Investigating the Role of Nature Elements in the Central Courtyards of Traditional Iranian Houses in Hot and Dry Regions

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Abstract: Lack of consideration to the nature and natural elements in today’s architecture has brought along some defects from both environmental point of view and mental and spiritual point of view. This approach influences on human-nature interaction which is an inseparable element related to human being and the rules governing on his life. Since the human being’s close relationship with nature results in continuing his life, Iranian traditional architecture seeks a discipline based on utilizing the natural gifts and endowments and has been formed in reaction to this demand. Using central courtyard, in order to create coordination with the desert characteristics, is a sample of the Iranian artists’ and architectures’ innovation. In the traditional houses, the space has been organized based on the courtyard component.

In this research, central courtyard investigated as one of the climatic patterns in the traditional houses of Iran hot and dry regions from the point of view of the natural elements (water, soil, wind and light), and role of any of these elements and strategies that meets human being’s convenience requirements in his life environment have been studied. Finally, after investigating the role of these elements, courtyard is presented as a space which provides grounds for imaging the memories and reinforcing the relationship with the nature, and it can be completed with naturalism imaging. Organizing the courtyard by the view elements is the main condition in granting meaning to it and creating the sense of beauty in it. Water, soil, wind and sun are used in this space in different manners, and present a coordinated complex of bio-environmental functions. By using central courtyard and natural elements in it, designing spaces which provide human-nature interaction may become possible, and the future architecture may approach the goals of sustainable architecture.

Key–Words: Traditional house, Central Courtyard, Natural elements, Desert

1 Introduction

One of Iranian people’s beliefs is valuing private life and its sanctity; this fact has made Iran architecture, to some extent, introverted. Introversion is a concept which has existed in Iran architecture as a principle and is observable in various forms. In the warm and dry climate of Iran, this Introversion has shown itself in terms of central courtyard.

The traditional architecture of Iran has formed based on courtyard. This greenery and courtyard represents the life existence and is a sample of life and growing. In Dehkhoda Dictionary, courtyard means a campus or any wall-surrounded space of a house [1].

In the desert houses, courtyard is the center and heart of the building. Iranian architecture has given an artistic response to the nature and climate, and has considered the individual’s convenience in all periods.

In this architecture, courtyard is a central core, a space with an independent, central, internal and open geometric design. This space exhibits the existence all-reflecting mirror through reflecting the blue color of sky in itself [2].

Human being is considered to be a symbol of god, and everything is considered to be the symbol of another thing to him and is valuable. Human being lives on the ground, his shelter, and he is center of everything on the earth, because he is God’s symbol. Human has used his around environment which is a symbol f God for him, and has applied it in his architecture so that this nature may lead him to the God. Thinking about nature, its components and elements, and the rules and regulations governing the existence system, is one of the most issues that the Iranian culture relies on it. Thus, respecting the nature has deep roots in culture, and coordination of human being, architecture and nature is completely obvious in the traditional architecture. Iranian people were never willing to cut their relationship with the nature, and have always consid-
ered a special value for the nature. According to Zoroas "I believe in a religion in which people respect to the waters, plants and nature". Also, in the glorious Koran, it’s frequently referred to plant, light and nature components and they are considered as the heaven symbols. This fact results in the all-dimensional existence of nature in the traditional architecture. Semi-open-semi-close spaces are located next to each other in a hierarchical manner; in a way that it seems that they respect and protect the God’s blessings.

Existence of water and light elements in the central courtyard causes that Izadmehr and Anahita Goddess appear in terms of water and light respectively, and spaces frameworks of Iran may be the mixture site of these two Gods, and also they indicate time passage. Considering Koran verses, it can be concluded that the divine Heaven consists of four symbolic gardens with four springs from which four streams flow; they are symbols of the four world’s elements: water, soil, wind and light. Human being tries to build a heaven on the ground; therefore, architecture is not in conflict with the natural phenomena.

2 Research Methodology

This research is carried out through observation and studying the previous researches, and studies the role of nature elements (water, soil, wind and light) in the central courtyard of the houses in Iran warm and dry regions. To do this, some houses with central courtyard, garden hole water pool and wind tower were investigated, which meet physical and spiritual needs of their residents by applying water, wind and sun energy. Therefore the effect of natural elements, in the central courtyard of traditional houses, on providing mental and physical convenience conditions for the residents was clarified.

