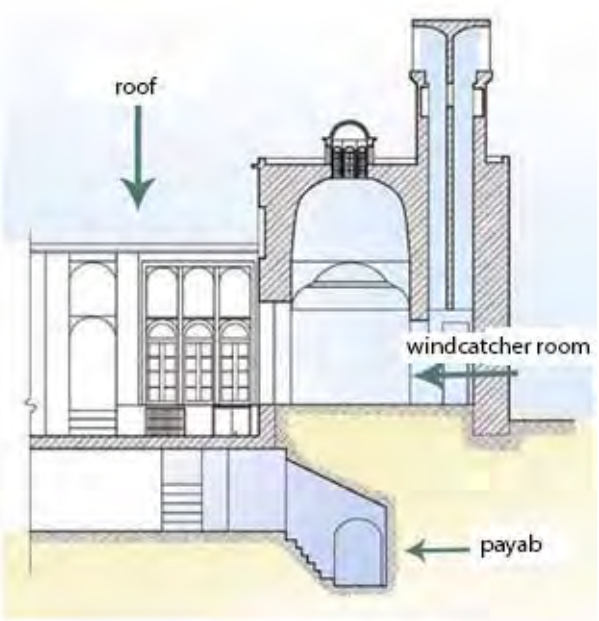

Figure 11. Location of spaces on the vertical migration

The horizontal migration of the residents happened with the change of seasons from the residence for summer to the winter stay and vice versa. These migrations made the use of renewable energies possible for the residents to meet their needs and consequently reduced the demand for the use of non-renewable energies.

Locating the courtyard in the center of other house spaces was based on a wide and long pool (to increase water evaporation) and evaporative water into the spaces to be and welfare of the space of houses the most part (Figure 12).

The reason why the courtyard was located in the center of other spaces was the moisture created by the wide and long pool (which increased water evaporation) and evaporative humidity generated from garden's plants and trees in the courtyard caused the center of other house spaces devoted to this location. All of those characteristics form a comfortable space within the house (Figure 12).

Figure 12. Location of the pool and trees in the Malekzadeh house, Yazd

Instead of spaces on the ground, basement and collar spaces are warmer in winter and cooler in summer due to being located below the ground.

In temperate and humid climate of northern Iran, local old buildings were surrounded by a roofed space opening to the court yard named «Gholam Gardesh» (e.g. a circular pathway like a porch all around a house) in order to take advantage of the airflows and avoid constant moisture in the house spaces. Contrary to the hot and dry climate, the courtyard can be seen all around the building in this type of architecture; i.e. the so-called extroverted architecture (figure 13).

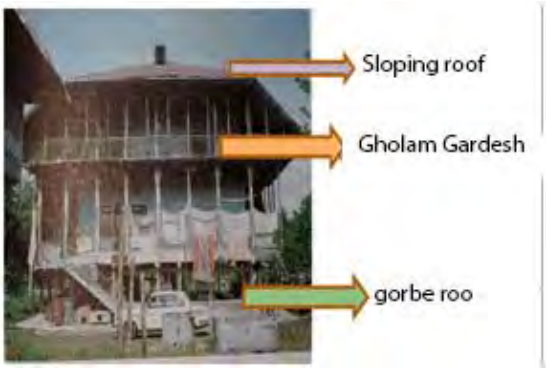

Figure 13. Position of Gholam Gardesh at temperate and humid climate of Iran

Remarkably, in today's architecture all areas of the house are designed at the same level and all the spaces of a building are considered to have identical temperature. The condition does not tune with different functions defined for various spaces of a house. On the other hand, the courtyard is located in one side of a house at present time and the pattern of the central courtyard can be seen only in historical buildings. Unfortunately, municipal laws support the loss of this efficient model. More importantly, the rules of construction in all Iranian climates are almost similar. In fact, there is no difference between a building that can be built in the north with the building to be constructed in the center or south of Iran. While "if you draw a cycle with a radius of 150 kilometers anywhere on the map of Iran, you can certainly report the temperature difference around 25 degree of Celsius among points in the cycle" (Beheshti, 2007, p. 72). This condition, for instance, has led to the construction of a four sided design of windcathers in Yazd and one sided design for the same instruction in Ardakan (Figure 14).

Figure 14. One-way windcathers in Ardakan (right) and four sided windcathers at Yazd (left)

This reflects the architects' attention to the variety of «micro-climates» and their special features. Windcathers built in the southern part of Iran like Loft harbor differ from Windcathers in the central regions in terms of color and form (Figure 15).

Figure 15: White windcathers of Loft horbor (left) Yazd windcathers (right)

Another example can be seen in temperate and humid regions of northern Iran. "In order to protect the building from excess moisture of the earth in very humid areas close to the sea shore, houses were built on wooden bases; while in slopes of the mountains where the humidity is in lower level, houses usually were constructed on the basis composed of the stone and mud and in some cases benefit from the catwalks around the house" (Kasmaee, 2005, p. 86). In any case, the current situation leads to the loss of identity in Contemporary Architecture. Previously, guessing the climatic features were possible through seeing pictures of a building; though today's architecture do not possess a specific identity and a building plan may be made in every region of the country and used for living.

As mentioned above, heating and cooling elements designed in historic buildings were entirely based upon the climatic features of their locations. However, in contemporary architecture those principles do not observed and thus provide some inelegance in the urban architecture such as the typical views of current apartments in cities which represent the installation of air conditioners and appliances (Figure 16).

