

The Role of Climate on Residential Architecture and Living Culture: an Example of Gaziantep

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Abstract

In architectural literature, researchers argue that there are many factors that affect architecture. Culture, local materials, climate, socio-economic conditions, and topography are the most influential factors in the formation of the architecture of a region. The climate of the place is one of the most important factors in the construction of the built environment for communities throughout history. In a certain region, the living spaces that receive the original form with the influence of the climate and the cultures influence the daily lives of the people living there over time and change the way of life. In this context, it can be said that there is an interaction between traditional architecture, climate and culture.

Gaziantep is an important city in the south-east of Turkey. Gaziantep is located to the north of Mesopotamia where the first civilizations originated and settled. And has hosted many civilizations that have been important trade centers throughout history. Throughout history, housing areas within and around the castle have been included in the city. The city is characterized by an urban texture suitable for hot and arid climatic conditions. In Gaziantep, houses are built around a courtyard completely separated from the street, in accordance with the Mesopotamian tradition. Traditional Gaziantep residences which lined up around narrow streets stand out with its materials, building elements and unique details.

The aim of this study is to reveal the construction techniques, ecological design principles of the houses which produced by Greek, Turkish and Armenian masters in accordance with the warm climate conditions and to discuss its applicability today. In this context, the traditional Gaziantep dwellings have been evaluated with six criteria for the ecological evaluation of traditional houses and the use of the obtained data in a new design. These are Settlement Texture and Streets, Building Form and Orientation, Spatial organization, Construction System and Materials, Physical Properties of Building Façade. In addition to the stone materials used in Gaziantep houses, building elements such as courtyard, water element, bird windows have positive effects on the building biology, and some of the findings that have ecological advantages of vine-like plants and gardening. In the conclusion of the study, an ecological and environmentally compatible project experiment was carried out which carried the findings and the basic principles of the traditional architecture.

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Keywords

Hot-Arid Climate; Vernacular Architecture; Residential Architecture

1. Introduction

In architectural literature, researchers argue that there are many factors that affect architecture. Culture, local materials, climate, socio-economic conditions, and topography are the most influential factors in the formation of the architecture of a region. The climate of the place is one of the most important factors in the construction of the built environment for communities throughout history (Varzaneh, et al., 2014). In a certain region, the living spaces that receive the original form with the influence of the climate and the cultures influence the daily lives of the people living there over time and change the way of life. In this context, it can be said that there is an interaction between traditional architecture, climate and culture. It is vital to keep variables such as heat, light and humidity at a certain level in order to ensure the physical and psychological comfort of the people living in the city at a scale ranging from the formation of the urban form to the building to be constructed.

Today, with the developing technology, the provision of suitable conditions for the comfort of the people is realized by using energy. This approach, which we can call air-conditioned architecture, is far from sustainable architecture. On the other hand, In the past, due to the designing of the living spaces with the consideration of the climatic conditions, the creation of suitable living conditions was possible without energy. In this context understanding and knowledge of traditional architectural examples that have formed over time in accordance with climate conditions is important for today's architectural circles where discussions of sustainability are made.

The purpose of this article is to evaluate the effect of climatic factors on vernacular architecture in hot and arid regions with special focus on Gaziantep city. The degree to which a structure has benefited from climatic factors such as the sun and the wind and how its microclimate is formed is indicative of the level of success of its design. Considering the negative and positive aspects of the climate, the designs provide the comfort of the user, while minimizing the amount of energy needed by the building. It is possible to use natural energy with climatic design principles that are as old as human history. Thus, the need for mechanical heating and cooling systems of the structure is minimized.

In the context of this study, the positive and negative aspects of the hot dry climate, which is the climate of Gaziantep, were taken into consideration. Later, design strategies applied in hot-dry climates were determined. In the next section of the study, the effects of these design strategies on Gaziantep's housing architecture and living culture were discussed.

2. Gaziantep City

Gaziantep is located in southeastern Anatolia Region of Turkey (Figure 1). Gaziantep, located on the Syrian border, is one of the developed cities of Turkey in terms of Industry and trade. Due to its geographical location and its location on important trade routes, the city has become an important center in every period of history.