3 Finding and Discussion

Iranian people have considered a special value for the four elements since long time age; in a way that these elements were sometimes considered as a tribe’s symbol. Islam religion has a complete and comprehensive perspective towards all the above-mentioned issues, and considers the nature as a sign of God’s wisdom [2]. As God created human being on the earth as his power representative on the earth, the first sign of this power appeared in the first man-made buildings. In order to construct these buildings, human being used the most primary material that is water and soil; and in fact, two elements out of the four holy elements form the creating art on the ground. Wind and fire also contributed in completing this house and did the final works of the human’s shelter and dwelling.

In the following, we shall introduce the four main nature elements (water, soil, wind and light) and explain their characteristics and the role they play in the central courtyard.

3.1 Water

Water is the clearest symbol of life, and its plenty indicates the abundance of productivity and God’s blessing. Its because of the purity and clearness of water that it has been considered holy in the Iranians’ religious beliefs since long times ago, as in the (worship of sun), Zoroastrian and Islam religions it has been referred to its value and people are ordered not to waste it away. God has used different symbolic aspects of water for guiding and leading the human beings [3]. Desert has always implied the meaning of dryness and lack of water has been always considered as the main life-giving element in the architecture. Water appearance in Iran architecture can be studied in two pre-Islam and post-Islam periods. In the pre-Islam period, architecture used to approach towards water, relax next to it and notify its existence without having any negative effect on the nature. In these times water had a more abstract role. Some temples were formed next to water completely respectful to it. After Islam, architectures, knowing water physical regulations, behavior, and its role and relation with human being, brought water into the architecture, in a way that unity and centralization of architecture may be formed in the water.

3.1.1 Pool

Courtyard is an appropriate place for connection of human being and the nature elements including water. In cases that the current water of subterranean canal is not flowing deep under the ground, another pattern shall be appeared. This pattern is the pool at the center of the courtyard. Human being places pool in the middle of the houses; it is symbol of the Heaven on the earth. The still and stagnant water in this pool reflects the sky and it’s a place where the depths and beauties of the infinite sky are displayed on the ground. The still and resting water omits the boundary between the sky and ground. The reflective silence and the still gathering of water in these pools have ambiguous secrets, as a pensive and reflecting spirit has penetrated in them from the nature [4].
Most fountains and pools are located at a part of the courtyard where the existing constructions may be reflected inside them and in this way the dimensions may be doubled. In the case of traditional houses, pools were made proportional with the dimensions of the courtyard. Pools in the traditional houses had various shapes and forms; sometimes they were six-sided and sometimes twelve-sided, but most of the times they were rectangular. Pools were often constructed along one of the main axis of the house, in a way that the length of the pool is located along the length of the house [5].

Also these pools often had a low depth, so that they may be extended and their water surface may be increased. Reflecting a swelling and effective image from the main porch (veranda) and porch, pools often occupy the biggest central part of the courtyard. In some cases, pools divide the direct rout to the main porch (porch) of the construction into two indirect lateral and side routs, in a novel and respectful manner. In the warm climates, pools were often made in two sections and were located in the coming and going passage, so that the wind passing above the water of these pools may provide a cool and desired weather for the residents in the warm summer days. The sonic and aquatic properties of the water are other positive and effective aspects of pools. A fluid like water has the ability to reduce a remarkable amount of sonic energy in its fluctuations; and in fact the existence of water in the pool acts as a hidden barrier and blocking against the sound passing inside and outside the house. Water sound has been always desired for Iranian people. The magic power of water mostly presents itself through its view and sound. This is why often there are some fountains in the rectangular pools from which water falls naturally due to the water level difference, and presents a desired view and sound that brings happiness and joy. Water drops falling was always indicator of some angles playing with each other [2].

3.2 Soil

Human’s body, nature and mould are naturally from soil, and they shall return to soil. Architecture anatomy is raised out of soil and it shall return to it as well. This homogeneity results in the compatibility of soil architecture with human’s nature. Islamic city rises gradually out of soil and uses natural recourses as much as possible; but when it is empty and evacuated it would return to the spoil gradually.

All nature is indicator of the wise creator and the earth and skies have been created for human being according to this viewpoint. The earth is a place for remembering God’s power. It is a holy place on which the superior creatures, for whom the skies have been created, bows down. For this reason in the Islamic architecture ground and carpet are holy, but this sanctity is not because of neighbouring with human’s essence rather than soil.

