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Secrets of Light in Traditional Houses of Iran

(Hot and Dry Climate)

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ABSTRACT: In addition to attention to natural light as a renewable, costless and environment-friendly source of energy in the late 20th century, numerous studies have been conducted into the effect of natural light on human being's soul and body and all such studies reiterate the undeniable role of natural lighting on people's behavior, attitudes, and efficiency. However, in spite of the awareness of the effects of natural light on human beings as well as on the environment, source of lighting in most buildings is still limited to artificial lighting and most of the solutions used in the old architecture with regard to the use of natural lighting have been forgotten nowadays. This paper, based upon a holistic approach and a qualitative research method analyses a few traditional houses in Hot and Dry climate of Iran and showed how their builders by using architectural elements as well as different methods of space organization so to better use light to satisfy the physical and psychological needs of the inhabitants, including visual and heat comfort, health, introducing variety and increasing space quality. As we will see, this research describes the methods they tried to create a balance between physical and psychological needs of the inhabitants and to supply the required energy.

Keywords: *Natural Light; Traditional houses; Physical Needs; Psychological Needs; Hot and Dry Climate.*

INTRODUCTION

Light is undoubtedly one of the most fundamental physical and psychological needs of humanity. Natural light and visual relationship with the outside in the living spaces of people such as places for work, leisure, entertainment, education and the like not only increases the efficiency but also decreases the tension, improves the behavior, and maintains and increases health and comfort (Poordeihimi and Haji Seyyed Javadi, 2008). In spite of the fact that based on different studies, no one could deny the effect of natural lighting on physical and psychological wellbeing of people, the ever increasing use of electric lighting that are easy, accessible, and controllable has led to the fact that many architects and designers have all forgotten about the role and effect of natural light in the building and have ignored the potentials of natural light in enhancing the quality of architecture. The decrease in the use of natural light in buildings not only increase the costs related to consumption of energy but will also affect the health, comfort and efficiency of people.

MATERIALS AND METHODS

Iranian architecture has used certain methods in using the nature and particularly the natural light. Studies have revealed that in historical houses, natural light was not just used for the sake of providing the lighting, but it played a significant role in providing comfort, transferring symbolic concepts, creating variety and beauty, and enhancing the quality of the space. Those who designed such buildings attempted to minimize environmental destruction while maximizing the use of natural lighting. This study aims to investigate the effect of natural lighting in people's lives under the two categories of physical effects and psychological ones and to introduce the solutions applied for efficient use of natural light in historical houses in the hot and dry climate of Iran.

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RESULTS AND DISCUSSION

Sources of Providing Natural Light

Yard: The most important source of providing light in the traditional houses in the hot and dry climate of Iran is the yard. Due to the climate condition and because of valuing privacy, which is indeed one of the principles of Islam, different parts of a building were organized around one or a number of yards. There was no window to outside and the light of all rooms was provided from the yard. In most of these houses, there was more than one yard. One yard was allocated to the public area and the others were allocated to the private area or such spaces as kitchen and bathrooms (Fig.1). The light of spaces around the yard was provided

through the windows in the vertical walls. Based on the amount of light and type of required light as well as the significance of the space, these windows had different shapes such as door-window, Orosi, shebak (Fig. 2).

Ceiling: In the historical houses, ceiling reminds of the concept of sky. In the closes spaces and where it is not possible to get light from the yard, ceiling is a place for getting light and to condition the air. Getting light from the ceiling was used in different places such as Talaar (living room), kitchen, Hashti (vestibule), and was in different shapes, based on the need for light, type of activity as well as structural or aesthetic reasons. In roof-lights, there is a view towards the sky and the possibility of getting light from sunrise to sunset. In addition, there was no risk to the privacy, an important issue in the Iranian culture (Fig 3). Light and Comfort: Hot and dry climate of summer and cold and dry climate of winter, rare raining, winds filled with dust, and difference of temperature during the day and night which is caused by little moist and distance from the sea are among the features of the hot and dry climate of a major part of Iran. Despite the abovementioned climatic problems, traditional architecture has found logical and desirable solutions for settlement of people since thousands of years ago (Ghobadian, 2003). In order to battle the tough cold weather in winter and the hot weather in summer, the rooms around the central yard that are towards the North and thus get the sunlight in winter and are consequently warmer are used in winter. Most daily activities were done in this part

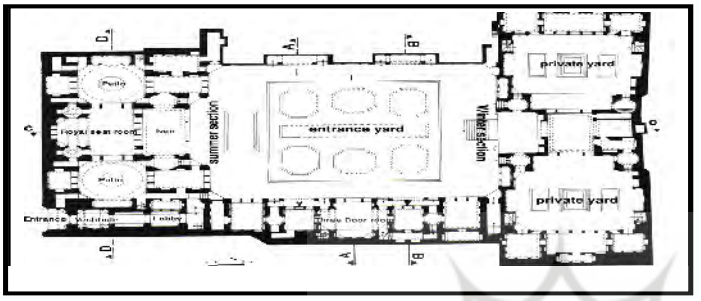

Fig. 1: Public and Private yard in Tabatabayi house, Kashan, Iran.

