ANALYTICAL EVALUATION OF HOUSING PATTERNS IN SUDAN

Case study: Evaluation and improvement of plan types of detached houses in Khartoum

The purpose of this paper is to evaluate plan types in the capital city of Sudan, Khartoum, relative to circulation and privacy characteristics with illustrating diagrammatical unit requirements and spaces. The paper also tends to illustrate how those features can relate to a certain life style. The use of diagrammatic representation such as adjacency diagrams is quite unique and valuable here because plan types of detached houses in Sudan vary drastically according to several factors such as religious beliefs, understanding of privacy and indeed housing related issues, including land area, location and housing affordability. Therefore, the process of classifying those plans became a necessity. It concluded that in the Sudanese detached house, the most dominant factor in the space arrangement, the use of space, the circulation and the life style is the culture of the religion and its understanding.

Keywords: Sudanese detached house, adjacency diagram, privacy, zonings for users, culture of religion.

1. Introduction:

This paper is an attempt to evaluate plan types of the detached house in the major culture in Sudan represented by Muslims. As the diversity of plan types of detached house in Sudan makes it very difficult to analyze, this study will classify plan types and describe them in certain terms and factors such as privacy and comfort.

Sudan is the biggest country in Africa, located in the mid-east of the continent, with a population of 39,148,162 (estimated in July, 2004) and a multi-national culture of a majority of Muslims (70%) and minority of African tribal religious (25%) and Christians (5%). Therefore the Islamic culture affects life styles according to the adherence and understanding of each individual. For instance, in Islam, women are considered sacred in many aspects, such as their appearance, their contact with men and their contribution in public activities is nearly limited as Islamic culture enhances gender separation since the 6th century, so the use of space at home is affected according to gender as well. The capital city, Khartoum, is a very rich example of this diversity, as the population of this city (around 7 million) has gathered from different tribes since the Turkish era (1822-1885). Accordingly, the city is facing a major problem of migrants from all over the country that have caused housing to suffer from various complications. The diversity of plan types in this city could be described as chaos, referring to the number of inhabitants who tend to buy the land to build their houses according to their own visions and requirements (social housing has not yet been established in a proper way). Despite the fact that there are some real estate companies, including the National Housing Fund (a department of the Local Ministry of Housing and Engineering Affairs) struggling to create a new possibility of the image of living in apartment houses. The city is facing the problem of horizontal expansion because most of the citizens prefer to live in detached houses. Although the diversity of plan types is hard to describe, the social order beyond this diversity is not only a very interesting topic, but it also reflects the influence of religion, traditions and community culture upon building the place called "home". As "home" should provide comfort and privacy, religion and traditions insist more on the privacy of women activities at home. Therefore this paper will describe privacy on the context of male and female comfortable use of space at home. Fig. 1 shows a photograph of a regular neighborhood of detached houses in Khartoum.

2. Purpose of the study:

This study suggests a method of evaluation for patterns relative to certain factors such as privacy, circulation and space arrangement, using a diagrammatical method introduced to simplify the process. The evaluation tends to elaborate the home requirements in the Sudanese detached house, circulation and type of detached house in different spaces. As the community in Sudan is socially rich and communally active, the study also tries to explain how this social richness can affect the location of the space and its use. The study also...
aims to explain the meaning of privacy in the Sudanese detached house in a
graphical methodology (how the residents and guests can use the space and the
conclusions in that use). The exercise of evaluation here aims to find out what type
of plans the detached house in Sudan has, and to look for popular plans in certain
modern periods. The study is also an attempt to explore types of patterns and
create a method of revising house plans in their design concept and spatial
solutions in terms of the above-mentioned factors.

3. Requirements in the Sudanese detached House:

A questionnaire was held in June 2003 to elaborate the requirements of the
Sudanese detached house and the results of this research as well. Table 1 presents
the age groups of responders. From the questionnaire, we found in 130 families
(100 nuclear families and 30 extended families) that the average size of a nuclear
family is 6.02 members, but for all families, it is 7.23 members. Table 2 shows the number of children for nuclear families.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>30</th>
<th>40 ~</th>
<th>50 ~</th>
<th>60 ~</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of responders</td>
<td>14(11%)</td>
<td>52(40%)</td>
<td>42(32%)</td>
<td>22(17%)</td>
<td>100(100%)</td>
</tr>
</tbody>
</table>

Table 1: Age groups of the responders of the questionnaire. June 2003

If we look at the result of the questionnaire taken in June 2003, where 130 random respondents answered a question about whether they would like to live in a detached house or an apartment, the result is as follows in table 3. The reason behind studying the detached house can be clear.

