

DOI: 10.7596/taksad.v5i4.621

Consideration of Climate Impact on Used Colors in Residential Architecture of Humid and Hot Regions

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Abstract

Consideration of architecture in humid and hot climate shows a beautiful and efficient intelligence in the back of architecture body. Fine arts would be considered from different perspectives in the issue of their color choice. Consideration of climate impact on used colors in residential architecture of humid and hot regions is the purpose of this writing. Descriptive approaches are used to understand theoretical history of the investigated subject in traditional architecture by applying objective observations. In addition, reasons of color choice on residential buildings in humid and hot environments are elaborated. While each color values next to other colors, companionship of different colors creates beautiful colorful contrast in little area with relative wide cob materials (middle brown). In addition, pacifying colors also are another reason for this mater. The results suggest that the beauty concept has the most important impact on traditional settlements of humid and hot regions.

Keywords: Climate impact, color, humid and hot regions, residential architecture, color choice.

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Introduction

Vernacular architecture that is formed based on climate of any region has widespread aspects which can be studied in different contexts. Also, we can consider new body for it according to past patterns. Architecture of any city is different based on beliefs, culture, tradition, climate and industry of that environment. These differences separate architectural traditions. Each architectural effect consists of two elements: Form and color that need each other. Color is very important because of variety and mental impacts. Imagination of the world is impossible without colors, which enliven life.

Architecture, in the humid and hot climates, has unique features like it would have in other climates in Iran. Maybe in first confrontation with this architecture, it is observed as creating maximum space for traditional life but by deeper thinking, we can observe existence of beautiful and efficient collective intelligence behind architecture body as any matter (like outer and inner colors) are considered from several angles and the best choice is selected.

Although color topic is considered widely in architecture and there are many articles about colors in books and papers and details are explored, but lack of colors in their vernacular environment and relation are felt so much. For this reason, I try to consider climate impact on used colors in residential architecture in humid and hot regions.

For this research, I employ a descriptive-analytical approach. By doing this, I aim to understand theoretical history of subject and achieve analysis of collected data. In addition, applied approaches in traditional architecture are considered by using objective observations. Finally, for residential buildings, approaches and policies for using compatible colors in environment where the climate is humid and hot are elaborated.

Color Concept

Color is existed everywhere and our environs are full of colors. Color is only material which is comprehensible. Color vitalizes life. All objective perceptions are performed by colors, and colors give admirable beauty to nature. In dictionary, color is the quality which is seen from appearance of something like white, red, green etc. (Moein, 2007:167). Itten summarizes color in three following notes: 1-objective and sensory 2-explanatory 3-structural. According to him, human accepts color phenomenon like sun and knows that s/he encounters with it in every phase of life. Despite this incuriosity against colors, we can perceive color beauty sense.

Color is widespread and complicated matter which includes visual and mental effects. Therefore, it plays an important role. In designing and painting of old portraits and using architecture effects, colored materials have played beneficial roles. Paintings inside of caves

and initial effects of architecture have astonished people with their colorful materials. Colored materials were existed in art of ancient Egypt, Mesopotamia, Sassanid art and Byzantine (Elliot and Maier, 2014). Also, in India and medieval Europe, colors were used on religious paintings according to their concepts and meanings (Halimi, 2013). There is lack of academic interest on the relationship between meaning and function of colors and climate. This paper would be a humble contribution to this specific area.

Climate and Its Features in Iran

Iran has different weather conditions in its regions. In urban regions, weather is variable as cold in west and north-west, humid and hot in south, and arid in center of state. Each of these climate areas needs a kind of housing designing to provide acceptable level of convenience and energy saving. Although climatic methods are different for providing convenience in different climates, their radiation energy absorption in cold seasons and prevention from sun radiation in hot seasons are common in all of them. During summer time, the amount of energy absorption and surface temperature increase; therefore, necessary cooling energy increases.

Form and shape of yard and its way of application are one of features that can be used due to the climate as proper editor for optimum function of yard under high different climatic conditions in initial phases of designing (Muhaisen, 2006).