Fig. 2: Shebak in basement and Door-Windows in first and second floor.

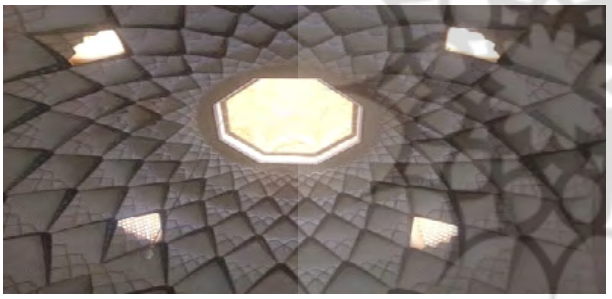

Fig. 3: Roof lights

Fig. 4: Tabeshbands are 6-15 cm walls that decrease the sunshine by providing shadow

of the house in winter. In summer, it was the opposite side and the room on the south of the yard, which were in the shadow and wre cooler, were used by the inhabitants of the house (Ibid). Furthermore, the sunshine angle is influentia in size determination of several elements in traditional houses, for example the depth of Sedari (3- doors) and Panjdari (5- doors) rooms and their window's height and width were designed in a way that light could penetrate the interior space as much as it was needed (Ahani, 2011). Providing shdow was one of the very important concerns of architects. It can be stated that approximately in all parts of the building except for the southern part which is used in the winter; different strategies were used for providing shadows. The projected and hollow volumes, roof parapets, Ivans (veranda) and small arches, the openings in the depth of pillars (Tabeshband), Shebaks and even decorated plaster moldings which provide light shadows in the building façade (Fig. 4 and 5). The main shadow casting part of the building is the big covered Ivan which is located in the southern part of the building and used to host the guests in the summer. In addition to the measures taken to provide shadows, colorful glasses used in Orosi eased visual and thermal conditions particularly in summer when the sunlight is too bright (Fig. 13). The beautiful combination of colorful glasses used in the windows protected the privacy of rooms, added to their beauty, controlled the light entered, and prevented the insects from entering the house (Omranipoor, 2005). Light and physical Health:Without question, a causal relationship exists between the indoor environment and human health. Daylight or the lack thereof, affects in no small way the psychological and physiological health of building occupants and their overall well-being. The lack of sunlight can even

prove toxic because it leads to a deficiency of vitamin D in our bodies. Vitamin D is vital to our lives and is the first defense against such ailments as cancer, osteoporosis, diabetes, multiple sclerosis, and other immune system diseases (Boubekri, 2008).

Today, increased urbanization in modern cities has led to compact cities and houses with small yards and tall walls that eclipse open spaces, limiting the access to sunlight and eroding the immediate connection between ourselves and the natural environment. Buildings should be designed to maximize our exposure to sunlight in order to facilitate the cutaneous photosynthesis that supplies most or all of our vitamin D needs (Boubekri, 2008). Use of sunlight to the most has been realized in traditional houses through creation of different covered and open spaces that are exposed to sunlight and through making it possible to carry out the daily activities in such spaces. In most traditional houses in the hot and dry climate of Iran, there are a number of open spaces in addition to the yard. The open spaces in these houses begin with the yard and are formed at different levels towards the sky. A bit higher than the yard, it is the Sofeh or Bahaarkhab, a bit higher is Sharemi that is the way to access the rooms in higher spaces, and a bit higher is Mahtabi, and the roof is on the top (Fig.6 and 7) (Haeri,2009). These spaces were either used in spring and summer for sleeping. Sometimes the door-windows were left open during the day and whatever was to be done inside the rooms was moved to these open spaces so to enjoy the light, the view, and the nature. Therefore, variety open spaces existed in these houses that had exposure to sunlight.