In table 3 we can see clearly that the Sudanese people prefer
to live in detached houses because they can have a yard space and experience more community life in the neighborhood of the detached houses.

3.1 The yard space:

The yard space is considered as a valuable part of the Sudanese house. It can be configured as a social space since families use it for their meetings. The yard space functions climatically in the Sudanese house like any other Arabian house as it represents the void for the heat to transfer to and from the outside, and for the wind to flow through the solid elements of the house. Table 4 shows the results of asking randomly 130 respondents if they think the yard space should exist in the detached house.

Table 4: Necessity of yard space in the detached house (questionnaire June 2003)

<table>
<thead>
<tr>
<th>Necessity of the yard space</th>
<th>It is necessary</th>
<th>Necessary, but waste of space</th>
<th>It is not necessary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>83%</td>
<td>17%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 5: Closest space to the main entrance of the house (questionnaire June 2003)

<table>
<thead>
<tr>
<th>The closest space to ENT.</th>
<th>ENT Hall</th>
<th>Yard Space</th>
<th>Guest Area</th>
<th>Living Area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>13%</td>
<td>51%</td>
<td>3%</td>
<td>3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

So we can conclude that the yard space is a fundamental space in the Sudanese detached house. It is also the closest space to the entrance of the house as shown in table 5. Moreover it is valuable to the extent that the Sudanese people have more than one yard space in their houses as can be seen in table 6.

3.2 The living area:

The living area in the Sudanese detached house functions like
any other house, except it is mostly used during the day time, as the family uses the yard in evenings and at nights. Since most of the Sudanese houses do not have a dining area, they normally use the living area to eat in as well. It can be also the space where the family receives their female guests as we will enlighten later. The use of the living area in the detached house is more multi-functional than it is in the apartment type.

3.3 The guest area:

According to the Islamic culture that was gained by the 6th century, most of the Sudanese receive their guests in what can be called the guest area. This space might not be designed in every detached house in Sudan as we can see in the result of the questionnaire below. We can also see the difference of receiving a formal guest or receiving a friend or a neighbor (informal guest) in table 7.

Table 7: Space for receiving formal and informal guests

<table>
<thead>
<tr>
<th>Type of space</th>
<th>Guest Area</th>
<th>Living Area</th>
<th>Yard Space</th>
<th>Verandahs</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving formal guests</td>
<td>69%</td>
<td>11%</td>
<td>5%</td>
<td>9%</td>
<td>6%</td>
<td>100%</td>
</tr>
<tr>
<td>Receiving informal guests</td>
<td>35%</td>
<td>25%</td>
<td>22%</td>
<td>12%</td>
<td>6%</td>
<td>100%</td>
</tr>
</tbody>
</table>
We can guess from table 7 that the guest area is also valuable in the detached house in Sudan.

The rest of the requirements in the detached house exist in any standard houses such as the kitchen (mostly used by female residents), the sanitary area that includes bathrooms, toilets and washing area, and the bedrooms. So we can conclude here with listing the requirements in the Sudanese detached house and referring to them with as follows to use in the adjacency diagram:
1. The yard space: in most of the samples, there are two yards spaces, we will refer to the front yard as (Y1) and to the back yard as (Y2).
2. The living area as (LA)
3. The guest area as (GA)
4. The kitchen as (K)
5. Sanitary areas as (S)
6. The bedroom as (B).

There might exist some different spaces, but not in every house, such as women reception (WR) or entrance hall (H). To avoid confusion, there are also spaces like verandas that are used as living areas in some samples, so we will refer to them as living areas (LA).

4. Introducing the use of the adjacency diagram:

Since the process of evaluation is complicated as we look at patterns one by one, the diagrammatic representation is introduced. The adjacency diagram is a product of analyzing the circulation and the space arrangement in the plans. Since plans are not quite similar, the adjacency diagram will help to find out similarities and differences and assist in grouping them. This very same diagram can be drawn for patterns for different countries. Prof. Kurosawa has developed this diagram to analyze house plans in Japan (Look references 1, 2, 3), but the diagram introduced here is more developed to include the outdoor spaces (yard spaces). Moreover, for the Sudanese detached house, the adjacency diagram is quite functional not only to analyze the patterns but also to apply zonings for uses of space relative to users (male and female residents or male and female guests). This zoning process helps to visualize how the detached house is affected by the culture of religion and its understanding from one individual to another. The diagram will also help to figure out the defects in the design concept of the layout of some plans.

