Response of Domestic Damascene Architectural Elements to the Climatic Factors between the Traditional and Modern Times

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Abstract  The climatic factors (temperature, humidity, earth geology, wind speed and direction, solar radiance) are considered one of the most important effects on any site prepared for construction. Thus, these factors are studied before suggesting any schematic regulations and plans for its influence on the building form, allocation, materials options, and suitable green cover, and the functional distribution between parts. This study is trying to analyze the effects of climatic and regional factors on the design elements of the domestic architecture of Damascus. We are going to select different cases of traditional houses that evolved and transformed through several transitions of history. Then we will analyze these transformations and the extent of the response and maintenance of respecting climatic conditions. Research method is descriptive and interpretative. For literature review the descriptive method is used and analyzing of cases is done by interpretative method. Samples are selected from saurian traditional and modern hoses. Building materials, shape of spaces and opening are studied variables in this study. Comparative method is used for comparison of mentioned variables in related to climate factors. The result of study shows that the traditional house in Damascus is considered a reflection of serious attempts in the environmental design which is compatible with regional climate. New buildings completely ignored climate closed central space, called (the sofa) replaced the interior courtyard within the traditional dwelling, with a deficit of this space to insuring sufficient light and air inside the building. Also it relied on those structural materials of medium or high energy content, such as cement, glass and aluminum, which are widely used today in constructing modern residential buildings, despite the lack of suitability of climate in the region. This was accompanied by the excessive use of heaters and air-conditioners to achieve the thermal comfort inside the building, without considering the amount of energy consumed.

Keywords: transformation, vernacular architecture, Syria, climatic factors, tradition, modern, house


1. Introduction

Long ago, the building instructor was accustomed to use the surrounding building materials, refined it consciously and carefully as a piece of his heart, designing a house with an interior space suitable for human being life instead of a stiff sculpture gazed from outsides, that why he was considered a first class architect. The interesting phase in Arabic architect is that they were able to find and apply great techniques in the natural ventilation, where they used to plug some of the house outlets by moisturized straw in order to transform the hot dry air into wet cool one when entering the house [5]. We see that some of the modern adaptation methods have been developed from this old domestic technology, which means that it is possible to develop some of these domestic technologies and apply it in an economic, practical and modern way [7]. What is required here is not to apply fictional theories which call for the revive of extinct ancient architectural styles, that is an arbitrary call outside history and reality. However, what is required is actually absorb in depth rather than copying traditional models, and reality represents spontaneity and originality in the use of local building materials, job distribution expressing the way of life, and respecting environment.

2. Materials and Methods

Research method is descriptive and interpretative. For literature review the descriptive method is used and analyzing of cases is done by interpretative method. Samples are selected from saurian traditional and modern hoses. Building materials, shape of spaces and opening are studied variables in this study. Comparative method is used for comparison of mentioned variables in related to climate factors [9].
3. Damascus: The Evolution of Architecture and the Problematic Western Foreign Style

Damascus is located on the latitude “33.3”, the longitude “36.17” in the eastern side of the Prime Meridian in Greenwich, and at 700m height above sea. Its climate is considered to be hot and dry with high temperature in summer time and moderate in winter (according to the General Directorate of The Syrian Meteorology). Accordingly, we can determine the climatic precautions in Damascus as follows: protection from sun rays, with ventilation and humidification in summer, and protection from cold with providing sundeck for warmth during winter times.

Damascus is one of the oldest populated cities in the world; it has been exposed to many changes throughout history, it witnessed the succession of several civilizations from Greek to Roman and Byzantine, then it turned to Islamic state in the sixth century. Its architecture was subjected to logical principles and a comprehensive system through centuries, where its architecture was an echo to a specific socially admissible pattern as to climatic and security criteria so that the overall design of the installations in its various types, was independent of the functional interrelation among the different functionalities of the constructional blanks; however, it was mainly dependent on placing the blanks according to the environmental criteria (summer-winter, sunny-dark, hot-cold, dry-humid,...) so that Damascus streets were narrow, serpentine, and pedestrianized preventing noisiness and dusty winds. Besides, its buildings were stacked protecting one another from sun, and they were arranged accordingly as public, semi-public, semi-private, then private buildings [8].

All of these concepts were set aside and replaced by the western style of architecture according to what was mentioned in the Athens Document. This style is still under discussion and criticism even in the western countries in a way that it took them long time to get accustomed to this change. During the 20th century, Damascus’s architecture developed rapidly where the western style succeeded in being the dominant one despite its inconsistence with much of people desires since it ignores the environmental and climatic criteria in addition to cultural and social values and principles that had been domineering long time [4].