In these houses, yard is not only a connecting space, but it should be considered a room, without a ceiling in which different activities such as eating, sitting on the ground or by the small pools, and even sleeping was provided through the use of wooden sitting places and the like. In most houses, the direction of the yard and the ratio of walls of the yard to its width and length provide a situation in which even when the sun is in its lowest position, some part of the yard is always exposed to the sunlight and is not in the shadow. In some houses, such as Abasian House in Kashan, which has a small yard with high walls, the building in the upper levels is set back and this has provided a bigger open space for the house and thus better exposure to the sun (Fig. 8). To these open spaces, different types of covered spaces such as Ivan were added in which the inhabitants of the house could sit under the shadow and enjoy the sunlight at the same time.

Psychological Effects

Light and Psychological Health

Because we are dependent on light for perception, it is natural that we should be psychologically affected by it (Boubekri, 2008). Environmental psychologists and behaviorists assert that even in less dramatic luminous conditions, small changes in lighting can alter the mood and the emotional state of the building occupants (Flynn, 1977).Whatever the explanation, the fact remains that most people prefer natural lighting and feel better under day lit conditions than under artificial lighting (Boubekri, 2008). As it was stated before, in traditional Iranian houses there are a wide range of open and covered spaces in which it is

Fig. 5: The projected and hollow volumes and decorated plaster moldings to provide shadow

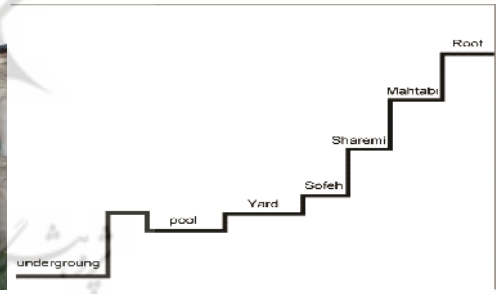

Fig. 6: Diagram of Open spaces of different levels in traditional houses (source:Haeri, 2009)

Fig.7: Sofeh (right), Mahtabi (left), open spaces in different levels.

possible to do the daily routines and to enjoy the daylight to the most.

Moreover windows connect those who are confined indoors with the outdoors and allow them to feel closer to nature. The idea that people prefer to live and work in buildings that have windows is generally well accepted and widely documented. On average, major health complaints were between 20% and 25% lower for persons close to an exterior window compared with those who worked in the interior core, without access to view and daylight (Ibid).

In these houses, the windows are usually opened to the yard. The ground of the yards is filled and decorated with trees, soil and water. There is a small pool, filled with water that has a size and form that suit the yard and it is usually placed at the center. There are usually four gardens located around the pool symmetrically and are filled with bushes, flowers, trees, and vegetables, providing the required moist, greenness and beauty of the yard in different seasons. Looking at these plants is possible through all the windows that are opened to the yard (Haeri, 2009). In the rooms that do not have direct view towards the yard, the door or the windows are located so that they provide a view towards the yard through another space (Fig. 9).

Fig. 8: The building in the second floor is set back to provide better access to the sun. Abasian House, Kashan, Iran.

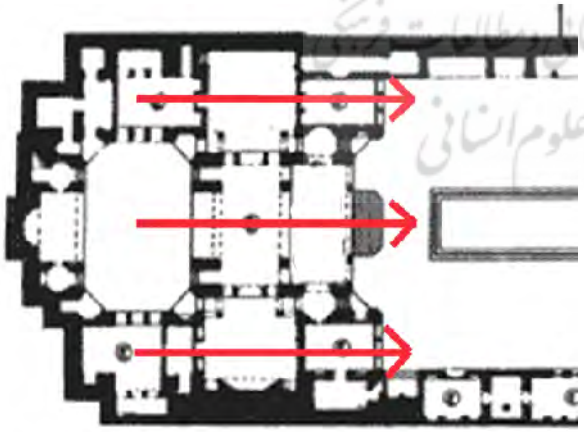

Fig. 9: View towards the yard through another space for rooms without direct views.

Variety: Perhaps the most obvious and certainly the most important aspect of day lighting is its capacity for change, leading to the infinite variety in appearance of the day lit interior. Change is at the heart of day lighting, the human body has a capacity for adaptation, particularly in vision, and the need to exercise this response (Phillips, 2004).

Variety in the Amount of Light: The existence of dark, semi-dark and bright spaces in the historical houses has resulted in having spaces with different qualities. The three types of open, covered and closed spaces and the different of form, location, type of lighting as well as the amount each space is restricted are among the factors that affect the existence of spaces with different lighting.

For instance, the lighting of Hashti and Daloon (A corridor) is different from that of the yard. Hashti is the first space after passing the portal and it is dimmer than the passage and its lighting is provided through roof lights. After entering the Hashti, one could enter the yard through the Daloon. Daloon is a semi-dark space to which no door is opened. When passing through the Daloon, it gets lighter gradually until one enters the light space of the yard (Haeri, 2009). This change from darkness to lightning doubles the excitement attached to entering a new space and emphasizes the special variety (Fig.10).

