Architectural and Physical Characteristics of Indigenous Gaza’s Houses

Emad S. Mushtaha*1 and Takahiro Noguchi2

1 PhD Candidate, Graduate School of Engineering, Hokkaido University, Japan
2 Professor, Dr. Eng., Graduate School of Engineering, Hokkaido University, Japan

Abstract
Living and environmental studies of housing planning, construction and operation have low priority in studies as compared to the conventional interests in cost, size, form, location and aesthetics. In 1994, the Palestinian National Authority (PNA) was founded due to the implementation of the Oslo peace agreement. Consequently, many living units have been built to alleviate housing problems with absence of specific studies related to the cultural distributions and environmental comfort of indoor spaces. Therefore, this study focuses on finding proper architectural and physical characteristics of indigenous houses throughout analyzing Gaza’s historical house layout architecturally and environmentally. Investigations have obviously achieved a significant guidance for future planning and construction.

Keywords: Iwan; court; healthy design; thermal performance; physical planning

1. Introduction
Gaza is a small city of 45km² located in Palestinian Territories (Fig.1) and at 34N° longitude with 31E° latitude 1. Historically, Gaza has been controlled by many empires, including the Pharaonic, Babylon, Persian, Hellenistic, Roman, Byzantine, Islam, Crusaders, Mamluk, Ottoman, British, Egyptians, Israeli, and finally the PNA. Currently, several housing problems are subject to discussion; one such problem occurs in the Middle East where the highest densely populated areas in the world are located within Gaza’s camps with 100.000 persons/km² 2. In 1997, a study was done for a sample of people distribution in Gaza city and it was found that 40.7 % of the sample has been moved to new houses, 30.4 % didn’t move their houses and renovated or added new floors, while 28.9% lived in houses forty years and older3. Accordingly, the new PNA is faced with the responsibility of providing living units, jobs, and food and to raise the quality of life without harming the environment4. Nevertheless, extensive areas have recently been built with widely western planning in public and private buildings (Fig.2). Achieving lively and healthy housing designs within the least means in a sound environment is more important than the balanced population growth and housing densities.

2. Objectives
The study aims to achieve a significant guidance for future planning and construction through the following means:
2.1 Find out the characteristics of architectural and cultural spatial distribution of indigenous houses.
2.2 Find out the most effective and required strategies for a healthy environmental design.

3. Framework of the Study
A signed peace agreement between both Palestinian and Israeli formal sides was internationally fulfilled in 1994. Accordingly, the PNA has taken the role of administrating some Palestinian cities. Gaza was one of these cities that could provide efforts to compose available resources for future development and planning. The municipality of Gaza had focused on rearranging and planning the city. The mayor of the city had activated a group of 13 professional members for surveying and documenting the whole historical buildings of the old city. The professionals were skilled in different fields such as architecture, urban planning, traffic engineering, and surveying. This group...
highly collaborated with each other for a period of three months and could present a readily available documented report. In the report, it had been mentioned the comprehensively historical, geographical and housing background of the city. Documentations of mosques, churches, schools, hospitals, castles, hot-baths, public markets and houses’ planning were graphically, photographically and descriptively included. The real conditions of each project (i.e. area, age and style, constructional elements and future ability of a required restoration) had been documented without detailed analysis. The drawing were surveyed directly from the site and estimated the age of buildings according to its constructional and architectural elements, shapes and arches. About 30 houses were considered as historical houses within different times. In this study, architectural analysis, investigations, activities, photographing and planning for only last twelve courtyard’s historical houses (Fig.3 and Fig.4), which range from 80 - 400 years ago (i.e. before the British Mandate) have been considered.

Most of these houses are not occupied or maintained due to the absence of public awareness and lack of institutional involvement. On the other hand, mainly specific reasons were behind the selection for these houses as follows:

1. These houses have been considered a lively example for a comfortable living environment; where they have been built away from the influence of the occupation.
2. These houses had considered “court-concept” in the design, which had a positive reputation among people of the city
3. Absolutely positive persuasion of the necessity of utilizing the court-concept in the residences.