4. Classifications of Residential Architecture in Damascus City

It is possible to curtail residence samples into three main ones:

4.1. First: Traditional Housing or Houses with Interior Courtyard

These residences are found in old Damascus whether within its core or out of it. They were designed and built by their dwellers, pursuant to their needs and social guidelines, and using available handy materials. In these residences, the owner has a complete authority in his dwelling and community in where its architectural sequence is characterized by the spirit of an Islamic city. Old Damascus consists of relatively small residential regions including harmonious community where its members are linked by religious relations and peculiar social customs embracing the decree of the rich neighboring the poor and sharing with them services. Moreover, the city is characterized by the hierarchy of the spaces starting from main to side ones within the residential regions, i.e. from the main road to the side one leading to the lane, alley, then to the internal courtyard. As for the trade sector, it was kept apart from the residential sector in a way that trade activities shrink as we get closer to the residential regions. These are the special regional traits of Damascus as an Islamic city [3].

4.2. Second: Houses Built in the French Rule Period

The city was under French domination from 1924 till 1946 in which the first organizational plan was set by the French architect and planner “Ekoshar” in 1936 according to the dominating guidelines affected by Beaux-Art in the French cities in the 19th century. To recall, the second organizational plan was set by “Ekoshar” and “Danjeh” in 1968 in order to encircle the rapid growth of the city at that period [7].

The residences within this classification represent the transitional phase from traditional to contemporary architecture where the houses started to be separated, open to the outside, and surrounded by gardens. They were designed by French architects or Syrian ones who got their degrees in France. The dweller had complete authority over his residence but not over the nearby or surroundings in which there was a turning point from residential level to the main road level. People taking houses along the main road were either foreigners or Syrians from the upper class who left the old city finding that the new lanes imitate development and higher classes. Besides, these houses consist of main closed space called “Al-Sofa” same as the internal courtyard in the old residences but with failing to obtain light and air. As for the guests’ rom, it was found as close as possible to the main entrance. The other zones varied from being sitting rooms, bedrooms, or service rooms according to the relatively wide space and enough blanks present in the residence.

4.3. Third: High-rise Buildings and Apartment Houses after Independence

These residences were built after the independence from the French Mandate in 1947 by the government or by building contractors, but if Damascus succeeded in gaining liberation, its architecture didn’t, i.e. it has been following the western style and still does. Here, a great change arose in building style wherein reinforced concrete was widely used, building guidelines and frameworks were improved, and there were apparent social and economic developments. In this residence style, small families are dominant where children leave their parents due to their desire to be detached from the parental family which was previously prevailing in old architecture. Thus,
homes were close leading to private problems and relations with neighbors. Most people resorted to changing and adjusting some spaces in their apartments in a way to balance between their building styles and their inherited social values. The most important adjust was closing balconies totally or with glass, closing some windows, or using some different techniques to save privacy of their apartments without closing windows [6].

5. Architectural Elements of Housing and Climatic Requirements

We will choose two samples of residential buildings in Damascus: the house with courtyard “Al-Qanawat district” as an example on the old traditional architecture and “Al-Houseinaya district” as an example on contemporary residential architecture at the end of 20th century. As well, we will get to know three elements of architectural design for both samples: wholly elements (the spaces and form of plans), construction elements (building materials), and partial ones (the openings) in order to be able at the end to evaluate if these elements were adequate with the climatic requirements in the region:

5.1. Elements of Architectural Design of the Courtyard House

Al-Qanawat district is located outside the western wall of old Damascus. It had noticeably witnessed an architectural growth since Ayyubid era, and its location at the junction of two critical paths: one to Egypt and Palestine and the other to Hawran and Mecca, helped in its development and growth. With the Ottoman invasion in 1516 A.C, a new period launched with continuous expansion and prosperity in which significant mosques, schools, and cemeteries were built.

In the 19th century, another development interval started through an enhancing renaissance in which the architectural expansion outside the mure reached a new administrative and economic spot all around “Al- Marjah” square beside Al- Qanawat district. This expansion continued till the residences spread to reach gardens which were replaced by houses for wealthy people [2].