Among the open spaces, the yard is the most light and it is indeed the lightest part of the house. The other open spaces enjoy greater shadow due to the smaller size and due to being adjacent to the walls of the house. The internal side of the yard is not just a smooth surface. The four sides of this yard have been designed with rooms, semi-light spaces such as Ravagh, Ivan, walls with arches and platforms. The empty and full spaces on the walls provide beautiful shadows and lights and thus the change of the angle of sunlight leads to the movement and changes in the shadows created on the walls, adding to special variety (Fig. 11). Variety can also be seen in the lighting of closed spaces. Examining the courtyard pattern houses reveals that there are three detectable layers of closed space located around the main

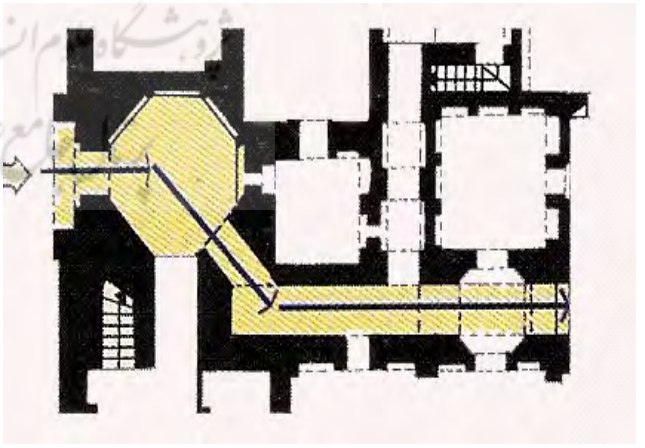

Fig. 10: Hashti and Daloon (source: Haeri, 2009)

core of light – courtyard – according to the importance of their access to the sun light; The first layer which is just adjacent to the courtyard and includes spaces like Sedari (bedrooms), Panjdari (guest room), Talaar (living room) (Vaafi, 2002). One side of these rooms that are mainly part of the public area of the house and are used for entertainment of the guests, holding religious celebrations, or getting together of family members, was designed to get the lighting from the yard and are thus lighter than the other rooms in the house. The second layer containing some spaces of minor importance (Ibid).These rooms are mainly part of the private area of the house and such activities as resting, sleeping and studying took place in these rooms. These spaces usually received their lighting indirectly through other rooms. In comparison to other rooms such as Panjdari and Talaar, these rooms had less light and view, thus providing more privacy.The third layer which consists of servant spaces like kitchen, water storage, food storage, entrance (Ibid).

It is noticeable that sometimes in small houses, the second and the third layer were merged into one and due to the lack of accessibility to the courtyard these spaces either have a separate exclusive yard of their own or could get their lighting and conditioning through the ceiling and the windows put on the top of the walls (Fig. 12). Variety in the Shape of Entered Light: The way light enters internal spaces leads to creation of various special experiences. Windows, Door-windows, Orosi , Shebak determined the way light could enter the space and the views could be seen through their various forms. The design and the colorful glass of Orosi, the geometry of Shebak as well as the various forms in the openings creates variety in the shape of the light that enter the room (Fig. 13). The lower surfaces of the windows and Door-windows are mainly covered with wooden plates and only the upper surfaces are transparent. This changes the amount and the shape of the light that was entering the room when the door-windows were open or closed. Roof lights had also different shapes and were places in different heights to create a wide range of light and shadow. They implied a movement upwards and thus eyes experience different degrees of lighting and darkness when looking from the floor to the ceiling.