Different climatic factors and their amount of difference that is due to the geographical difference of different regions create different climatic areas in the world and Iran and they have special features. Principally, in many regions of the world, climate is determined by latitude and sea level. Iran is in hot regions because of locating in 25 and 40 degrees of north longitude and it is high plateau that total of its surfaces which their sea levels are lower than 475 meters formed little percentage of state (Kasmaei, 2010). About climatic divisions, Iranian scientists have worked based on Koppen method. Therefore, Iran fourfold climatic divisions can be used which are suggested by Dr. Hasan Ganji. He divides Iran to four following climates based on Koppen classification by little changing and due to the geographical complications of state:

1. Humid and mild climate (southern beaches of Caspian Sea)
2. Humid and hot climate (Iran southern beaches)
3. Cold climate (western mountains)
4. Arid climate (central plateau)

Humid and Hot Climate

In this climate, buildings have central yard and they are middle introverted. Rooms are located around central yard. General difference of these central yard buildings with similar cases in central plateau of Iran is that although these buildings are middle introverted, their relationship with outer space is not totally closed, large and elevated windows and wide porches located to alley and/or they have field in second floors and particularly in third floors. Porch in this region is larger than other regions and very important space in the building. In hot seasons which continued half of year, most of routine activities performed in the porch because proper ventilation occurred in the porch and it is under shadow. Often, around central yard and in one or two sides out of building, there are elevated and wide porches.



Figure 1: residential home in humid and hot climate

Main feature of this climate includes hot summers and mild winters, high temperature and humidity in all season of the year, intense radiation of sun light, low and irregular raining, invisible changes of day and night temperature, winds with average speed and many periods with stable air flow without motion. Because of scarcity of raining and lack of raining about six months of the year, ground surface is arid and reflects sun radiation easily, as a result, temperature increases and convenience region will be interrupted (Zomorshidi, 2005). Also, high level of underground water exists.

Generally, architecture elements and formation of cities are compatible with climatic conditions and they are created in coordination with environment and nature force. Also, they have proper environmental conditions. High amount of temperature and humidity of region, particularly in the summer, are the formatting factors of old texture, integration of residential units and narrow, thin and winding alleys. Urban space located to mainland to use sea breeze and conversely, along beach axis for having suitable view and perspective. It is also located

half densely. Organization of empty and full spaces in scale of architecture units and urban texture, type of separation of public and private sections, certain spatial sequence, attention to cultural and social conditions, and adaptation with climate and environmental conditions create considerable and special physical architecture and view of Iranian city in this region. They evolve considerably during years by collecting experiences of different generations that today, we can use them properly for new spaces and needs (Afshari, 2012).

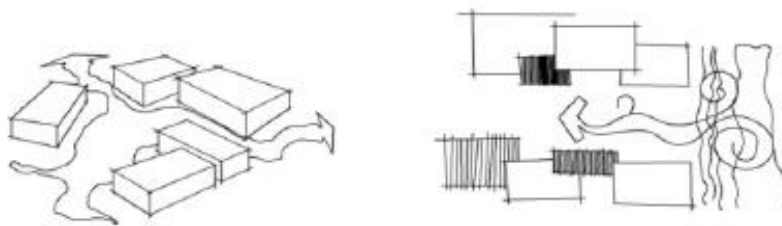


Figure 2: alleys and pavements parallel to beach breeze (right), using dense and half dense texture to remove humidity (left)

Generally, the characteristics that can be mentioned are opening and spread of plan, disusing basement, existence of closed spaces, open and half open, using domestic building materials like stone, cement and plaster, disusing basement because of coral stones of ground and high level of underground water, using bright colors in facing, using porch, creating stage for prevention from humidity influence, existence of central yard as floor of the yard is lower than home floor and building orientation is in a way that it has minimum radiation and maximum ventilation.

Climatic Designing

Three components of climatic view are human, shelter and natural environment. To understand and perceive physical relationship of human with shelter and his environment, biology science is employed and to perceive weather of natural environment, meteorology science is used. Any of weather elements such as wind, sun radiation, humidity and temperature are measured by experts of meteorology with special tools. Then, they are given to experts (PourDahimi, 2010).

Weather condition is variable in Iran, from cold air in west and north-west to humid and hot in south and arid in center of the state. Each of these climatic arenas needs a kind of housing designing that provides acceptable level of convenience and energy saving.

Residential complex with higher density has advantages and disadvantages for climatic designing in comparison with complexes with lower density. Their advantage is compact volume and lower external surfaces against thermal exchange. Also, because of existence of mutual surfaces among units, thermal insulation is done easier. However, against this advantages, by increasing compactness, flexibility reduced in establishment and orientation of residential units to achieve proper light and natural ventilation and probability of locating building under shadow increased. Particularly, this matter occurred in complexes that have unconventional topography, orientation and ground dimensions. Whatever compactness increased and private open areas reduced, climatic designing of residential units is emphasized further (Alizadeh et al. 2014).

Climatic thought that architect puts ahead in view to artifact environment, will be condition and features of route weather, its effect on natural environment and human-made things and observing architectural responses which is compatible with these climatic conditions. He seeks for relationship among weather condition and its formatting elements with architecture components. He has climatic interpretation from each architecture component like materials, structure, space, color, urban texture etc. (Einifar, 2003).