After water, soil is the most important element in forming the personality of this architecture. Floor, wall, ceiling, far and close view and all architecture elements are made from the soil. Soil appears in the foundation in the shape of concrete, in walls and arcs in the shape of mud, mortar and stratum, in the courtyard wall in the shape of coating, cob and clay-and-straw mortar. Everything is a form of soil, as a component of the desert lands where there is nothing but soil, and in fact, different and various forms of soil. In fact, if water is the language grammar of this architecture, soil is its accent [6].

Traditional architecture mixes the soil with love, as the God created Human being. Traditional architecture learns philosophy from the Wise Architect and applies it in its task. Thus, the main materials used in the construction of the central courtyards of Iran houses are proper soil, mud, Adobe brick and brick that are proper for constructing thick and huge walls. These materials have high heat-strength and thermal-capacity, and they can attract sunlight through their outer surface. By attracting the sunlight, they prevent increasing the temperature in the inner spaces, and store this heat so that they can transfer it to the environment during the night when the environment temperature decreases.

Also, we may observe the usage soil in the garden pit. Garden pit used to be constructed in the center of the central courtyard and go down into the ground equal to one floor. In the garden pit the excavated soil was used for making Adobe brick and constructing the building. Also this pit used to provide the possibility of reaching the water of the subterranean canal.

3.3 Wind

Wind is the clearest symbol of the ether, a carrier for light, and indicator of heat and moisture properties. The air flow gives the things lightness, softness and ability to rise. Wind is warm but not dry and its wet quality gives it expansion and dissolution properties. Wind is the clearest symbol of air in the nature. This element is symbol of human being’s invocations of God, speeches and blessings. Plentiful shapes of roof spaces, wind towers and wind catchers are the constructive shapes that are related to the wind that is the air layer movement [7]. Wind is among those natural phenomena that thinking about it and the role it plays in continuing the nature and human life, can remind those principles and
values which are the requirements of a spiritual and meaningful life. The importance of air flow and movement in the residential spaces has been considered in the Islamic training, to that extent that limiting the air of the neighbour’s residential space by constructing a high building is considered as spoiling the neighbour’s right.

Wind, as the third fundamental concept, has imposed influence on this architecture deeply. In the desert lands, after water, wind shapes the soil. Natural air-condition and applying non-mechanical cooling have had a special place in Iranian architecture. Wind tower as an index of Iranian architecture has an undeniable worldwide fame in this case. The existence of this element is a sample of Iranian architect’s effort for utilizing natural gifts.

Wind towers are considered to be the breath system of the town that are mostly observed in the residential and old places. In his thesis, “Mohamadkarim Pirnia”, the architect and researcher from Yazd, considers the wind towers and wind catchers as "the lungs of a desert town". Wind towers are components of the Iranian architecture in the warm and human and warm and dry climates that can be seen in the Iranian architecture face in vertical element. These element lead a desired wind to the inner spaces of the construction through their vertical pores, and apply the stable energy of the environment by connecting the architecture to its around environment and entering a dynamic and environment-based flow into the construction.

3.3.1 Wind Tower Operation

Wind tower influences on creating natural cooling in two ways:
1- air movement and displacement
2- evaporative cooling

In an overall classification, air movement and displacement operation of the wind towers can be analyzed in two ways:
1- leading the wind into the building (when wind blows)
2- sending the inner air flow out of the building (when wind does not blow)

There are some pores on the top of the wind tower that are mostly made vertical to the prevalent windward. When the wind tower places in the wind direction, the pores that are in the direction of the wind are loaded by the positive pressure and the pore that are at the opposite of the wind direction are loaded by negative pressure.

Air-condition is effective only when the wind speed is more than 2.5 m/s. at night, in the result of air flow inside the wind tower, and the heat reflection of the outer surface of the wind tower to the sky, the wind tower mass is reduced and the wind tower becomes cool. During the day, when the outside air flows into the wind tower, the air cools, due to the heat exchange with the inner surfaces of the wind tower, and enters the neighbouring or the beneath building.

When the wind speed is not remarkable, the wind tower natural air-condition takes place according to the chimney (smoke venting) property. In this mood, whole of the wind tower acts as a chimney and when the wind does not flow, the air inside the construction is raised and transferred to the outside of the construction through the wind tower. In this way an air flow is created inside the building, although its intensity is less than the times when the wind flows outside the building.