Gaziantep, the sixth largest city of today's Turkey, is located between Mesopotamia and the Mediterranean, where the first civilizations were born in history. Since prehistoric times, the city has been the settlement area of human societies. The city, which was dominated by the Babylonian Empire for a while, became a city of Hittite state in 1700 BC. The ruins of many ancient settlements, such as Belkis, Zeugma, from the Hellenistic, Roman and Byzantine periods, have survived to the present day. During the Seljuk, Mamluk and Ottoman periods, the city became an important center on important trade routes (Ünal, 1998).

The climate of the city is a transition climate between the mediterranean climate and the continental climate. For this reason, winters, long and cold and summers are hot and dry. The highest temperature of the year is 44°C in Gaziantep, which is located at the in Southeast Anatolia, the hottest region of Turkey. The lowest temperature is -16,8°C in January (Anon, 2016). Hot, dry, clear, cloudy, dominant Western windy climate conditions prevail in the city during the summer months. In winter, the climate conditions, cold, rain and snow are rainy (Figure 2).



Figure 1. (a): Location of Gaziantep

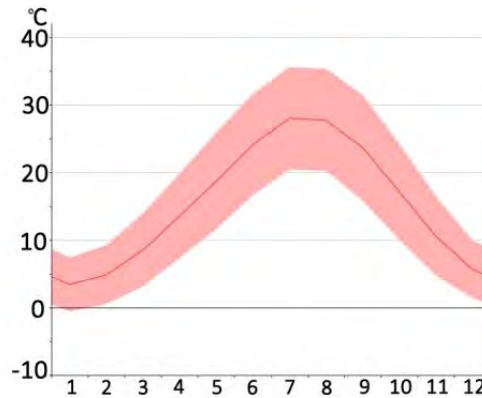


Figure 2. (b): Monthly Temperature Averages Of Gaziantep (Gaziantep, 2018)

3. Hot-dry climate and climatic design principles

In this study, the traditional residential architecture of Gaziantep, which is a city shaped by hot-arid climatic characteristics, is discussed. In order to understand how the problems of traditional climate are solved in the traditional architecture, firstly the design principles that should be applied to provide thermal comfort in hot-dry climate type are discussed.

The hot-dry climate zones are regions with very high radiation levels and associated high temperature and low humidity characteristics. In these regions, the annual amount of rain is below 70 mm and the average annual temperature is at least 18 ° C. (World Climates, 2018). There are two main purposes of the design to achieve thermal comfort in this climate type. The first of these is to reduce the heat gain and prevent the inner temperature of the structure from increasing. The second is to increase the heat loss and to carry out the regulations that will increase the cooling effect in the hot summer days. To reduce heat gain, to reduce the sun exposed building surfaces, to prevent overheating, to choose the colors that reflect the most white and white are some of the main design principles. In summers, reducing the ventilation during the day and using elements that will provide shade, such as high walls, around the building, are some of the methods according to the developed climate type. In order to achieve heat loss, increasing the ventilation during the night hours where the temperature is low and cooling it through evaporation during the day are common design methods used in this climate type.

The humidity of the air in this climate type, where the summer days are hot and dry, and the winter days are cold, is low and needs to be increased. In hot-dry climates, there is a need for insulation against the heat losses at night, and the elements that help to protect against the sun during the day and the effect of cooling are needed. (Janani ,A. 2014).

4. The Effect Of Hot-Dry Climate On The Architecture Of Traditional Gaziantep Houses

In the years when technology has not developed sufficiently and the systems that are known today are not used, various design principles that enable adaptation to climate conditions have been learned and this knowledge has been transferred from generation to generation. In order to provide thermal comfort in the examples of traditional architecture that conveyed these design principles from the past to the present day, regulations have been made to make the buildings more comfortable and more livable in certain climatic conditions, and palatable building elements and building materials have been used. According to the climatic conditions, the way of applying these methods, which are developed to enable people to live their lives more comfortably, have been brought together under five conceptual headings in city and building scale;

1- Settlement Texture and Streets

2- Building Form and Orientation

3- Spatial organisation

4- Construction System and Materials

5- Physical Properties of Building Façade

Within the context of this study, the development of traditional Gaziantep houses according to climatic conditions was evaluated through five conceptual headings.