4. Planning Features and the Living Environment
Sixty historical buildings such as mosques, hot-baths, castles, public markets and houses have been listed in the bulletin of Gaza’s Municipality. Generally, it is noticed that the number of traditional houses is decreasing due to the absence of public awareness and lack of institutional involvements. This paper focuses on analyzing these twelve houses’ plans; which have been located in and beside Gaza’s old city (Fig.3).

Visualized and analyzed studies of these historical houses’ plans (Fig.4 and Table.1) have simply noticed that most of plans consisted of five functional elements. These elements are described hereafter.

4.1 Gates and Entrance Halls
Eleven entrance halls of the sample’s buildings have consequently an indirect entrance with an average, minimum and maximum entrance hall area of 7.5, 2.2 and 16.0 m² (Table.1) to work as:

1. A lobby serves functionally for inhabitants to put on and take off their shoes and additional heavy clothes (Fig.5). This design is influenced by Asian culture; in which Gaza is located.
2. Cutter of the invasion of privacy by strangers to provide social privacy and security as shown in all houses (Fig.4) except house number 5, which has a direct entrance. In eleven houses of the sample, a stranger’s eyes can’t see the interior spaces if the external door is opened, (i.e. the available corridor will be shown only with its utilities).
3. Neck to connect private with public spaces smoothly in a homogeneous integration (Fig.5).
4. Modifier to change guests’ to inhabitants’ status; where movement inside spaces is personalized only for inhabitants.
5. A visual conductance to strengthen court vision clearly; hence a transition from a narrow to a wide space gives a psychological convenience (Fig.5).
6. Most entrance halls are directly connected to the W/ C “water closet” for some external usages and to release the bad smell outside as shown in the Figure 4 plan numbers 1,2,4,5,7,8,9,10,11 and 12. This leads occupants to welcome foreign visitors in a room, which has direct contact with the entrance shown in the Figure 4 plan numbers 2,3,5,6,9 and 11. These rooms are served by the closest water closet.
7. In the case of a big lobby, it is used to enlarge spaces to work as a multipurpose area as shown in Figure 4 plan number 6.
4.2 Kitchen, Cabinet Spaces, WC and Bath

Analysis, numbers, average, minimum and maximum areas of kitchen and cabinet spaces, and WC and bath are arranged in Table 1. Storage spaces were connected directly to the kitchen as shown in Figure 4 plan numbers 1, 6 and 7, or indirectly separated spaces as in Figure 4 plan numbers 5 and 8.

These spaces are added to another space for enlarging their functional storage areas. The kitchen is the space where a woman spends her morning. It is known that Arab women consider this space as their favorite place for practicing some activities. It is found in Table 1 that 8 of 12 houses indicated that the kitchen is positioned in the east with high and small openings to provide maximum privacy for occupants as well as decrease thermal penetration of sunrays into indoor spaces in the summer. Openings are oriented to the court to enhance cross ventilation inside shaded areas; hence a fresh wind is coming from the northwest (Fig.6), while unpleasant odors are thrown out from small openings. In the winter, direct and reflected sunrays can easily penetrate the space to maximize a healthy living environment. The same concept is found in some rooms as shown in Figure 7. Therefore, an orientation of space can maintain a positive and healthy living environment.
4.3 Courts

A court is connected directly to linear spaces designed of bedrooms and a kitchen with its storage and spatially configured in relation to the Iwan. Climatic and socio-cultural aspects have been considered in the court design. Courts are completely opened to the clear sky (Fig.6) or partially shaded with overhangs and arcades. They tend to differ in size and shape according to the geographical location, type of climate, property shape, and location, resulting activities, and socio-cultural relations. In Table 1 and Figure 4 it is found that the number seven plan numbers 2, 3, 5, 7, 10, 11 and 12, the number three plan numbers 1, 8 and 9 and the number two plan numbers 4 and 6 courts are consequently oriented to the north, center and to the south. Moreover, an average, minimum and maximum area of the court is arranged to 47.65, 20.0 and 93.0 m² in Table 1. The average percentage of the courts’ area is approximately to be 22% of the average area of the sample. Northern courts are arranged to gain immense wind for enhancing cooling loads inside spaces; while southern living spaces are shaded at noontimes where the sun is at its highest altitude. Courts could provide:

1. Privacy for a family and keep activities away from invasion of privacy as shown in Figure 5 and 7.
2. A place for not hearing disturbing noises.
3. Alleviate congestion of extended families because it is known that people of Gaza like extended families.
4. It reduces risks by offering an accessible path of escape in case of sudden emergencies.
5. Generally southern courts enhance the filtration process for the incoming wind of the winter; hence it contains much soil and dust. On the other hand it is absorbing and reflecting sunlight throughout massive and decorated rough floors, and then releasing pleasant rays to inner spaces (Fig.6 and Fig.7). This enhances immediately thermal performances of indoor spaces.