4.1 How to draw an adjacency diagram for patterns:

The process of drawing the diagram starts by elaborating the circulation in the pattern as can be drawn in fig.2A and fig.2B. We can set the spaces in the grid in fig.2C, according to their adjacency to the outside walls of the house. From the grid diagram, we can draw a circulation grid diagram (fig.2D) to simplify the lines. The final adjacency diagram can be drawn by omitting the open corridors connecting the yard spaces (Y1) and (Y2), and put the spaces in one circumference of a circle. Fig.2E represents the final product that is used to evaluate the plans.

4.2 Classifications of plans according to the adjacency diagram:

We can identify some groups of plans for detached houses in Sudan using the adjacency diagram. Assuming that there are the basic five types of spaces (yard spaces (Y1 and Y2), living area (LA), guest area (GA), kitchen (K), and sanitary areas (S)) and two bedrooms (one for male residents and female residents) as an ideal number of spaces for a middle class family. As we have drawn from the samples
collected for the rest of the analysis, the living area is the central space in most of the samples. In fact, there are always odd cases where the plans are different such as having more than two bedrooms or less than the five basic spaces mentioned above (less than 10% of the samples). Basically, there are six types and by adding the bedrooms they form 90 types of plans. In fig.3, we can see the basic six types. As it is a systematic diagram, we use the same type to represent the mirrored plans. The types are named alphabetically from (A to F) and the spaces between the five basic requirements (Y1, Y2, GA, K, and S) in the circumference of the circle are numbered from 1 to 5 (clockwise) to name the types when we add the bedrooms. There should be 12 basic types for the Sudanese detached house, but since (GA) has access mostly from (Y1), (GA) should be always adjacent to (Y1) in the adjacency diagram. Hence, the other six basic types are not considered here (we found no samples for those six types). Fig.3 shows the popular types as a result of analyzing the collected samples using the adjacency diagram.

![Diagram of popular types](image)

**Note:** One sample is different from the assumed types (close to Type D1-4).

**n=150**

4.3 Findings of classifying plan types of detached houses in Sudan:

After using the adjacency diagram to represent the samples collected in June/July 2003, we attempted to find the existence of each type in certain periods as shown in fig.4 above. We realized that in each period there was a favorable type of plans that existed more than other types.

[1] Looking at fig.4, we can clearly see that type (B) was used more than other types in the period of 1975-1984 for following reasons:

- Gender separation was positively adhered by residents; so they preferred to build the kitchen (K) away from the guest area (GA), since they would not like for the guests to see their women (religious beliefs).
- For the first reason they preferred to have the sanitary area (S) close to the guest area (especially in the case of houses with one toilet) to avoid the intersection of circulation.
Looking again at fig.4, type (C) was the dominant type in the period of 1985-1994 for the reason of the change in culture of the Sudanese people, because educated individuals brought back part of the western culture. That is why it was reflected in the layout. For example, the layout of type (C) can apply for modern apartment houses with terraces.

For the period of 1995-2003, type (A) was dominant, so that it took different properties: for instance, the kitchen (K) became closer to the guest area (GA) for better service. But, as, in most of houses in this period, the guest area (GA) had its own toilet; the sanitary area (S) of the house could be built far from the guest area (GA).

For real estate houses (built after 1998), they follow the houses of the period of 1995-2003, so the most dominant type is (A).

4.4 Using the adjacency diagram to analyze the privacy and comfort ability in the use of space:

To explore the comfort of using the space in the Sudanese detached house, we have to define users according to the followings:

1. Male residents  2. Female residents  3. Male guests  4. Female guests

After that, zonings of spaces can be used in the adjacency diagram to define the areas which can be used by each type of users. We will use the example in fig.2A to elaborate the concept of zoning the spaces in the detached house and to explore problems relative to the culture of the religion as shown in fig.5. The diagram looks complicated with zonings for all the users, but to simplify the diagram, the problems will rise in these two situations depending on the culture of the users:

1. Female residents would feel uncomfortable using the spaces which male guests have access to.

2. Male residents would feel uncomfortable using the spaces which female guests have access to.

In order to explore the two above-mentioned problems, we proposed to simplify the diagram in fig.5 into two diagrams as shown in fig.6. Looking at fig.6, we can clearly notice that female residents use the front yard (Y1) to access the house uncomfortably if a male guest is received in (Y1). We may explain that in the plan of the house in fig.7. Female residents could use a different entrance to the house through (Y1) and (Y2) to the living area (LA). It would be also uncomfortable if there is a gathering of male guests in the front yard (Y1) as shown in fig.7. On the other hand, we can clearly see in fig.6 that male residents would not be comfortable accessing the front yard or their private room (bedroom) if a female guest is accessing the house through Y1 or sitting in the living area (LA). We can also illustrate it in the plan of house in fig.8. From the figures above, we can see that type (A1-2) has many confictions in the use of spaces, but if we reverse the process by designing type (A1-2) from the adjacency diagram, then we will have better example of that type as shown in fig.9. In fig.10, we have chosen some of the popular patterns shown in fig.3, to elaborate more about the use of zonings. There will be a systematic analysis of all the 90 patterns in the next research.
Fig. 7: Uncomfortable use of Y1 for female residents

*We assumed that in each of the patterns, there is a guest sanitary area, which can be used by male residents if a female guest is received in (LA), and in all patterns, female guests can access the house through (Y2).

<table>
<thead>
<tr>
<th>Type A1-1</th>
<th>Type A1-2</th>
<th>Type B1-4</th>
<th>Type C1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Type A1-1 diagram" /></td>
<td><img src="image2" alt="Type A1-2 diagram" /></td>
<td><img src="image3" alt="Type B1-4 diagram" /></td>
<td><img src="image4" alt="Type C1-2 diagram" /></td>
</tr>
</tbody>
</table>

Fig. 10: Examples of using the adjacency diagram and zones of users

- Male residents accessing the space
- Zone for spaces used by male residents
- Zone for spaces used by female guests
- Male guests accessing the space
- Zone for spaces used by male guests
- Zone for spaces used by female guests

Fig. 8: Uncomfortable use of spaces for male residents

Type A (1-2)

![Type A diagram](image5)

(Land area = 350m², Built area = 150m²)

If a female guest is received in (LA), then the male residents can use the guest area and the guest.

Fig. 9: Example of a better layout for Type (A1-2)

5. Results of studying samples for detached houses in Sudan

After using the adjacency diagram to study random samples of detached houses built in different periods in the city of Khartoum, collected in June, 2003, the findings are as follows in notes and diagrams with a reminder that all the houses are inhabited up to date.

1. In 48% of the samples, we have found that the female guests use (or pass) the backyard (Y2), the living area (LA) and the sanitary area (S).

Therefore, the following consequences are noticed:
- The living area (LA) becomes uncomfortably accessible to male residents if a female guest is received in (LA).
- If there is only one sanitary area (S) in the house, then it would not be comfortably accessible to

male residents or male guests.
- The living area (LA) acquires a new different function as a reception for female guests (can be seen in all adjacency diagrams as there is no female guest area in the typical detached house in Sudan).

2. In 67% of the samples (Y1) is accessible to female guests.
① We can see that the results for the existence of a male guest area and a female guest area are as follows in fig.11.
② In 84% of the samples, male guests have access to the front yard (Y1) and the guest area (GA), but in our sample we found some different results of 16% where they can access other spaces due to some defects in the design concept: for example, the guest area or the guest sanitary area was designed to be accessed only from the living area.
③ In 20% of the samples, male guests use the same sanitary area (S) with the house residents and female guests simply because there is only one sanitary area in the house.
④ Fig.12 illustrates the number of houses with one bedroom, 2 bedrooms, 3 bedrooms and 4 bedrooms (results of questionnaire asked in June, 2003). Fig.12 may indicate that houses with 3 bedrooms have to be studied, but because most of those who have 3 bedrooms consider the temporary rest area (or bedroom area) in the guest area as a third bedroom (look fig.2A), we consider houses with two bedrooms to create more compact layouts in order to solve the problem of horizontal expansion in the city.
⑤ In a questionnaire asked to 130 respondents about comfortable use of space when a guest is received in the house, the results are in table 8. Looking at table 8, it is clear that the detached house in Sudan needs a serious revision of design concepts.
Findings are based on the comparison between adjacency diagrams drawn from the samples and re-checking house plans.