4.1. Settlement Texture and Streets

Streets are the city components that connect buildings and settlements, connect neighborhoods, and determine the main lines of physical tissue. Therefore, the investigation of the neighborhood and street texture will provide important data in terms of revealing the relationship between the architectural form of Gaziantep city and the climate of the city. Gaziantep's traditional texture consists of the castle which can be considered as the center of the city and its surrounding residential areas. In the neighborhoods around Gaziantep Castle, the housing texture is mostly composed of streets that are organic and show a more radiocentric structure (in the form of a Web) (Figure 3). The climate of the city has been effective in shaping the city's texture in this way.

In Gaziantep, the houses are located in a tight and contiguous neighborhood, providing cross ventilation in the north-south direction (Figure 2). It is observed that as much as possible, compact settlements were tried to be established in the city which developed over time as required by climatic conditions.

Thus, the surfaces that will cause heat gain and overheating have been reduced. In the city, the center of trade and daily life and housing areas were built very close together. In everyday life, people spend time in narrow streets, where load animals can pass by, instead of wide open spaces.

The residential buildings surveyed in this study were selected from Bey neighborhood, where the traditional architecture was partially preserved. Bey neighborhood is located on a hill to the south of the Gaziantep castle. Armenians, Turks and minorities from different nations lived together in this neighborhood which was established for the people who came to the city with immigration in the 17th century. The streets, which vary in width from three meters to seven meters in width, form an organic texture (Deringöl, 2015). Bey neighborhood preserves its original identity with narrow streets covered with cobblestone and traditional houses that have reached today. Today, some of the restored buildings continue to be used as dwellings, while others have been given different functions.



Figure 3. Gaziantep City Satellite View (Yandex, 2018)

In Bey district, selected as study area; When the streets are examined in the context of home-street relationship, the houses are insulated from the street, and the constrictions and expansions along the street make up the identity of the neighborhood. The different perspectives that form the intersection of the streets form the original texture of the neighborhood (Figure 4) (Yüce, B. 2010). Buildings with a courtyard adjacent to each other, coming together around the narrow streets; And they are separated by high walls from the street. The high walls provide the privacy of everyday life in the courtyards of the houses while keeping the streets cool by protecting them from the sun's heat effect. This enables daily life to take place in the courtyard of the house, which has led to the development of an introverted lifestyle (Figure 5). The courtyard where the daily work is done in the traditional Gaziantep houses is called 'Hayat' and it means 'life' in Turkish. In the neighborhood, the end of the streets is sometimes turned into a stairway and sometimes into a dead end street. The dead-end streets are usually arranged to form small squares where several house entrance doors are located. These squares are used as semi-private social spaces where thermal comfort is provided.

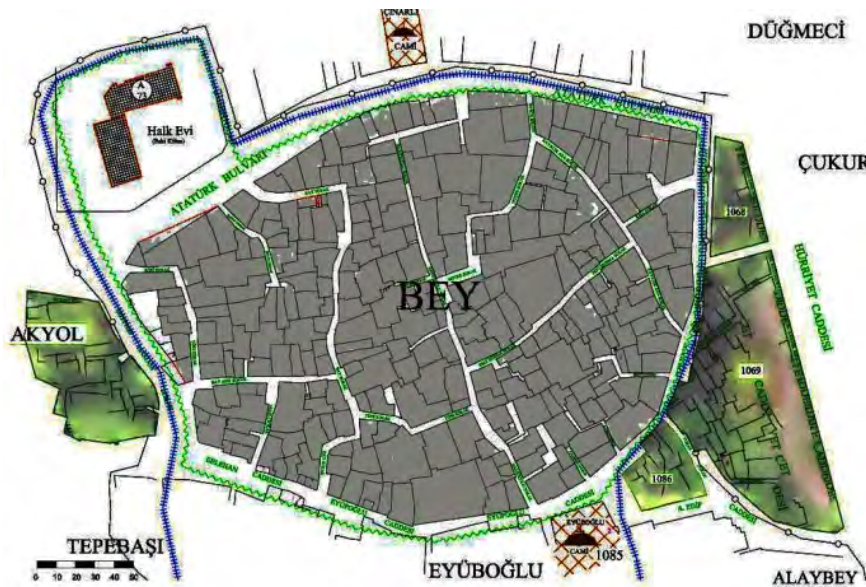


Figure 4. Bey neighborhood urban texture.