In the French Mandate since 1920, Damascus witnessed advanced architectural and constructional principles such as using cement and building the empty lands in chess- like framework till Al- Qanawat district was linked to the nearby districts. These principles were also used even after the end of the mandate in which “Fakhri Baroudi” road was opened to the east-west and “Khaled Bin Al- Walid” street which is still the same, in addition to the spread of building works till the nearby gardens [6].

5.1.1. The Interior Design of Traditional Residential Samples in the District

- The spaces and form of Plans

The basic element of the traditional houses in Al-Qanawat district is its yard opened to sky. Most of the houses in the district consist of three major sections with each having a yard of plants and fruitful trees; however, most of the current houses of the district have one yard due to divisions caused by buying, selling, and heritage, but we can still find some houses with two yards as shown in Figure 1.

Figure 1. Sample of real estates with two yards (as close as possible to the original 3 yards sample)

Figure 2 shows the elements of the residential sample starting from small blank or vestibule “corridor” for entrance, leading to the open yard. From the yard, we enter to the rest of the residential blanks as follows:

1. Al-Iwan: with marble fountain or lake in its center and 2 rooms, one in east and the other in west.
2. Luxury drawing-room located beside the open yard or Al-Iwan.
3. Living rooms, not that important as the drawing room.
4. Services: bedrooms and kitchen.
5. One room or more relatively located in the middle above corridors or services zones, and it is called “Al-Nasseiah”.
6. First floor consisting of northern room open to the south.
7. Stairs made of stone having decorative iron handrail.
8. The flying room which is a sitting room at the highest roof with windows in each of its four walls.
9. Wooden stairs, from the first floor to the roof, with walls and inclined ceiling [1].

Figure 2. Repeated sample of houses in Al Qanawat district with its essential elements

It is worth mentioning that Al-Iwan floor is approximately 40-50 cm higher than courtyard level and that the ground floor rooms are also higher than yard level in order to avoid cold airstreams which flow into the low openings as if these rooms are air bumpers. Upper floor rooms were less humid and more exposed to sunrays while ground floor ones are more suitable for summer times. Dimashqi houses were designed such that the light can enter from three sides according to sun rotation especially Al-Iwan which doesn’t miss sunrays but at sunset [3].
The internal courtyard provides light and air to the house with its green plants and fountain where Al-Iwan (half-open zone) is always directed to the north away from the heat of sunlight.

- **Building Materials**
  The major material used in building walls is limestone, and some frameworks can be made from alabaster or other kind of decorative stones with thickness of walls 60–80 cm. This thickness is built with two fronts that would be linked together where the outer front is made from trimmed stone while the inner front would be built rather from trimmed stone or from coarse stone. As for the filling, it is made of small stones, clay, and mortar prepared from crushed limestone which helps in fixing the mixture in the wall. The carrying walls lift the vertical structure of the building whereas the horizontal structure is represented by intersecting and continuous cellars in Al-Iwan and the rooms especially the upper floor rooms.

  The outer walls are left empty and abstract unless for the shown stones that are carved; however the inner walls are strained with lime in blue color. Besides, we could find base of floors in some rooms made from ceramics with height 1.5m. Paving is done with the yellow stones in the courtyard and the inner rooms with using alabaster in crucial zones. Also, it is possible to find a courtyard paved with black and white stones [7].

- **The openings**
  Frontages facing the streets are usually covered or semi closed except the opening of the main door; however, the internal frontages facing the courtyard are opened consisting of several openings for ventilation such as windows. Ventilation system in these houses depends on forming a contrariety of pressure to be able to have good air through opening the lower and upper windows.

6. Elements of Architectural Design of the Modern House

Features of modern houses are as follow:

6.1. Historical Preface of Al-Huseiniyye District under the Frame View of Damascus City

Al-Huseiniyye district in south Damascus is located after Sayyidah Zaynab district on the highway from Damascus to As-Suwayda. It is a residential enterprise built in mid 90s of the 20th century resembling a workers resident like the one built in the end of 19th century and the beginning of 20th century [1].

6.1.1. The Interior Design of Modern Residential Samples in Modern District

- **The spaces and form of Plans**
  The residential units were organized in an allied way, on long parallel rows, and each with three floors. Each two consecutive rows share a posterior separating zone which forms a private courtyard related to the ground floors. It is worth mentioning that this residential zone misses green areas except two islands where the green areas are represented by a group of small trees planted along the sidewalks beside the rows of these residential units.