6. Conclusions

By deploying the adjacency diagram to analyze all the samples and by illustrating the zonings of users in the detached house in Sudan, we have reached an ideal method of evaluation for all the plans. The following conclusions should be considered when conceiving the design for detached houses (Look fig.9&13):
① The house should always have a second entrance for female residents and female guests through the back yard (Y2) to the living area or the female guest area (to avoid passing the front yard by male residents or guests). (Refer to Notes ①, ②).
② It is also recommended for male residents' bedrooms not to be accessed from the living area (in the cases when the living area is used as the female guest reception). (Refer to Note ①)
③ It is recommended to have a space for female guest reception instead of using the living area for that function. As a result male residents can use the living area if a female guest is received in the house. (Refer to Note ②)
(Refer to Note ①)
(Refer to Note ②)
(Refer to Note ①)
④ The male guest area should not be accessible from the living area. If so, the female residents can use the living area comfortably. (Refer to Note ④)
⑤ The house should always have a guest sanitary area for the use of male guests (could be used by male residents if a female guest is received in the living area). (Refer to Note ①, ②).
Examples of better layouts for the Sudanese detached houses where desired privacy and comfort ability can be conceived as in fig.13 (a better example of type A1-2 in fig.9).
In the case of compact detached houses with one sanitary area (for all users), some sub-types of types (A), (B), (C), and (D) can be developed for better layouts. That also will be explored in the next research paper.

The conclusions above could be drawn from a different methodology without using the adjacency diagram, but using the diagram here, has made it the analysis more systematic and logical, and it would save time rather than using ordinarily the plans to compare types and explore the problems in each plan type. Moreover the use of the diagram increases the prospects of simplifying the analysis process from data to simple calculations for the types of the diagram (accordingly types of plans), then deriving the conclusions of type popularity and comfort ability. The aforementioned exercise was to explore the very influential factor on the use of space represented by the culture of religion and how it affects privacy and circulation. These factors should be reflected in the design concept and the layout of spaces. This research also concludes with the fact that the concept of designing the detached house in Sudan has remarkably changed since 1970s because the religious understanding has differed in the last three decades. The concept of privacy in the house unit is realized within the limits of the belief of each individual. We have to remember the effect of the Islamic lifestyle has influenced the use of the space in detached house in Sudan (the emphasis on male and female culture and the sacredness of women). Since the traditions of the Sudanese people are originated from principles of Islam, they also follow the culture and lifestyles brought by Islam itself.
Remarks:

1) The problem of the horizontal expansion of the city could be solved by inventing apartment housing that satisfies the Sudanese people. Designers and real estate companies should think of developing apartments with open terraces and wide balconies to replace yard spaces that Sudanese people require in their homes.

2) Detached house can be found in other Arabian countries such as the Egypt (in the south), Saudi Arabia, Kuwait and Bahrain (that can be known also as the front yard/back yard court house). On the other hand, there is the courtyard house that has a yard space in the middle of the house in other Arabian countries such as Syria, Iraq, Algiers and Morocco. The analysis for the courtyard house can be similar to the detached house, in which the courtyard can be the central space.

3) The yard space in the Sudanese detached house represents the outdoors family space. Y1 is mostly defined as the front yard, which is used by male residents in afternoons, evenings and nights to receive guests, sleeping in hot summer nights and male residents' meetings, etc. Y2, mostly defined as the back yard, is similarly used by female residents.

4) The living area can be classified as a semi-private area in the detached house. The yard spaces are, as well, classified as semi-private areas, where the residents can use as what we can call outdoors living areas as well as an outdoor guest area.

5) Guests in Sudan visit usually in the evenings (except on Fridays), so that the guest area can sometimes be used as a secondary living area for male residents. It also depends on how the family furnishes the guest area.

6) The kitchen in the Sudanese detached house is mostly a female resident area, where they can do their cooking, chatting while cooking itself and even other activities such as beautifying and using local cosmetics in certain ways with certain arrangements.

7) The use of bedrooms in the Sudanese detached house is different from other types of houses. Bedrooms can often be turned into a second living room for male or female residents in the afternoons and evenings. The privacy in those bedrooms is quite limited.

8) The orientation of the house would not change its plan type. Although it may have a remarkable effect when applying the concept of zoning the spaces according to users.

9) Since the collected samples are from 1975 up to 2003, this period is classified in three periods of ten years each (eight years for the last period 1995-2003), so the change of types used can be understood according to reasons mentioned in the main text such as the adherence level to gender separation, the transformation to what can be called a modern Islamic thinking (educated individuals brought back part of the western culture) or types appearing as a result of mixing properties of previous plan types.

10) In fig.9, if we look at the new example of type A1(2), when we change the orientation of the front yard (Y1) and the back yard (Y2), to side yards (Y1 and Y2), we could have different entrances for male and female users though (Y1) and (Y2) respectively. So in that case we avoided the mixed use in the front yard (Y1) as in the previous example (look fig.9 below). If we also assume that the male residents can access their bedroom without passing (L.A), and they can use the guest area sanitary (GS), then we would avoid the mixed use in (L.A) and (S) as shown in fig.9. This assumption was applied to the other plan types in fig.10 to explore the comfort ability in the plan types and the result was as shown in fig.10.

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研究の背景と目的・方法

本研究は、スウェーデンの首都ハルツウム（約 700 万人）に近年多く建設されている都市型戸建住宅（Fig. 1, 2A）を対象として、その型変化をもとに多様な住宅プランについて、バターン図式を用いた類型化とゾーニング（男女生活領域の分離）による分析評価を加えて、イスラームの住様式により見出された住居型を見出すことを目的としている。スウェーデンの都市型戸建住宅はイスラーム圏の典型的な分離型のコートハウスと異なり、前庭・裏庭のコートハウス（平屋）である。（このタイプの住宅はエジプト南部、サウジアラビア、クウェート等にも見られる。）都市部ハルツウムにはスウェーデン全国からの移住者が増え続けて、大量の住宅建設による都市のスプロールが深刻な問題となる。また、イスラームをメジャー文化とする多民族混在、近代化、西欧文化の移入などで住宅型が短期間で著しく変化し多様性を増している。このような多様な住宅型の分析を基に、住居の動線と室配置の特徴を把握する。住宅平面バターンを用いる（Fig 2A, 2D）。筆者の一人内藤は日本（首都圏、北海道）の戸建住宅の1階プランをバターン図式化した方法を発展させて、スウェーデンの戸建住宅の図式化では、新たに外部空間（前庭、裏庭）、単位空間に取り入れたバターン図式化する。スウェーデンのバターン図式住宅を例にとり、室配置や動線の比較検討から住宅型の変化展開方向等を分析する。さらに、イラストの住様式に特有な男・女家族の領域の分離・混在をバターン図式上の単位領域のゾーニングから割り出して、住様式により見出される住宅型を示すことを試みる。住宅プラン（150 サンプル）のバターン分析と住まい方調査分析（130 件）をつないで合わせて考察する。

2. 住居型のバターン面での基本空間単位

スウェーデンの戸建住宅を構成する基本空間の模様になる。前庭（Y1）が裏庭（Y2）。前庭（Y1）は男性家族の接客（男性客）と団扇にも使われ、裏庭（Y2）は女性家族の接客（女性客）と団扇にも使われる。男性家族の接客（男性客）と団扇（男性客）の見出しとして行われる。家族は夕方から夜は前庭、裏庭に出る。食事室として使われる。女性客をも含めると会員となる。屋上にある庭はリビングにつけ、（3）寝室（GA）。男性家族の接客客、男性の第 2 のリビングとなる。女性客の時は男性家族はこの接客客や寝室を使う。一部を仕切って客用、家族用、対面用。対面用寝室にも使われる。（4）台所（K）。女性が炊事、家事など多用途に使う。S サニタリー（S）。（5）洗面室（S）：洗面、洗濯、浴室、トイレ。（6）寝室（B）。寝室の 1 つは男性、もう 1 つは女性の第 2 のリビングとしても使われ、個人のプライバシーには制約が多い。専用サニタリーがつくこともある。

3. 住居型のバターン図式化とバターン分析

・バターン図式（Fig. 2E）

スウェーデンの戸建住宅の室配置型を把握できる「隣接バターン」図式は次のように行われることで、6 つの領域（S）が対応する。円周に近いところが「近接バターン」図式を対称に図式化できる（Fig 2E）。円周内に近い領域（L）を固有のデータ（L）を図式化する。円周の中段・下段の左・右の 4 ケ所に前庭（Y1）、裏庭（Y2）、台所（K）、サニタリー（S）を並べ、円周上のこの 4 ケ所（Y1, Y2, K, S）の並び方のうち左右対称の並び方は住方だけにして全ての並び方を円周上に置く（室配置が左右（東、西）対称の住宅型は 1 つずつバターン図式を対称）できる。

円周に寝室（B）を並べる前後の「基本バターン」図式（Fig 3 的左）は 12 タイプできるが、スウェーデンの住宅サンプルでは上記の円環上の 4 ケ所（Y1, Y2, K, S）の並び方で、前庭（Y1）と接客客（GA）とが隣接しない並び方は著しくなかったので基本バターンは 6 タイプとなった。

「基本バターン図式」の円環上の 5 ケ所（Y1, Y2, K, S, GA）の間に寝室（B）を配置で「隣接バターン」図式を完成させる（Fig 2F, 2G）。

・バターン分離（Fig. 3.4）

スウェーデンの住宅サンプルでは、隣接バターンは異なっていても基本バターンと同じサンプル配置が比較的未経験している（Fig. 3）。また、住居型には建築時期（1975-2003 年）で大きな変化がある（Fig. 4）。[1975-1984 年]型は「台所（K）を含む女性家族領域を男性接客客（GA）から隔離した男性家族に、男性客分離型」と多く、このタイプは、この時期以後に激減する。[1985-1991年]型は「家族領域を 1 まとまりにして接客客（GA）から隔離した欧米様の近代モダン型」と呼べる型である。この時期のように新しい（1996-2003 年）型は、「男性家族・男性客分離型で、且つ接客客（GA）に台所（K）を隔離させた接客客サービス重視型」が急増した。男性客用トイレ（GS）をもつサニタリー（S）が接客客（GA）と隔離される配置が多い。

・ゾーニング（Fig. 5, 9, 10, 13）

互いに訪問しあうことが多いスウェーデンの住宅において、女性が他の住民の視線から保護され、来客時にプライバシーと快適性を保つには、（1）男性来客時の男性領域（接客客（GA）- 前庭（Y1））と女性家族領域「リビング（LA）- 裏庭（Y2）- 台所（K）- サニタリー（S）」（Fig. 5.10）が混在せず、（2）男性来客時の女性領域「リビング（LA）- 裏庭（Y2）- サニタリー（S）」と男性家族領域「接客客（GA）- 寝室（B）- 前庭（Y1）」が混在しないゾーニング（領域構成）が必要とする（Fig. 5-9）。

スウェーデンの戸建住宅型（Fig. 3）の中で、上記の 2 条件を満たす型と混在する型は、その隣接バターン図式上の上記の 2 条件に挙げられた領域ゾーニングをしてみると見分けやすい（Fig. 9, 10）。このゾーニングは接客客（GA）に客用トイレ（GS）がある場合ゾーニングである。隣接バターン図式を用いたゾーニングの住用の改良に役立てられる（Fig. 9.13）。

4. まとめ

住居型のバターン分析と住まい方調査分析を踏まえて、スウェーデン都市型戸建住宅に特有される基本的な室配置・動線条件を挙げることができる。これらの条件を満たす住居型はバターン図式のゾーニングから導かれる（Fig. 9, 13）。（1）男性家族と女性客が前庭（Y1）を通らず、裏庭（Y2）を通ってリビング（LA）にアクセスできる（Fig. 9, 13: EN1）をとる。 Investigators（Y1）は、男性家族の対面客（B）が、女性客の来るリビング（LA）を通らずに前庭（Y1），接客客（GA）にリビング（LA）をアクセスできる動線をもたこと。（Fig. 9, 13: 8m-11-6a）（3）女性客が来客しても男性家族客がリビング（LA）を使うことができるよう、女性客スペースをもっとも望む。論文ではリビング（LA）に女性客スペースをもつコンパクトプランを採った（Fig. 9, 13）。（4）男性の接客客（GA）はリビング（LA）を通らず、前庭（Y1）から直接アクセスできる。（Fig. 9, 13: 11-6a）接客客（GA）と男性家族の対面客（B）からリビング（LA）を通らずにアクセスできる客用トイレ（GS）をもつこと。（Fig. 9, 13: 6s）

スウェーデンの首都ハルツウムの住宅型の類型化変化は上記の室配置・動線条件を満たす方向に展開していると見解するが、今後は体系的なバターン分析から、多様な住様式に導き細かに対応する住居体系を求めることが課題である。

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