Figure 5. Current condition of Bey neighborhood (Bey Mahallesi, 2018).

Another feature that develops with the effect of climate is the passageways, which are called 'kabaltı'. Thanks to these passages, the generated air currents provide a cooling effect on narrow streets (Figure 6). The 'kabaltı' that provide a sense of security and provide additional space form a shadow area on the street and define the transition between the street and the residence. One of the original design features of the neighborhood is the dead-end streets that have been customized and built to reach the buildings located in the inner parts of the big city blocks. The fact that the users of dead-end streets are identified and restricted makes it possible to create semi-private, public spaces for the socialization of people using this street (Figure 7).



Figure 6. Passage example which is called 'Kabaltı' (Taştan,,2014)



Figure 7. A Dead End Street in Bey neighborhood (Taştan, 2014)

4.2. Building Form and Orientation

Traditional Gaziantep houses are usually located on land with one or two sides adjacent to the parcel of land border. One or two of the building facades adjoins the wall of the neighboring building. In this way, the surface area of the houses is reduced and the construction area is used in the most economical way (Deringöl, 2015). Traditional Gaziantep Houses are built around the inner courtyard, which is visually separated from the street by high stone walls and called 'hayat'. The houses were built as adjoining buildings in narrow streets, but the houses were prevented from covering each other's landscapes. High windows or no windows were placed on the façades overlooking the adjacent house. Thus, the importance of ensuring privacy has been given.

In Gaziantep, in the winter, winds are dominant in the north-west direction, so the houses are generally directed to the south, considering the dominant wind direction (Center, A. 2018). Traditional Residences were constructed in U,L and I form or in rooms assembled around the courtyard called The Mansion type (figure 8). The large houses, called The Mansion type, were built on lands of 2000-3000 m² (Atalar, 2004) .

In the construction of traditional Gaziantep houses in this way, climate conditions were taken into consideration. The buildings are designed in two parts and usually have large gardens in their courtyards. In the gardens located in Avlu, a wide variety of agricultural products are grown, while in most gardens broad-leaved trees are planted to provide a shade and a cool area. One of the two houses forming the residence was constructed in such a way that the direction would be to the north and the other direction to the south. In this way, the sunlight is being used more in the house. The mass directed towards the northern direction is used in summer and spring days as it is cool. The mass towards the southern direction is used as the main living place during the winter days because it is hot and benefited from the sun (Taşdoğan, A. D. 2008).

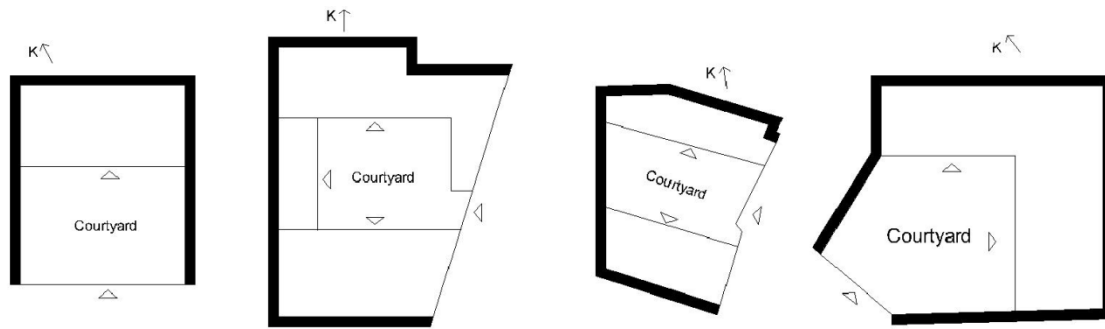


Figure 8. Types of Traditional Gaziantep Houses (Adopted from, Taşdoğan, A. D. 2008)