4.4 Iwan "The Living Space"

An Iwan is a covered space where inhabitants can practice their occasional activities properly (Fig.8 and Fig.9). Throughout the analysis it is found that the average, minimum and maximum area of the Iwan is arranged to be 20.0, 9.0 and 40.0 m² (Table 1).

It is located among several spaces such as bedrooms and the kitchen. Several long and medium windows are oriented to the Iwan for thermal and social purposes. A house’s heart is expressed by the Iwan position, where cultural occasions can be performed easily. It is found in Table 1 and Figure 4 that 8 of 12 houses had 9 Iwan spaces. The southern (plan No.1, 8, 9 and No.10), eastern (plan No.3 and No.7) and western (plan No.6, 7 and No.11) Iwans are widely found to enhance cultural aspects; hence prayers should be directed to the southeast (i.e. Kaaba “Mecca in Saudi Arabia”) (Fig.10). On the other hand, the southern and eastern Iwan have effectively exploited the required northwest wind of the summer (Fig.5), hence it is noted that the percentage of total cross breeze is approximated to 71.9% in summer while the remaining 28.1% is received from different directions'.
4.5 Bedrooms

Collected bedrooms in an L or I shape are arranged to surround a court. These rooms are located on one or two sides of rectangular buildings. In Table 1 and Figure 4, it is found that the average, minimum and maximum area of bedrooms are arranged by 16.5, 9.7 and 21.4 m². These rooms are occupied at night as the parents’ room; female and male rooms, while external rooms are multi functional spaces where it could be used as a guestroom due to its direct location with the main entrance. It is noticed from Figure 11 and Table 1; that 74% of bedrooms are found in the southwest direction to represent 29 bedrooms, while 23% and 3% are found in the east and north to represent also the 9 and 1 bedroom. Moreover, it is recommended to face Kaaba to the southeast during sleeping times, thus the best direction of bedrooms is the north south (Fig.12).

5. Principles and Guidance of Planning

Architecturally, the previous analysis is arranged for different subjects:

5.1 Distribution of Zones.

From the previous study of the impressive historical plans, it is observed that plan No. 1 represents Gaza’s houses hence most of houses are kept in the shapes of spaces almost the same L and I shape. This plan is arranged mainly to three differently functional and periodic activities (Fig.14) as follows:
a) **Zone 1** consists of collected services such as a kitchen, cabinet room and bath (Fig.13), (i.e. morning spaces) and is almost always positioned in the east; where massive walls are used for lessening heat transition and losses. Thus, shadowed and cooled spaces are created in this zone to embrace human activities (Fig.6 and Fig.7). A strong relation to the main entrance has been created for cultural responses. On the other hand, it is found that 8 plans (No.1, 2, 5, 6, 7, 8, 11, and 12) have an I shape for zone 1, while the rest of the plans have an L shape.

b) **Zone 2** is a predominant space; which consists of the Iwan and the court together (Fig.13) in L and I shape (i.e. daytime spaces) and contributed to the north-south orientation. The constructed L-shape is directed to filter the northern winds directly into a shaded southern Iwan (Fig.8). L-shape is shown in Figure 14 plan numbers No.1, 2, 5, 7, 8 and 10, while the rest of plans have shown an I-shape plan numbers 4, 6, 9, 11 and 12.

c) **Zone 3** is a relaxing space, which consists of bedrooms (Fig.13) (i.e. nighttime spaces) and is positioned...
in a north-south orientation with an L-shape like plan numbers 1, 3, 4, 5, 6, 7 and 8 or I shape like plan numbers 2, 9, 10, 11 and 12. This zone is heated during the day then at night cold air damens the space, then the heated space moves upward to the upper side where small openings are found. Its concept is similar to Figure 8.