The Effect of Lighting in Spatial Quality

Use of lightning sources and the views revolutionize the spatial quality. Color, amount and direction of light, the form of openings and their location are among the factors that affect the spatial quality. For instance, one of the most beautiful architectural elements which were designed based upon aesthetical aspect of light are Ororsis, latticed windows with colorful pieces of glass which creates a spiritual atmosphere by producing attractive light effects inside buildings (Pirnia, 2006). Light beams penetrating the interior space through Orosi windows often create remarkable patterns on the wall or the floor which looks like an artistic painting or a precious carpet (Afshar Naderi, 2003) (Fig. 14). Roof lights are another examples that often make attractive effects, resulted by light reflection from folded shape surfaces of the sophisticated ornament around them and establish a new order in building geometry which emphasizes its visual axes (Ahani, 2011). The change of light and shadow on the building, walls and the ground creates an active texture that not only has a unique beauty but also revives and enriches the space. Light could intensify such qualities as balance, symmetry and centrality and eventually create order in the space. The geometry used in the lattice surfaces of the Orosis, the odd number of windows that are usually 3, 5 or 7 ones (even the odd number of divisions in the Orosis) that emphasized the spatial axis and light wells in the center of a domed space roof and intensifies the centrality of the room are indeed among the tools used for creating spatial order. One of the other significant effects of light on the space is expanding it. Using the view and lighting, a space could give the impression of being bigger. In these houses the location of doors and windows inside the walls was designed in a way that based on the spatial position in the spatial organization of the house, it could provide the possibility of combining one space with the adjacent one(s). In the rooms that are located around the yard, one side of the room is kept for lighting expansion and for having a view of the yard. However, e location of the doors and windows in the rooms that are not directly connected to the yard is in a way that lighting and satial expansion and view is provided through the rooms that are directly connected to the yard. Therefore, even the rooms that are not directly connected to the yard can use its lighting and the view. In Iranian architecture, the light metaphor engenders metaphysical connotations, where the Devine is always omnipresent. Light is always a virtue of the sky, of heaven, of truth, of realization, even if brightness is sometimes hidden by shade or darkness (Ayvazian, 2004).

Fig. 11: Light and shadow in the walls of yard

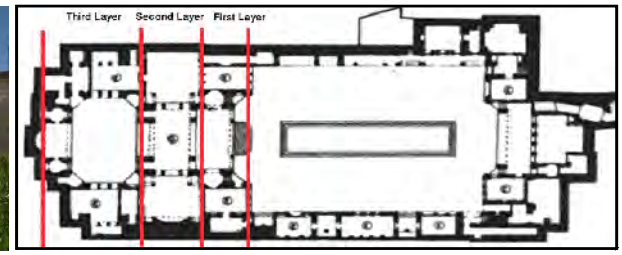

Fig. 12: Layers of closed space

Fig. 13: Different forms in the openings create variety in the shape of entered light

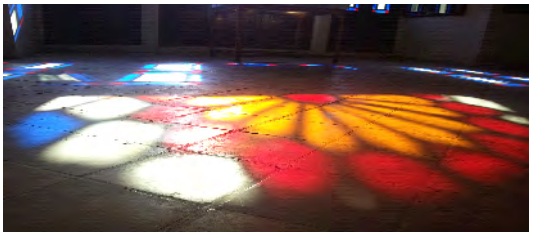

Fig14. Light beams Penetrating through Oorosi create remarkable patterns on the floor

Iranian architects used different symbolic elements in order to make the space a spiritual one by using light. The entrance of light through colorful lattice glasses or through ceiling openings and the reflection on the geometric forms made of brick, mirror, Stalactite creates a spiritual space that reminds one of the presence of God.

CONCLUSION

Some of the applied strategies in the traditional houses of the hot and dry climate of Iran that have been investigated in this writing include: Reduction of consumption of energy with regard to proper direction of the building and the possibility of movements in summer and winter so to use sunlight more effectively during winter and avoiding the extra light in summer. Lighting the house from inside, i.e. through the central yard due to climactic factors and the significance of privacy. Desiging the openings with proper dimensions so to supply the rquired lighting, heat, and natural conditioning of internal spaces. Creating variety open and closed spaces that were under the eposure of sunlight in the building and providing the condition for doing the daily routines in these spaces so to aximize the use of sun and to guarantee physical and psychological health. Providing proper views through the use of windows and openings in order to provide the possibility of taking part in theactivities that are simultaneously taking place outside the roos and thus enhancing psychological health of the people. Providing proper conditions for observing and experiencing th natural variety of light and emphasizing this variety through rchitectural elements as arches, Ivans along with the variety in the amount of light and its form when enters the internal space. Changing and enhancing the spatial quality through creating beauty, order and dynamism by the use of light.-Eventually, using light as a symbolic element to create a spiritual space at the service of religious concepts.Studying light in the traditional houses in the hot and dry climate of Iran indicates that use of natural light was not limited to its technical aspects but it was always used as a factor contributing the creation of a better and healthier environment. The strategies used in these buildings, although very common at the time, have been forgotten nowadays due to the advances in technology and the reliance on it. Emphasis on physical and psychological impacts of light and the combination of thought and the techniques used in traditional buildings and today's technology leads to new understanding among planners and architects of the necessity to work in harmony with nature and to take maximum advantage of daylight as the source of life and wellbeing.

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