



# Classification of climatic strategies, used in Iranian vernacular residences based on spatial constituent elements



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## ARTICLE INFO

### Article history:

Received 18 January 2015

Received in revised form

5 May 2015

Accepted 6 May 2015

Available online 22 May 2015

### Keywords:

Climatic strategies

Vernacular residence

Hot-dry (arid) region

Classification

Air temperature levels

## ABSTRACT

In spite of worldwide climate change and problems caused by fossil fuel use, energy consumption levels in Iran and all over the world, while already high, keep up to rise each year. Iran's hot and cold climatic regions are vast, and significant amount of energy is consumed in these areas for heating, cooling, and ventilation. However, with the same climatic conditions in the past, multiple effective strategies had been used in vernacular residences to confront the harsh circumstances. These strategies have a high potential for getting reused and revived in a way that the fossil energy used in contemporary architecture is minimized. Although lots of strategies taken from the past such as wind towers have been reused in most sustainable structures, and most of them have been perfectly studied one by one, but the relationship between these strategies in different levels of the space working together to make a comfortable environment has not been perceived precisely. This paper aims to classify almost all climatic strategies into different levels of space which has been separated based on air temperature difference, such as roof level, wall level, ground and under ground level, and plan strategies together, so that they could be seen all in one pattern in different levels of the space. The final pattern of strategies relationship with true emplacement, as the conclusion of analyzing mentioned levels in three case studies in this paper, could give environment designers more awareness to utilize climatic strategies in more appropriate way in contemporary architecture.

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## 1. Introduction

Various natural and built-up elements such as topography, altitude, water bodies, land cover and constructed surroundings modify the characteristics of a macroclimate and change it to a microclimate. The microclimate of the area in which building is constructed affects the indoor climate of a closed or architectural space. Climate and environmental conditions are highly important parameters in a building design. Buildings are designed to achieve or to create a suitable atmosphere for human comfort [1]. They provide essential protection against the outdoor climate. Furthermore, they create an artificial indoor climate based on the given microclimate of the surrounding. Architectural elements forming the thermal envelope such as walls, windows, roofs, and floors

separate the microclimate and indoor climate and thus influence the indoor climate significantly [2].

Unfortunately today's architecture particularly in Iran pays less attention to the climate of the context. What can be seen today is affected by popular trends, fashion, imposed tastes and people's desire.

Every environmental designer or landscape architect has specific thinking process in his/her design and environmental patterns (ecological, physical and cultural) among which holistic and effective factors are the most important [3]. And there are a variety of architectural rootless styles. Alexander asks in "The Timeless Way of Building": How can designers design without connecting to the design context and environment [4]?

However the ancestors in the Middle East area erected sophisticated buildings, while their main concerns were the thermal, social and functional performance of their designs. Generally speaking, these builders are integrated to their physical environment and their designs and constructions were based much more on the performances rather than decorations [5]. Such

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architecture is known as vernacular architecture. Generally, one of the most important meanings for the term “vernacular” is specific building environments. However, specialists use varieties of terminologies in order to define similarly built environments. Dinçyurek states the vernacular is the native idiom in the study of the language [6].

Totally vernacular architecture is the functional architecture of common people which belong to current environmental characteristics, socio-cultural features with the traditional technology and available material and tends to emphasize the utilization of local building resources, as well as the use of passive and low-energy strategies that could lead to reduce the need for both air conditioning and lighting requirements [7,8].

Kasmaee has evaluated annual thermal requirements of a residential building or other vernacular buildings with simple function and slight thermal loads in multiple cities of Iran [9]. According to his study, in the event that building plan would be entirely harmonious with climatic situation of a context, 292 days of a year, thermal circumstances of interior spaces of building is naturally suitable for human comfort. Only in 73 days it is necessary to use mechanical systems to cool interior spaces. In order to achieve comfortable thermal levels with these percentages in old settlements, different cooling and heating strategies have been implemented like using wind tower, central courtyards, basements, semi open spaces, adequate window size and location, and appropriate selection of material for roofing, storage, and walls [7,10]. These strategies used in vernacular architecture to overcome climatic conditions and make environmental comfort for dwellers are all called climatic strategies in this paper.