In climatic architecture, many cases are considered for designing residential buildings that most important of them are:

1. type of materials 2-buildings plan 3-urban texture 4-type of coverage 5-surfaces color 6-number of windows 7-yard (FallahFar, 2010).

Consideration of Color in Humid and Hot Climate

Generally, external color of walls of building affects the amount of absorbed heat in wall and heat condition of internal air of building. When the color of external wall dark, it is warmed considerably rather than around air and its internal surface also is heated. In this condition, increase of thermal resistance of wall reduces thermal influence. As a result, thermal degree of internal air of building is hold down. When external surface of building walls is white, particularly in regions which domain of change of temperature is low, thermal resistance of walls has different effect in comparison with previous effect (Karami et al. 2012).

In such conditions, because of proximity of around temperature, thermal pass from holes of external walls of the building is little. As a result, thermal resistance of walls and roof of building would not have considerable effect on its internal air. In this condition, further

thermal resistance caused increase of minimum daily temperature of internal air than reducing maximum temperature of it. Generally, in hot regions and natural conditions namely when internal air of building is controlled without using mechanical tools, there is desirable limit for thermal resistance of walls and roofs that its amount can be determined by considering external color of walls and condition of natural ventilation. Increase of thermal resistance more than mentioned limit would not have considerable effect on controlling and adjusting heat condition of internal air of building (Lenzhonzer et al. 2013).

Color of Casements

Casements play important role in humid and hot climate. They have formed of two parts: moving and constant sections. Constant section usually emerges as semicircle, sometimes rectangle or combination of them. This section is covered by colorful windows and various models of combination of wood and glass. Moving part of casements is created as pair or two pairs and the kind of casement is different due to the used space and way of relation of space with outer space.

In this climate, direct radiation of sun light increases temperature and interferes residents' convenience. Also, because of ground dryness, reflection of light by ground increases temperature of the region. Of actions which are employed by vernacular architecture to reduce this matter are use of central yard with low length and width and high height of wall for providing more shadow during a day, orientation of buildings back to sun, thin alleys with large buildings with shadow in a day, tallness of windows vertically, existence of wooden shutters, Mashrabiyas, porches and sunny to prevent from influence of sun light into building, use of colorful glasses with wooden frame and illuminating view of the building (Memarian et al. 2014).



Figure 3: colorful glasses in residential building in Bushehr

As it is shown in figure 3, window surfaces, absorbent and doors were divided to small surfaces in order to light entered into the space indirectly and desirably. Use of colorful glasses caused refraction and entrance of desirable light to space.

Color of internal and external surfaces

The amount of absorbed solar energy depends on color of external surfaces of its walls. White and shiny surfaces absorbed almost 15 percent of solar energy. Usual bright colors like chrome or bright gray absorbed 40 to 50 percent, dark color like dark gray, green or red almost 60 to 70 percent and black color 80 to 90 percent of received solar energy.

The amount of solar energy which is permeated into the building from glasses or surfaces with glass depends on type of shading and a bit to type of the glass. Dark external shadings only direct sun lights into building which are radiated to window. But internal shadings (venetian blinds) direct 40-70 percent of sun lights into building. In the case of disuse of shading, about 90 percent of sun lights permeated into the building (Kasmaei, 2010).

The relationship among temperature and air and internal and external surfaces of building depends on color of external walls, type of used materials for dimensions of windows and quality of shadings. Amplitude of internal air can be reduced. In the case of using party walls with low thermal and capacity resistance and dark color of external surface or use of large windows without shading, temperature of internal air will be more than external temperature that this matter is considered properly in climatic architecture of humid and hot regions of Iran.



Figure 4: using mild brown colors (cob) in one of traditional homes of Bushehr and traditional texture of this city

By accepting considerable role of geographical factors and climate in formation of unconscious mind and its indirect effect on aesthetic, beauty has the most important impact for traditional settlements of humid and hot regions. Since any color is shown in adjacent of other colors, association of different colors in low area with relative wide surface (mild brown) created beautiful colorful contrast. In addition, relaxing of colors also increase the matter.

Conclusion

Colors have qualities that should be used deliberately with attention to other space qualities and local features. We cannot present approaches and regulations about them by only general recognition and observe increase of quality of residential homes. Exact recognition of climatic conditions, native features of place and local identity facilitate this matter. The subject that should be considered is this sensitive matter that in any place, there are proper samples about colored qualities that can be used as pattern for new designing.

Therefore, by correct use of native materials and combination of them with new conditions of construction and using experience of efficient experts in the field of applying proper colors, we can recover and develop architecture consistent with people culture and region climate because to create original and dressy future, attention to valuable bed and past is very important. Using proper colors with culture and climate can provide vitality, identity, environmental quality, increase of satisfaction level etc. which are existed in traditional residential architecture of these regions.