- **Residential Units**
  The residential unit or department consists of three rooms that are semi identical in shape and size in addition to a space specialized for services such as kitchen, bathroom, and water cycle. The space reserved for one department does not exceed 75 m2 only for the repeated floors; however, the space for the ground floor of one department with its posterior courtyard reaches approximately 100 m2.

  The internal courtyard that was inevitable became rejected in the beginnings of the 20s of the 20th century, but there is an internal or main room (Salon or Sofa). As for Al-Iwan, it was totally removed in both the transitional and modern architecture it cannot be present with the absence of the internal courtyard. Instead, opened balconies were built at the front of the street side where there is movement of passers-by in such a public place.

  The role of the internal courtyard as a natural cooler of...
weather is now done by artificial air conditioners. Besides, the presence of electronic machines in the kitchen took it from neglected level to a primary one in the residence [7].

As for the external fronts and windows, they were treated in a completely different way in which the openings to the outside zone become a special characteristic of the modern houses. Besides, the new techniques greatly influenced the shape of the residence [4].

It is worth mentioning that not all of the residential samples in Damascus city give this dim view of Al- Huseiniyye district. The latter is a sample that appeared in the end of the 20th century with its designs and plans unable to satisfy personal, public, and environmental needs at the same time [6].

Figure 7 presenting chosen samples from Damascus City presenting the evolution of the architectural elements of houses in three districts of three periodical stages: traditional, transitional, and modern [2].

Table 1 presenting the architectural elements used in every period, in addition to the given conditions of the nearby environment and the design limits that must be respected to answer these given terms, then analyzing and evaluating the extent of respecting and conforming these elements to the climatic data of the city [1].

<table>
<thead>
<tr>
<th>Elements</th>
<th>Old Architecture</th>
<th>Modern Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Materials</td>
<td>• Limestone</td>
<td>• Cement</td>
</tr>
<tr>
<td></td>
<td>• Wood</td>
<td>• Glass</td>
</tr>
<tr>
<td></td>
<td>• Clay- paste and plaster</td>
<td>• Aluminium</td>
</tr>
<tr>
<td></td>
<td>• Ceramic</td>
<td>• Cement block</td>
</tr>
<tr>
<td></td>
<td>• Colored Stones (white, black, and yellow)</td>
<td>• Flagstones</td>
</tr>
<tr>
<td></td>
<td>• marble</td>
<td>• Marble</td>
</tr>
<tr>
<td>Shape of Spaces</td>
<td>Opened to in-house and presence of internal courtyard with water and green elements</td>
<td>• Opened to the outside, cancelling the opened courtyard and replacing it by a main closed space</td>
</tr>
<tr>
<td></td>
<td>• Al- Iwan and the other spaces are higher in level than the roof of the original residence</td>
<td>• Independence and privacy of each residence</td>
</tr>
<tr>
<td></td>
<td>• Connected and convergent web of houses</td>
<td>• Absence of the green and water elements</td>
</tr>
<tr>
<td></td>
<td>• Various considerations of spaces</td>
<td>• Ignoring the resident’s needs of spaces of suitable size and quality</td>
</tr>
<tr>
<td></td>
<td>• Buildings directed according to sun</td>
<td></td>
</tr>
<tr>
<td>Openings</td>
<td>Windows located in the center of the wall at a determined fixed height in each space without taking into consideration the size of the space and its depth</td>
<td>Using the concept of varying the pressure by locating windows in different levels</td>
</tr>
<tr>
<td></td>
<td>• Opened to the outside</td>
<td>• Windows and openings to the inside courtyard</td>
</tr>
<tr>
<td></td>
<td>• Benefiting from the woven curtains to reduce insolation, but negatively affects the entrance of air</td>
<td>• Benefiting from “ Almashrabiat” to best control insolation.</td>
</tr>
</tbody>
</table>
Table 2. Environmental Requirements in relation to Materials, shape of space and openings

<table>
<thead>
<tr>
<th>Elements</th>
<th>Environmental Requirements</th>
<th>Designs Most Relevant to Environmental Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Materials</td>
<td>• Natural materials “environmentally friendly”</td>
<td>1. Climate:</td>
</tr>
<tr>
<td></td>
<td>• Materials with low power consumption</td>
<td>• Moderate climate in winter and hot in summer</td>
</tr>
<tr>
<td></td>
<td>• Using light colors or colors close to white and capable of reflecting sun rays</td>
<td>• Long sunrise duration with vertical insolation in summer but with mild height in winter</td>
</tr>
<tr>
<td></td>
<td>• Materials with high heat capacity and low heat conductivity</td>
<td>• Generally low humidity with very dry weather in summer</td>
</tr>
<tr>
<td>Shape of Spaces</td>
<td>• Fulfilling requirements of residents in the building</td>
<td>2. Requirements:</td>
</tr>
<tr>
<td></td>
<td>• Using entrance and exit for air currents in the corridors of entrance and exit</td>
<td>• Get rid of high temperature in summer</td>
</tr>
<tr>
<td></td>
<td>• Choosing suitable depth for rooms to achieve the natural required lightening</td>
<td>• Protection from insolation in summer</td>
</tr>
<tr>
<td></td>
<td>• Obtaining internal borders for good sound and temperature isolation</td>
<td>• Benefiting from insolation periods in winter</td>
</tr>
<tr>
<td>Openings</td>
<td>• Location and directions of openings with controlling insolation in buildings</td>
<td>3. Fulfilling requirements:</td>
</tr>
<tr>
<td></td>
<td>• Obtaining good temperature to gain residents’ comfort</td>
<td>• Benefiting from insolation using fronts in winter</td>
</tr>
<tr>
<td></td>
<td>• Normal ventilation of spaces</td>
<td>• Isolation in summer using thick roofs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Getting rid of high temperature with personal lightening during summer (wide angle, clear sky)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Preparing a suitable weather in the internal courtyard through openings in it (controlling insolation, humidity, and ventilation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• More connection with land (benefiting from humidity of the land and balancing temperature through benefiting from constant temperature of the land)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Benefiting from insolation, ventilation</td>
</tr>
</tbody>
</table>

Figure 7. Samples of Damascus houses
It is clear that old architecture are much more better than modern one which benefits from the non-environmentally friendly and high power consumption materials. In addition, modern architecture ignores temperature effects and colors of external fronts. It does not play a role in organizing the internal space; however it was replaced by closed narrow spaces with no lightening. In contrast, spaces in the old houses of Damascus not only have a special role fulfilling the environmental requirements, but also obtain a space that fulfill the residents' requirements and needs.

7. Conclusion

The traditional house in Damascus is considered a reflection of serious attempts in the environmental design which is compatible with regional climate. This is because it presents great samples with intelligent environmental solutions in a way that the design of the old Damascene house was closed to the outside for temperature isolation; however, it was opened to in-house opened courtyard which is linked to all surrounding rooms. This helps in creating a local moderate climate specifically temperature, humidity, and ventilation. Environmentally friendly construction materials were used, which are considered local building materials like natural stone, clay, wood, straw and other. These substances have great heat capacity of low energy consumption in either the manufacturing phase, or installation, or even maintenance, which do not contribute in increasing the internal contamination of the building for being healthy natural originated materials. As well as the use of suitable forms, sizes, and location of openings through benefiting from protrusions and protecting the openings by Msharabeyya, to break the unity of the sun's rays in the external interfaces. These factors helped in alleviating the hard climatic conditions and achieving ecological balance and best possible response to climatic conditions that is compatible with the available potentials that time [2].

Unlike modern residential buildings, which are considered a step towards the access of modern construction methods and liberation of limited forms giving the ability of building in larger horizontally and vertically spans which no of us one can deny. However, these buildings completely ignored climate closed central space, called (the sofa) replaced the interior courtyard within the traditional dwelling, with a deficit of this space to insuring sufficient light and air inside the building. Also it relied on those structural materials of medium or high energy content, such as cement, glass and aluminum, which are widely used today in constructing modern residential buildings, despite the lack of suitability of climate in the region. This was accompanied by the excessive use of heaters and air-conditioners to achieve the thermal comfort inside the building, without considering the amount of energy consumed. In addition to the non-observance of the shapes, sizes and the appropriate places of the openings. This indeed prompted some of the residents to use additional architectural elements to fill the defects of those openings and their negative climatic effects, whereas others made changes on the size of those openings and perhaps in some cases completely closed them. The negative effects of those openings are represented by their inability to control the required incoming solar radiation, or performing of the required role in the natural ventilation process [1].

Thus, the modern residential buildings fulfilled more ease and comfort in our life apparently. But besides it was unable to answer the surrounding environmental needs, which is one of its aspects is to insure psychological comfort for residents, causing a lot of environmental damage, such as over energy consumption resulting over thermal emissions. This leads to a fact that these buildings are characterized by not taken into consideration the correct environmental conditions, which reflects negatively on the environmental architecture.

References