Generally, these strategies have been studied and analyzed separately and precisely through different special studies, but as it was stated before, architectural elements such as walls, windows, roofs, and floors which form the thermal envelope, all together influence the indoor climate, consequently the effect of the strategies manipulated through these elements should be considered altogether.

Accordingly, this study aims to classify almost all climatic solutions in different elements, mostly used in residences based on different levels of space and categorized mainly by height and functionality, so that they can be climatically reviewed and analyzed in a better way while their functions are seen altogether in one pattern.

## 2. Variety of residential architecture

Iran is one of the few countries, where there is variable architecture consistent with different cultural and geographical characteristics during history. This variety could be even seen in geographical division of a specific district. For instance a variety of residential architecture existed in north of Iran in different districts of Lahijan and Dileman or Masoole highlands. Also residential architecture of central districts existed in Yazd Abyane, Kashan and kerman clarifies this subject.

There are different factors which caused different residential types such as topography, climatic characteristics, economic, cultural conditions, water source, height, and the way of dwelling that create a wide variety of architecture all over this country by having ingenious and capable architects while describing all is beyond the limit of this article [11].

Consequently, analyzing the vernacular residences is limited to the hot and dry (arid) districts of central plateau region because the climatic characteristic is harsher in comparison with other districts and climatic strategies are more conspicuous accordingly.

## 3. Climatic strategies used in residences of central plateau region

This region covers a large section of the central and eastern parts of the country. The two great barren deserts of Dasht-e-Kavir and Dasht-e-Lut are located in this region. These two deserts have very little precipitation. Wind erosion drives dry land transitions by removing key nutrients and reducing the water-holding capacity of soil [12]. There are small villages in or around them and there is very little vegetation and relatively more temperature climate with more rainfall on the perimeters of the two deserts and their surrounding hills. But still the climate is arid [11].

The region's climatic conditions are:

1. Hot and dry in the summer and cold and dry in winter,
2. Low precipitation, especially in the summer,
3. Low relative humidity, especially in the summer,
4. High temperature fluctuations between day and night,
5. And sandstorms in or around the two great deserts.

These conditions have all made this region a very difficult place to live in. However, in spite of these difficulties, Iran's traditional builders and architects had come to rational and sustainable solutions for human comfort in this harsh environment and used variable strategies [11]. Very dense urban fabric, urban spaces with high degree of coverage, narrow and irregular streets partly covered with the arch of building joined together, the way they are established based on the direction of the sun and wind, and in general all living spaces in these areas are protected against atmospheric agents using multiple strategies, which are used

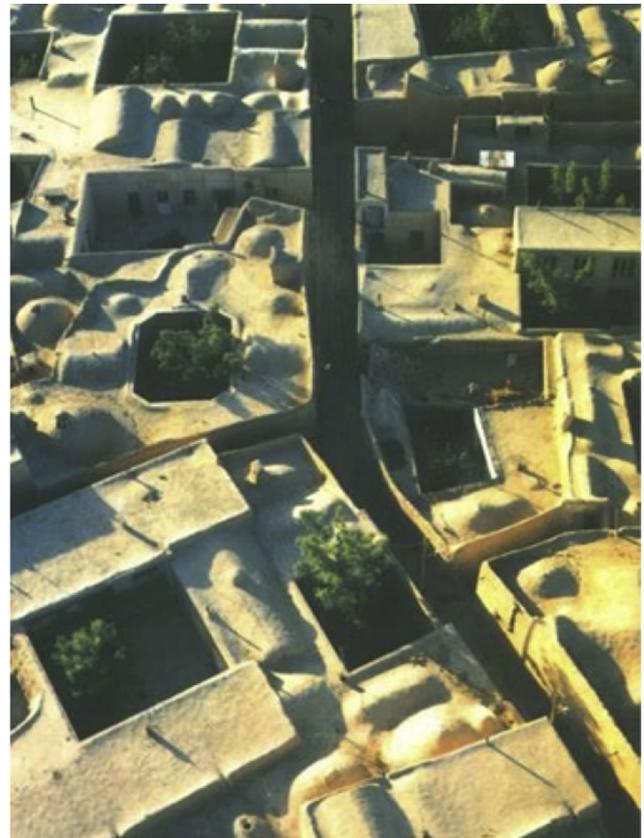


Fig. 1. Vernacular residences in a city of hot and dry region called Birjand in Iran [11].

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