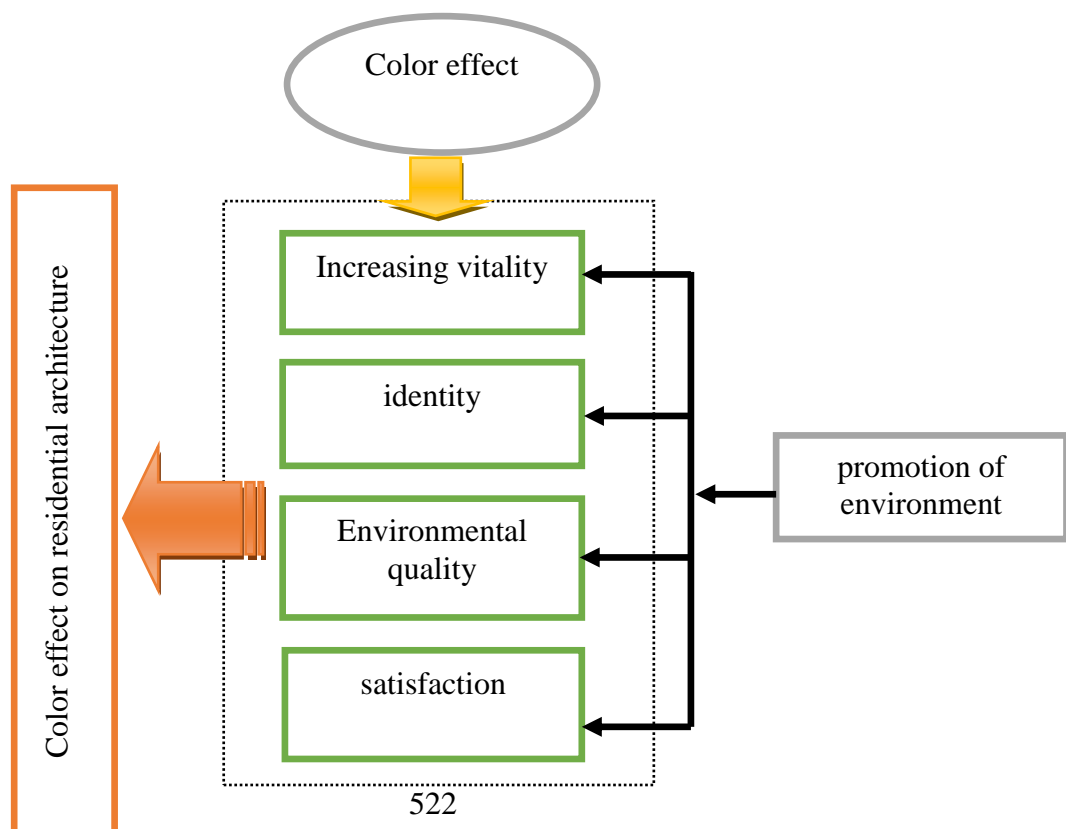


Diagram 1: effect of proper using of color in humid and hot climate on inhabitants of residential homes

Colors can affect the life by different ways that most important of them is their effect on feelings. The world which is human live on it consists of thousands of different colors and tonality that show object and animals to us attractively even deeper mentally. Each one is considered as important source of energy to improve health and vital of soul in humans. To achieve goals like proper function, visual beauty, space harmony and positive and effective environmental and mental effects on internal designing, we need beautiful, meaningful, coherent and coordination use of designing elements. In a desirable plan, all elements and components have close relationship in their relative qualitative and semantic effects on space.

Using materials which can satisfy colorful and mentioned texture characteristics is very important. Also, it has power of influence on physical changes of space. Actions which are performed to adjusting and dividing of colorful walls can be considered as an idea for determination of physical body of space and bring functional aspects of designing with aesthetic criteria which is coordinated with climatic architecture.

Therefore, following approaches are suggested for application in contemporary residential architecture

Table1: suggested purposes and strategies

strategy	purpose
Using happy and energetic colors in walls of residential homes	Increase of vitality by proper using of color
Showing historical and cultural identity and personality by using proportional colors and integrated planning	Increase of space identity by proper using of color
Promotion of vegetation level and greenbelts by using colorful plants and traditional used colors in historical memory of inhabitants	Increase of environmental quality by emphasizing on color
Promotion of quality of environment by using color in natural and artificial elements and using traditional architecture elements and enough attention to climate	Increase of satisfaction level of citizens by emphasizing on application of color in space

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