4.3. Spatial Organisation

Traditional Gaziantep houses are usually built on two floors. The house is connected to the street with a large door opening to the courtyard on the ground floor. The units arranged according to the location of the land have taken their original shape as a result of the effect of climate on housing design and daily life. These units are courtyard (hayat), livan (eyvan), kitchen (ocaklık), cellar (mahzen), room and toilet. (Merkezi, A. 2018).

The courtyard houses are designed to allow all family members to enjoy the outdoors. The courtyard is also the place where weekly and seasonal housework are done. All things such as washing and drying clothes, baking bread, preparing food for the winter months are done in courtyard (Figure 9). The kitchen, which is a heat source, is positioned close to the courtyard. Usually the toilet and bathroom are also positioned close to the courtyard.



Figure 9. Spatial organization in traditional Gaziantep housing (Adopted from, Taşdoğan, A. D. 2008)

The rooms on the ground floor are directly connected to the courtyard. The rooms on the first floor are connected to courtyard with open staircases. One of the important places connected directly to the courtyard is the iwan. The iwan, which makes the passage between the rooms, can be defined as a room arranged on one side open to the courtyard. Having a cool environment on hot summer days, the iwan is very useful.

Iwan is the shape in which the sofa in the traditional Turkish house is transformed into the houses in southeastern Anatolia as a result of changing according to the climate conditions. The facade of the eyvan, which was reached with stone stairs and which was positioned higher than the courtyard elevation, was covered with wooden joinery and glass (Tatlıgil, F. 2005). Courtyard usually has a pool and a garden that meets the vegetable needs and is usually covered with grapevines and trees are planted so that the solar heating effect is minimized (Figure 10).



Figure 10. Courtyard and eyvan in traditional Gaziantep house (Taştan, 2014)

4.4. Construction System and Materials

The traditional Gaziantep houses, built using natural materials such as natural stones and masonry construction techniques, are quite successful in adapting to hot-dry climates. The thick stone walls provide a cool environment in the summer months, while ensuring the necessary insulation in the winter months to keep the interior warm. When the houses were being built, natural stone called 'havara', which is the local material, was used. (Figure 11).

During the day, the courtyard is soaked with water. Stones with porous structure used as floor covering; allowing the water to slowly evaporate. The evaporated water thus reduces the temperature of the courtyard during hot summer days. The stones used in the construction of the houses are usually supplied from the surrounding stone quarries. In some cases, the stones used during the construction of the house have been obtained as a result of using the house ground as a stone quarry. In the basement of these houses, there are also caves that function as refrigerators. These caves, located in the basement of the houses, are cooled by water from the underground water collection pools called 'Kastel'. The water collected in the underground water collection pools is used in the pool in the courtyard and in the daily needs. Thus, the refreshing effect of water is used (figure 12)



Figure 11. Use Of Natural Stone Material In Wall Construction (Taştan, 2014)

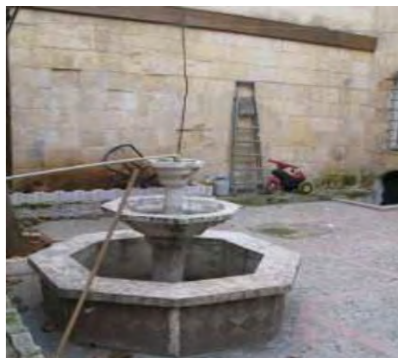


Figure 12. Pool In The Courtyard Of The House (Taştan, 2014)

4.5. Physical Properties of Building Facade

The climate factor was effective in the formation of the facade characteristics of traditional Gaziantep houses. In the houses, it is possible to mention two different facades, the facade facing the street and the facade facing the courtyard. Gaziantep houses are made of masonry construction technique and because of the difficulty of glass production, window sizes are quite small. There are small windows on the south facades of the houses. On the northern façades, the use of windows was avoided as much as possible. In addition, the ground floor windows opened to the courtyard instead of the street side because of privacy reasons. This situation brings the feature of collecting all the spaces of the courtyard to the forefront.

Traditional Gaziantep houses have been arranged to make console to narrow streets. Thus, the street texture is gained a movement. These structures expand the use area of the house and also form shadow areas on narrow streets (Atalar, A. 2004). Traditional houses have been constructed with floor heights of three meters and over. These houses were built with small windows called bird windows, which are located above normal windows (Figure 13). Bird windows provide natural ventilation. Wooden shutters, which are located on normal windows and can be adjusted in their viewing direction, are used to provide solar control (Figure 14). The other element that provides natural ventilation in the houses is the hollow walls built on the upper part of the high courtyard walls. The function of these walls is to provide protection against the heat-raising effect of the sun and to create air circulation. Thus, the courtyard is cooled (figure 15)



Figure 13. Bird Windows (Taştan,2014)



Figure 14. Wooden shutters (Taştan,2014)



Figure 15. Courtyard Wall (Taştan,2014)

5. Conclusion

In this study, the impact of climate on housing architecture and living culture was discussed in Gaziantep sample. Gaziantep's partially preserved neighborhood texture; has been developed in accordance with the climate to provide protection against hot weather during summer and cold weather during winter days.

Bey neighborhood; narrow streets and compact urban texture, is one of the examples of traditional architecture applied by climatic design principles. Traditional Gaziantep houses with courtyards were isolated from the street with high walls and built with a stocking system using natural stone material. The courtyard, which is a cool place with a pool, and the iwan was developed as a unit in the traditional Gaziantep house where most of the daily life passes. The garden in the courtyard cools the environment with evaporation and also meets the vegetable needs of the users.

The thick stone walls used in the houses provide insulation while the inner surfaces of the rooms are covered with natural material, breathable wood. Traditional houses have been constructed with floor heights of three meters and over. The bird Windows, located just below the top floor floor, provide natural ventilation. In addition, wooden panels on normal windows protect the building from the sun in summer and cold wind in winter. The climatic design principles seen in traditional Gaziantep houses are stated in the table (Table 1).

Although developing technology and construction techniques have changed, the climate design principles seen in Gaziantep houses are valid today. Later studies should focus on how traditional houses will be maintained today and how information from these living museum-like buildings will be adapted to contemporary buildings.

Table 1. Characteristics Of Traditional Gaziantep Houses's Climatic Design Principles.

Concept	Characteristics Of Climatic Design Principles
1- Settlement Texture and Streets	<ul style="list-style-type: none"> - The buildings are positioned adjacent to each other, in the north-south direction and to provide cross ventilation. - The city, which is developed as required by the climate and consists of narrow streets, has a compact form as possible.
2- Building Form and Orientation	<ul style="list-style-type: none"> - There are different sections for the summer and winter periods in the residence formed by the units coming together around the courtyard. - The courtyard, which provides user comfort with its pool and garden, has been isolated from the street and has become the centre of the house.

Continued on next page

Table 1 continued

3- Spatial organisation	<ul style="list-style-type: none"> - The heat sources, such as kitchens and bathrooms, were built to be associated with the courtyard. - Everyday life happens in the courtyard. With its high walls in the courtyard of the house, lifestyle isolated from the street has been established. - The sofa in the Turkish culture has been rearranged in accordance with the hot climate and has become a useful place called 'iwan'.
4- Construction System and Materials	<ul style="list-style-type: none"> - The thick stone walls built with the masonry construction system help to provide thermal comfort. - Light colored stones reduce the heat effect of the sun and provide insulation with the help of their porous structures.
5- Physical Properties of Building Facade	<ul style="list-style-type: none"> - By keeping the window openings small, the solar heat effect is reduced. -The windows turned to the courtyard instead of the street. This provides an introvert lifestyle. - Bird windows on the facade provide ventilation, especially in hot summer nights. - The wooden and adjustable panels on the windows provide solar control.

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