Building Orientation

One of the principles of architecture consistent with climatic features to choose the correct orientation of the building. According to these principles, orientation of buildings and urban forms should be based upon their interaction with the sun and prevailing winds. "In the past, considering the weather, mode of sun radiation and wind types and directions (e.g. pleasant winds, storms, hurricanes, etc.) a direction was recognized to build houses towards. Iranian architects were used a hexagonal shape for this purpose and generally employed three types of building orientations (i.e. "Ron" in local accent) including straight, Kermani, and Isfahani orientations" (Pirnia, 2004:1). Concept of orientation considered in Iranian old buildings actually represent people attention of each region to climatic characteristics of various areas (figure 17).

Figure 16. Comparison of historical and contemporary home cooling facilities

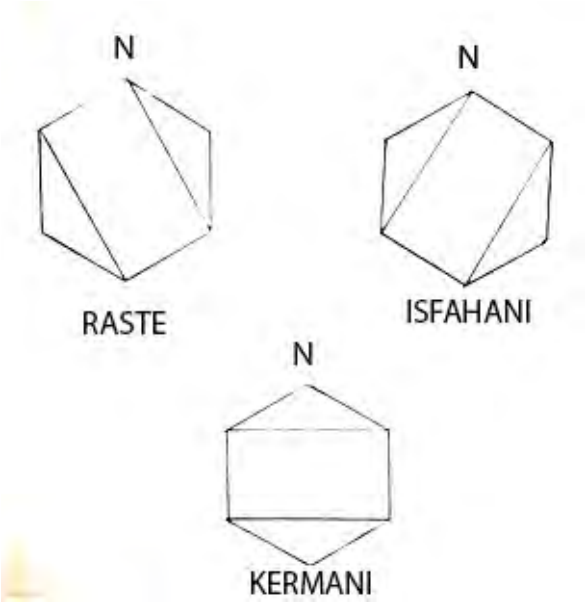

Figure 17: Different orientations of the historical houses (Pirnia, 2004:172)

Considering the orientation concept in Iranian buildings date bake to seven thousand years ago and examples of such constructions can be seen in the slum houses discovered in the hills. "The length of those rectangular houses on the map stretch from North-East to South-West or vice versa. The direction was selected with respect to the constant winds of Qazvin plain an as a result, the smaller surface of houses (i.e. the width of the house) was located against the wind" (Pirnia, 2004, p. 41).

Historical houses should carefully observe the orientation of their buildings; lack of attention to this element makes the buildings uninhabitable. Although in present modern time – along with all advancement of technology and discovery of new energy sources – human beings could built their accommodations regardless of the climatic characteristics of various regions and relying solely on

nonrenewable energies to create comfort conditions within them. Dependence on non-renewable energies in contemporary buildings is to the extent that if incidentally the connection with one of those resources cut off for a while, living would become impossible. This happened until recent decades, architects and also people knew how to build houses which are less dependent on non-renewable energies and rely mainly on climatic features to provide pleasant and comfort living conditions in the buildings.

An example of contemporary architecture which has neglected the house orientation principle can be seen in Yazd city, "in this city, Kermani orientation is poor and not fitted to the climatic features of the region and makes a state of great discomfort; this is why it is cool in winter and warm in summer. Unfortunately, houses with a new east-west orientation were built without observance of the issue recently in the city. As a consequence, the building are not suitable to live in the hot season" (Pirnia, 2004, p. 2) (Figure 18).

Figure 18: An example of contemporary architecture in Yazd

Conclusion

Historic Architecture of Iran is full of tips that architects built their edifices accordingly. Recognition of these points and making use of their experience seems necessary and beneficial specially at a time when the world is facing the crisis of nonrenewable energy sources and also threat of environmental pollution caused by indiscriminate use of those energies as well as their high price. In order to consider those points in the review of historical monuments, the climatic characteristics of the buildings must also be addressed in addition to aesthetic deliberation.

Regrettably, climate and environmental issues referred by the past architects and outlined briefly in this paper (Such as observing the orientation of the building to suit the local climate, the use of insulation in buildings, the correct combination of spaces depending on the type of building and climate zone, etc.) are the contemporary architectural issues which have been neglected in many cases at present time. This negligence happened surprisingly when the observance of those tips is not a tough and demanding endeavor and merely requires a proper planning in macro-levels (Municipalities and Ministry of Urban Development) and micro-levels (e.g. offices of consulting engineers of Engineering Council). Situation highlighted the heavy duty of today's Iranian architects in order to implement the tips of Iranian historical architecture. They should search for the ways to update and apply the above mentioned principles in today architecture.

Bodies such as municipalities and the Ministry of Urban Development must try this by compiling and codifying of new regulations adapted to different climates of Iran to be able to struggle and come up with the emerging issues.

Suggestions for Further Researches

For further studies, several possible directions can be suggested to other researchers to pursue in the future to achieve new results according to this article, including:

1. Thermal identification of the various spaces of the historical buildings in different seasons;
2. Determination of the architectural differences in distinct climates of Iran ;
3. Examination of updating approaches for new ideas in Iranian historical architecture
4. Exploration of how ancient architects pay attention to climatic issues and aesthetic values simultaneously ideas in Iranian historical architecture.

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