These zones consequently represent three different positions. It is noticed that inhabitants are moving inside most of the plans consequently clockwise to the sun and shadow movement (Fig. 14). Some houses have double circles as in Figure 14 plan numbers 6, 7 and 8. That happens when some functional elements such as the entrance, Iwan and court are multiplied. Generally, shapes of spaces are almost arranged to L and I shapes for the structural reasons and social demands.

5.2 Standards of a Flat’s Spaces
Mr. Kurazz, an architect who works on the Palestinian Housing Council (PHC) evaluated two new housing projects, which were constructed in Gaza from 1994 - 1997 by the PHC. The number of housing units is estimated at 736. The two projects consisted of 23 tall buildings with a ground floor and 8 housing units floors. A sample of 200 respondents was interviewed and filled out questionnaires. As a result, several recommendations have been drawn according to the inhabitants’ opinions and their actual modifications in housing units.

1. Lack of a proper entrance hall.
2. The entrance door is negatively closed to the guest room.
3. The WC too far to the guest room.

Table 1: Directional Distributions and Average of Building’s Spaces

<table>
<thead>
<tr>
<th>Building Number</th>
<th>NO.1</th>
<th>NO.2</th>
<th>NO.3</th>
<th>NO.4</th>
<th>NO.5</th>
<th>NO.6</th>
<th>NO.7</th>
<th>NO.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>178.8</td>
<td>133.0</td>
<td>172.2</td>
<td>123.0</td>
<td>123.0</td>
<td>195.9</td>
<td>337.0</td>
<td>2441.2</td>
</tr>
<tr>
<td>1. Buildings</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>80</td>
<td>158</td>
<td>250</td>
<td>X</td>
</tr>
<tr>
<td>2. Number and distribution of 1 Gates and Entrance Hall</td>
<td>1N</td>
<td>1E</td>
<td>1N</td>
<td>1W</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
<td>1E</td>
</tr>
<tr>
<td>3. Average Area of</td>
<td>5.2</td>
<td>6.3</td>
<td>5.4</td>
<td>5.5</td>
<td>5.6</td>
<td>5.7</td>
<td>5.8</td>
<td>5.9</td>
</tr>
<tr>
<td>3. Bathroom Room</td>
<td>1N</td>
<td>1E</td>
<td>1N</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
</tr>
<tr>
<td>4. WC</td>
<td>1E</td>
<td>1N</td>
<td>1E</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
</tr>
<tr>
<td>5. Bath</td>
<td>1N</td>
<td>1W</td>
<td>X</td>
<td>1E</td>
<td>1E</td>
<td>X</td>
<td>1W</td>
<td>1S</td>
</tr>
<tr>
<td>6. WC</td>
<td>1N</td>
<td>1E</td>
<td>1E</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
</tr>
<tr>
<td>7. Court</td>
<td>1C</td>
<td>1N</td>
<td>1N</td>
<td>1S</td>
<td>1E</td>
<td>1N</td>
<td>1S</td>
<td>1E</td>
</tr>
<tr>
<td>8. Bedrooms</td>
<td>1N</td>
<td>1E</td>
<td>1N</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
<td>1W</td>
<td>1S</td>
</tr>
<tr>
<td>9. Lobby between spaces</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9.5</td>
<td>5.8</td>
<td>X</td>
<td>16.8</td>
<td>X</td>
</tr>
<tr>
<td>10. Lobby between spaces</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9.5</td>
<td>5.8</td>
<td>X</td>
<td>16.8</td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>N*</th>
<th>Ind Ent</th>
<th>C</th>
<th>BR</th>
<th>X</th>
<th>N</th>
<th>S</th>
<th>W</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Entrance</td>
<td>Indirect Entrance</td>
<td>Center</td>
<td>Bedroom</td>
<td>Without</td>
<td>North</td>
<td>South</td>
<td>West</td>
<td>East</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NO.9</th>
<th>NO.10</th>
<th>NO.11</th>
<th>NO.12</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Buildings</td>
<td>178.8</td>
<td>133.0</td>
<td>172.2</td>
<td>123.0</td>
<td>123.0</td>
<td>195.9</td>
</tr>
<tr>
<td>Status</td>
<td>178.8</td>
<td>133.0</td>
<td>172.2</td>
<td>123.0</td>
<td>123.0</td>
<td>195.9</td>
</tr>
<tr>
<td>1. Buildings</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>80</td>
<td>158</td>
</tr>
<tr>
<td>Status</td>
<td>178.8</td>
<td>133.0</td>
<td>172.2</td>
<td>123.0</td>
<td>123.0</td>
<td>195.9</td>
</tr>
<tr>
<td>1. Buildings</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>80</td>
<td>158</td>
</tr>
<tr>
<td>Status</td>
<td>178.8</td>
<td>133.0</td>
<td>172.2</td>
<td>123.0</td>
<td>123.0</td>
<td>195.9</td>
</tr>
</tbody>
</table>
4. Lack of natural light and ventilation in the WC.
5. Lack of storage spaces within the kitchen.
6. Windows without security bars.