In warm and dry regions, besides warm weather, dryness and low rate of moisture are among those factors that endanger the thermal convenience. Thus, the wind towers in these regions try to optimize the cooling operation by evaporative cooling. For this reason, they act like water-coolers to some extent. This wind tower operation is not efficient in Iran warm and humid climates.

The evaporation phenomenon takes place in the wind towers when the water surface is under the wind flow. As the water turn from liquid state to gas state, attracts a remarkable rate of heat from its around environment and in this way it helps to the environment cooling. Generally, in the evaporative cooling systems, water may be sprayed in the air. This kind of evaporative cooling can be observed in terms of some fountains in the pool inside the wind tower room.

Water exists beneath the wind tower in four forms:
1- Placing water pots beneath the wind tower.
2- Preparing and making a pool in the middle of the wind tower room.
3- Connecting the wind tower to the living room through a humid horizontal canal.

A rare sample of this kind of evaporative operation of wind tower was in Bam. The wind tower was located in a distance from the residential space and connected to the construction by a horizontal canal. This canal was under the courtyard and gardens. Thus it was always wet due to penetrating the water of the gardens and plants watering to it. The air flow entering the residential space from the wind tower was remarkably wet due to passing through this wet underground canal.

4- Connecting the wind tower with the underground water flow through a vertical canal [8].

3.4 Sunlight

Fire, by its ability of burning, softening and processing, creates coordination in all things. Light and
warmness are aspects of fire, and they are most important things for the architecture art. In Iran, a country with a severe sunlight, light had been always considered to be the most prominent aspect of the fire [7]. In most of the religions, light is symbol of divine wisdom and source of all purities and doing goods, and human’s exiting from darkness of ignorance and entering the knowledge light has been always a final goal. Although shadow and darkness indicate lack of light (this God’s great blessing), they are also among God’s signs, in a way that the existence of shadow and using it by animals, plants and human beings is not less important than light, since in the absence of shadow, there is no night and no trees and plants shadow; and no creature can be alive on the ground under permanent light. In addition, the creatures’ and objects’ shadow is the sign of their humility in front of the Single God; this is symbol of the creatures’ divine purity [3].

Light, the most non-material, perceptible element of the nature always exists in the Iranian architecture and in fact, it is the sign of the superior world and spiritual space. The traditional architecture observes the light greatly under influence of Islamic thought. Islamic architecture has a special focus on light, especially in Iran. In the desert, due to the sever sun shining and clear air of the high plateau, light-tolerance and need to live in the light-resistant places, have been the inseparable parts of Iranians’ lives along the time. Light is the main feature of Iran architecture that is not only a material element but also a symbol of God. Iranian architecture, knowing the importance of the light, tries to bring the light into the close spaces, so that it can lighten the spaces through reflecting the light in the water. As it can be understood from “Lecorbusier ‘s Speeches”: architecture is the objects’ wise, correct and magnificent play under the light. Traditional buildings have been shaped based on the natural sources of energy and are designed in a way that they provide maximum light in winter and maximum shadow in summer. In the Iranian houses, depth of skylight spaces differs in the different directions of the courtyard, and separating summer and winter rooms was playing an important role in coordinating the spaces with the residents’ needs during the different seasons of the year. Winter rooms are all spaces built in the northern side of the courtyard in order to use the winter light which shines into the rooms with a sloped angle. On the other hand, the summer rooms are built in the southern direction of the courtyard so that they can be safe from the direct sunlight shining in the summer [9].

4 Conclusion

The great concepts and symbolism roots are those things that have maintained the desert architecture stable up to this date. Perceptible and astonishing nature has been always the inspiring source for the traditional architects. The central courtyard of traditional houses in Iran warm and dry climate is a symbol of supplying the convenience and designing based on the climatic conditions.

Nature elements (water, wind, sun and soil) have been applied in this pattern in different manners by technology. This indicates the architects’ clear understanding of the environmental conditions. Using proper patterns and models in the field of designing (central courtyard) Iranian architects enjoy maximum privileges of the renewable sources and energies. Traditional houses have been built with a full consideration of all the climatic, cultural and social factors, and they have been designed with the aim of utilizing the pure energies and respecting the nature.

Today the designers are looking for different methods to reduce using the renewable sources and developing the natural environment in the residential complexes. One of these methods is modeling the traditional architects’ experiences for utilizing natural elements. Central courtyard can be introduced as a sign of sustainable architecture and as a proper pattern for this aim.

References: