

# Bioclimatic interpretation over vernacular houses from Historical city Basrah

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**ABSTRACT:** Basrah's climate is hot, dry summer, mild to cold winter, and a pleasant spring and fall. The old builders from this region putted a big effort to create passive bioclimatic houses that corresponds the negative effects Basrah's macroclimate. The courtyard is the central and dominant space in the house plan with a direct access to the living spaces. Houses from the city are compact with interior courtyard; the streets are sinuous and pass through houses volumes. The shady interior courtyard has the effect that the rooms do not communicate directly with the overheated air outside, but through intermediate buffer spaces. In the mean time between courtyard and street at least a wall or a building is always interposed. The House plan had an endomorphic form, (open tree form). The volumes were concept to create shadow which helps to move the air by natural movement to the deep superior side, that can be achieve through special holes. The architectural elements are strongly decorated, reproducing special typologies and traditional houses. Open spaces, covered by large roofs, are interesting due to the mix of diffuse light and shade that are an essential aesthetic factor in these buildings.

**Keywords:** bioclimatic architecture, shadow, compact volumes, spaces, courtyard

## 1. INTRODUCTION

The region of Basrah, the city of Sinbad, is, some would say, the most beautiful part of Iraq. It is Iraq's second largest city and principal port. It's commercially advantageous location, near oil field and 121 km from the Arabic Gulf, has made it prosperous. In Basrah there are more than 635 rivers and canals that had direct connection with the great river (Shatt al Arab). The average temperatures in Basrah range from higher than 48 degree °C in July and August to below freezing in January. A majority of the rainfall occurs from December through April and is more abundant in the mountainous region and may reach 100 centimetres a year in some places.

The summer months are marked by two kinds of wind phenomena: the southern and south-easterly (sharqi), a dry, dusty wind with occasional gusts to eighty kilometres an hour, occurs from April to early June and again from late September through November. The (shamal), steadies wind from the north and northwest, prevails from mid-June to mid-September. Vary dry air, which accompanies the (shamal) permits intensive sun heating of cooling effect.

The traditional living way in Basrah is accurately reflected in the households' organization, in their volumetric configuration, in the forms of useful locations they engender. The shadow is wanted to create both by means of architectural details and volumes, which have become a landmark of the local architecture specific character, and by means of natural elements (vegetation, water, etc.). The

northern orientation is perfect for the summer functional rooms. These half shades are limit that has depth and width, and of considerable dimensions with its universe of lights, shades, and experiences, becoming an important theme of design to resolve the transition between inside and outside. The way people use houses in Basrah has an important bearing on their effectiveness. Living in the basement during the hours of heat sun, sleeping on the roof at night, heating only those rooms being used are common-sense measures which give some adjustment between men, the houses and the climate. The modest Basrah's houses, the daily removals are usual in summer, using those terraces shadowed during various parts of the day. The over-night supplied coolness of rooms in protected by systems of galleries or loggia, of wooden jigsaws walls etc.



**Figure 1:** Traditional house from Basrah

## 2. VERNACULAR HOUSE MECANISM

### 2.1. Habitat spaces with thermal role

Habitat spaces on bioclimatic concept in Basrah can be;

#### 2.1.1. Closed spaces

##### 2.1.1.1. Functional spaces

For the vernacular tradition houses in Basra, the functional spaces are the place where the whole family carries on its activity with maximum convenience.

#### A. Habitable rooms

Those spaces are related to the outside both directly and by means of buffer spaces. The habitable rooms having high level height, warm air raises during summer, and then it is evacuated by the currents of air deriving from the difference of temperature between the outside space and the cold air storage place. The windows are small and inside patio-oriented. Daily inside removal in a traditional house takes place between the rooms located at the same horizontal level. The north-oriented rooms, habitable during summer, are plants developed and have thicker walls to keep coolness; while the south-oriented rooms are used during winter is ground floor and floor developed. The design of such a building has a deep bioclimatic character. The rooms are isolated, the shadows deep and the two spaces can overlap generating the vertical seasonal removal.

#### B. Guest room

This room is isolated from the rest of the house, they have a separate entrance usually with window giving to the narrow, winding streets, and the windows are made of wooden jigsaw panels. The intermediary spaces provide for the relation with the dwelling, often well sun-oriented spaces and properly ventilated.

#### C. Kitchens, bathroom, storeroom, etc.

Those spaces are isolated from the dwelling may be with street-oriented windows; they do not need special physic comfort. The kitchen, as a heat and smell source, is located deep in the house, north-oriented, taking into consideration the dominant wind. A buffer space provides for the relation with the yard. The same solution is agreed for the bathroom and the storerooms.

#### 2.1.1.2. Basement (Sirdab)

The Sirdab is the buried basement where the cold air is stored using the ground's thermal inertia and is connected with the outside only by means of a gap in the ceiling. In Basrah, the Sirdab is vaulted, sometimes decorated, made out of burnt brick.

The (Sirdab) is connected with the terrace by means of the (Bagdir), where the difference of pressure between the two spaces results in a cool current of air

#### 2.1.2. Intermediary spaces

Those spaces used to solve the integration of two components opposite in meaning namely, the inside and the outside space and help bringing the two spaces to the closest level possible from one another, aiming to achieve the appropriate comfort.

#### A. Loggia (Shurfa)

This space is deeper than the galleries and has the role of supplying shadow and removing the sun and strong winds' effects just like a buffer space. They are used for guests and are separated from the

outside by means of a tracery work made of rectangular wooden panels.

#### B. Gallery (Rawak)

This is an intermediary space surrounding the patios; it is an outside open corridor with a porch used for traffic. It protects not only the doors, the windows but also external walls

#### 2.1.3. Open spaces

##### A. Patio (courtyard)

The patio is for the traditional dwelling the outside space that creates a microclimate and the most efficient form of using the inside space of house. The system's efficiency can be amplified by supplying the place with fountains, water pools, and big leaves plantations. The water pools and the vegetation get warmer during the day and keep a convenient temperature during the cold night period. Thus, the air stays due to the difference of density in the upper part of the patio and allows a comfortable environment in the lower part of the patio. In the case of the houses with several levels, the patio can be covered above the ground floor, leaving a gap for ventilation or it may be covered with a grid; sometimes, a tarpaulin is stretched over the patio under the form of a bar-supported tent. Such tarpaulins are also stretched over roofs, on terraces, having a very important bioclimatic role as a (Rawak) in the shape of an outside open corridor.

This space plays an important role on local microclimate and helping in ameliorates of the surrounding environment.

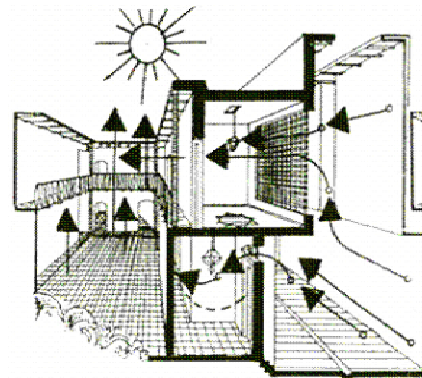


Figure 2: Patio function in the day

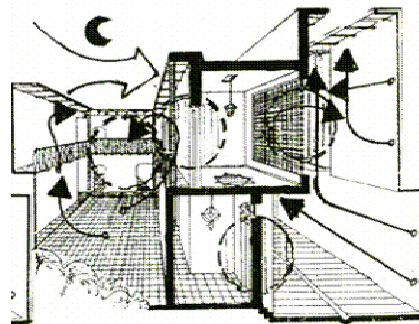


Figure 3: Patio function in the night

## B. Terrace

Houses in Basrah have two types of terraces;

### B1. In the front of house

This terrace play the role of lowering the temperature and creating a pleasant atmosphere, it can be covered by the shadow of the trees and the climbing plants which are cooling it or it can be covered by a light fabric canvas.

### B2. On the roof of house

This terrace is a space surrounded by four walls that thanks to their 1.8 - 2.2 m height provide with shadow and can be used as a sleeping place.

## C. Tak and Iwan

The (Tak) is an original and typical space, intermediary in architecture from Mesopotamia. It looks like a square room in one side open planes and is connected with the patio, it is used in the houses provided with water pools or fountains and sometimes it is covered by an arch or a cupola-terrace. The (Iwan) is north-oriented and as it has no outside wall, shady, cool, high space, fit for reception is created. This type of space is also an intermediary space.

## 2.2. Architectural elements with thermal role

### 2.2.1. Wind tower (Bagdir)

This element is an air pipe provided with inside ventilation channels, in direct connection with the closed spaces of a dwelling. The basic principle of its functioning is the wind and thermal pressure got due to difference of temperature, resulting in a thermal depression which engenders currents of air by opening and closing the ventilation doors. The wind (Bagdir) is useful to reduce the sand and dust volume often brought in by the winds. (Bagdir) harness summer breezes, they are usually closed during winter. During the day heat is absorbed from the air which passes downwards by the walls of the passageways, to be released at night so warming the air and causing it to move upward. Doors and windows can be opened to assist the upward air movement at night, if there is a wind at night the flow is downwards and the air warms slightly but still allows some cooling.

When there are no daytime breeze airs can flow through opening in the side of the (Bagdir). Sometime use was made of a fountain or an underground stream placed at the basement of a tower to permit cooling by evaporation with some increases moisture content.

### 2.2.2. Ventilation gaps

This element is opening located at the upper part of the houses, which is decorated with a grid network under the form of a drilled screen wall and used for ventilation and lighting.

### 2.2.3. Shanashil

Shanashil is a wooden jigsaws piece or made out of tiny wooden fragments allowing the inside ventilation and lighting and preventing the penetration of the outside excessive heat because wood warms up due to absorption and does not convey heat by radiation. The thermal role of those elements is also a reflection of the sunlight and changing the current of air direction.

### 2.2.4. Fountains, water pools (selsebil)

Those elements help water integration in the architecture, by their privileged location in the house's

design, and help in creating a local favorite microclimate.

### 2.2.5. Doors and window

House elements had function of air current control. The windows are small sized, located in the upper part and wooden-framed. The doors are usually wooden elements decorated with metal.

### 2.2.6. Outside decoration

Outside decoration are profiled elements of bulky volumes under various forms play the role of creating pronounced shadows on the sun-warmed facades and changing the current of air direction.

## 2.3. Natural elements with positive effect

### A. Vegetation

Vegetation is used association with the town's buildings and streets to diminish the sun, wind and pollution effects. Climate decides the form and the component of trees, which can helping in create the necessary of adaptation to climate consequence. The solution with green spaces can be divided in;

#### a1. High trees with thick leaves (palmer)

This type of trees help in; hindering the sunbeams, lower the environment air temperature of the house, change the wind direction and shadow on the roof, walls, terraces, ground lowers their temperature

#### a2. Grass

Has the function of lowering the temperature at the surface of the ground and weakens sun radiation.

#### a3. Climbing plants

These forms of plants create cool spaces near the buildings by covering with green leaves the surface of the facades, walls, terraces, etc.

### B. Water

Is used as an air conditioner element, the water pools are dug in the floor or raised on a richly decorated porch, in testimony of its importance.

## 3. HABITAT SPACES DISCRPTION

### 1. Specific urban texture

Houses are compact with interior courtyard; the streets are sinuous and pass through houses volumes. The shady interior courtyard has the effect that the rooms do not communicate directly with the overheated air outside, but through intermediate buffer spaces. In the mean time between courtyard and street at least a wall or a building is always interposed. This isolation from the street indicates concerns for defense. The architectural elements are strongly decorated, reproducing special typologies and traditional houses.

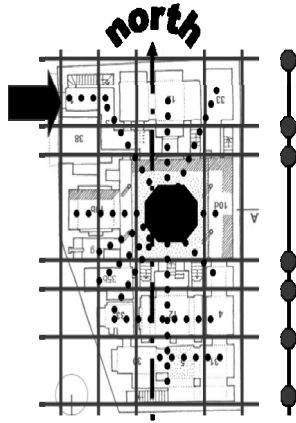
### 3.1. Specific volumes

The volumes were concept to create shadow which helps to move the air by natural movement to the deep superior side, that can be achieve through special holes. Specific house volume reflects the necessity to achieve thermal comfort. Flat roofs, courtyard position, and a compact form of residential unit, explain the new concept of bioclimatic house.

### 3.2. Specific habitat plans

Houses plans in Basrah had an endomorphic form, (in open tree form) in which the bundle is

hierarchical and situates, each entity having a relational and structural role well specify, by principle univocal function. That mean development of residential units from (0) (entrance) to a concentrate of living spaces in the depth of house plan such as open tree.



**Figure 4:** Specific habitat plan from Basrah city

### 3.3. Buildings material

As besides earth and sand materials can hardly be provided, the first building systems have been invented. Arches and cupolas made out of burnt or sun-dried bricks filled in gaps with could be closed only with wood provided with great efforts.

Finishing materials have been made out of burnt clay, such as enameled ceramics. Folk's intuition and millenary experience determined the peoples of such zones to use building materials and systems not only to achieve long lasting buildings but also to protect against excessive temperatures. Where building materials were insufficient to protect against heat, the spatial-volumetric outlook and the auxiliary device camp up. Mud-build is also an essential material in house from Basrah.

## 5. CONCLUSION

A traditional house in Basrah was influenced of the first house create by Sumerians civilization in Ur city northwest of Basrah which was displays with heavy facades; limited openings on the external elevations but those that do exist are well shaded. These simple ideas used with modern and traditional materials can produce an energy effective house, which is traditionally Basrah. In vernacular houses in Basrah, builder creates closed spaces that are embraced by walls to conserves the cool interior. The opposition of light and shade is dramatically expressed in these architectures of walls. The spatial relation between the interior and exterior is limited to a few apertures in the thick walls, through which the light penetrates, revealing the thickness of walls. In such cases, the border between the interior and the exterior has depth. Just in architecture from warm dry climates is of walls, where in the temperate climates it is roofs. Open spaces, covered by large roofs, are interesting due to the mix of diffuse light and shade that are an

essential aesthetic factor in these buildings. In them inhabit the depth, the reflections, the veils, the chiaroscuro, and the attenuated clarifies that are specificity of the shade. The transition from the intense and crude light of the exterior and the shade of the interior via the eaves, pergolas, and other elements produce an intermediation of chiaroscuro and create an interior shade that is perceived as a shade surrounded by half shades.

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