To have a complete and a successful study, supporting the residences with fundamental characteristics of the historical architecture is highly recommended; hence most of the achieved recommendations were interpreted in the previous analysis of historical houses.

Moreover, in his study, satisfied areas for various spaces have been clearly investigated without clearly mentioning the importance of courtyard planning in housing units.

Stressing on utilizing the “court-concept” in future planning and design is urgently needed. Hence, courts will provide people’s satisfaction both culturally and environmentally, which in turn makes it possible to easily estimate the favorable standards of interior spaces. Thus, from the previous interpretations, it is noticed that the historical houses’ plans could represent a forward reference, which requires strong permanent development with people’s satisfactions in term of sustainability.

5.3 Distribution of Courts

Most historical houses included a courtyard design. Many features could integrate and develop planning and design in different appearances as follows:

1. The court is a good concept for extended families, hence families in Gaza have been culturally encouraged to share internal spaces. It is recommended to join courts to the planning and construction processes in order to achieve social satisfaction by practicing regular daily issues in terms of extended families.

2. Environmentally, courts should be oriented to gain both benefits of sun and wind during the year, and should be spatially connected to livable spaces.

6. Conclusions

Throughout the analysis of historical houses’ plans, conclusions can be drawn for architectural and physical characteristics as mentioned hereafter.

6.1 Architectural Characteristics

1. The daytime zone has clearly implied the heart function of a body in a house; as it has been located in the center of space to draw out cultural activities such as discussions, enjoyment, meals and prayers during the daytimes.

2. The court has been spatially connected to the Iwan for enhancing basically horizontal extended families within fairly large internal spaces.

Culturally, this mentality has continued in society in a vertical extension. Therefore, the historical houses’ area and distribution could be a good guidance for future planning while it has achieved the satisfaction of inhabitants according to Kurraz’s study.

Northern and southern courts are consequently arranged to gain substantial benefits of the wind and sun. This will lead to the required satisfaction. Central courts represent culturally social spaces to perform social activities with required privacy.

6.2 Physical Characteristics

1. The houses are oriented to the north-south axis for climatic reasons; therefore it is preferable to extend houses on the long east-west axis to exploit strong winds in summer and sunlight in winter.

2. The northern and southern courts have been found to mitigate thermal stresses, lessening the gradient of temperature; and decreasing cooling loads.

3. The rest of the year in between hot and cold climates is located in the comfort zone. Thus, clearly central courts haven’t been needed. It has been used as mentioned before as a local of sociality.

4. Massive walls with small external openings decrease heat losses and improve the thermal environment of a room. This has encouraged inhabitants to move throughout the plans with the clockwise rotation of the sun. Thus, it is highly recommended to keep utilizing insulated walls with small outside openings.

Generally, it is strongly recommended to activate previous characteristics into current processes of planning and construction to get closer to sustainability in terms of cost, culture, and the environment.

References

3) Salha Raid, Gaza City, A study on Cities Geography, (1997), Gaza City, P.177. (in Arabic)
7) Hussam Kurraz, (2003), Post-Occupancy Evaluation of Housing Projects Implemented by Palestinian Housing Council, Internal Report of Palestinian Housing Council (PHC), Meeting No.11, Gaza, Palestine. (in Arabic)