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Abstract

In Sudanese houses the plan layout is differentiated along gender lines. This study explores and analyses the layout syntactically according to user/gender zones rather than along the functional definition of the structures/spaces. In general, these houses consist of the family/female domain and the male/visitor domain. The mean depth of the family domain is always slightly higher than the male one seen from the street. However, internally the family gathering zone is always the most integrated one. The spaces are gender differentiated but mostly on the basis of equality. Two different layout models are identified, the parallel and the sequential. The latter gives power to the male gender.

Introduction

"Who said that we want them around us", asked one of the women, responding to my question. We were five females and our hostess sitting in the kitchen veranda (a female space). "Well, in many other cultures, there is no such segregation between the genders", I said. "In what way do you mean?" said another lady, who was sitting in front of me. "Men have their own *bosh* (courtyard), and women have their own" I said. "Yes?" said the same lady, as if she wanted me to explain further; "A woman, should always stay away from the view of a male stranger". "Or maybe it should be the other way around", said a young lady. "I think, such an arrangement is convenient for us as well", said one of the neighbours. Our hostess intervened in the conversation and she said, "In this veranda I spend most of the day time. It is far from the *diwan* (a male room), but it is close to the kitchen so I can easily keep an eye on the cooking. This place is also close to the *bosh*, where my kids play. Here, I can move around without wearing a *toup*. Here I receive my guests, we eat, drink tea and coffee, sit or rest". She stopped for a while, to catch her breath, "Here, is my little, private world." Suddenly, the previous young lady said, "Men have their own interests, and we have ours. I don't care if we share the same room or not. Actually I don't want that. I want to keep my privacy, and I want them to respect it". In a deep, determined voice, she added. "But, what I really want is my decision and opinion to be respected. What I want is to have my rights. My right to say yes or no. I just want my right as it is written in the *Koran*, the Holy Book. Why is this so difficult for them to understand and for us to acquire?" (Farah, field study, 1998)

The opening scene presents and raises the question of gender division and gender identification in the use and occupation of domestic space, which is considered one of the main spatial features, not only in Sudan but also in most Arab Muslim societies. Generally the separation

Keywords:

Sudanese house,
gender domains and
layouts, power and
space

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of males and females in various aspects of life and particularly in the domestic environment is a pivotal debate among researchers from different disciplines and backgrounds around the world (Ahrentzen et al 1989; Booth 1999; Rendell et al 2000). The division is not as obvious as it was some decades back although it is still found in many ways across all cultures. (Ahrentzen et al 1989)

Gender and space

In the Arab Muslim world of the Middle East and North Africa, gender division exists and is well defined. However this division is promoted and enforced by means of cultural constraints rather than religious obligations. The house, as an artefact of culture, confirms gender classification on the use and occupation of spaces. The strictness of this gender division in the domestic environment, by physical or mental barriers, varies from one country to another, from one subculture to another, and from rural to urban situations. However, in general, it exists in different degrees and ways throughout the Arab national cultures. Unfortunately, there is a confusion and lack of clarity on the input of culture on the one hand and Islam on the other, on the gendered nature of the spatial divisions. In many architectural research reports, the spatial position of the female in the house has been interpreted as “a segregating and secluding” sphere embedded in religious tenets rather than in cultural norms (see Petherbridge 1987, Mazumdar & Mazumdar 1997).

It might be important to this debate to clarify two points. The first point is that there is no definite obligation in Islam concerning the spatial location of the female in the house. As a matter of fact, there is nothing mentioned in the Koran about the seclusion or segregation of the female in the house or anywhere else. All the surats (Koran verses) say concerning the built environment is about respecting privacy, i.e. to seek “permission” to enter others’ private domains and secluded areas. This is an obligation and a right accorded to all persons irrespective of gender. The second issue is the use of the terms “seclusion and segregation” by scholars in the identification of the female sphere. They too easily adopt these concepts without providing empirical evidence or spatial interpretation based on empirical observation. The intention here is not to investigate whether or not there is gender division in the use and occupation of Sudanese home, it is rather about how gender is related to the spatial configuration in terms of zones.

Function zones or/and user zones

The design process in the field of architecture usually groups the spaces of any given structure/building according to the functions of the spaces. According to Amorim these zones of functions, for many architectural schools around the world, may be defined as social, private and service zones (1997:18.2).

To analyse the architect-designed house as a configuration of function zones is of great interest. However, in the case of the Sudanese house a labelled space serves generally more than one function (Farah 2000: 169). Moreover, the house, particularly in the north of Sudan, is usually categorised into domains and zones, each of which are occupied and dominated by particular users. The inhabitants themselves name spaces in relation to gender identities rather than to their function. For instance, they say *bait El-rugal* and *bait El-nisoan*, which mean male residence and female residence respectively. They also say *bosh El-rugal* and *bosh El-nisoan*, meaning the male and female courtyards. These two terms usually indicate a number of spaces. The courtyard (*bosh*) itself is only one of them. However, these terms also integrate in

their meaning the demarcation between the zone of male visitors and the family/female core. This paper examines the underlying spatial structure of the home in terms of zones of users that embed gender codes instead of zone of functions. It is also an investigation into the spatial configuration of female spaces as socio-spatial phenomenon.

The sample

Wad-Nubbawi, the selected site of this empirical study, is one of the oldest traditional, ethnic quarters in Khartoum, the capital of Sudan. It is predominantly inhabited by a homogeneous middle class community, who shares the same religious convictions and social customs. The physical mobility of its people is minimal; most of the families, in Wad-Nubbawi have resided in the same locations for generations.

The adopted methodology for the fieldwork consists of:

- Formal and informal interviews with the inhabitants of the selected houses, complemented by a structured questionnaire supported by personal observation. Furthermore, each person interviewed was asked to fill in a time-space table of a one-day diary (i.e. how did he/she spend the previous day, when, where and with whom). A time-space table was also filled in for the weekend, indicating the “usual” pattern of his/her average week.
- House survey i.e. measuring and drawing of plans and furniture plan of the selected houses.

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In order to help the respondents relax and to establish trust, the first author (Farah) and her survey team chose areas of Wad-Nubbawi, where they had some relatives or friends. The support of the relatives and the fact that half of the survey team is female made their task much easier and made them feel more welcome among the inhabitants of the particular case study area. The survey covered 78 households who live in both modern as well as traditional houses. (Farah 2000:21-35).

We contemplated two syntactical options for the study, i.e. either to carry out an analysis of all houses or to present and analyse only a limited number of the total sample. The second option was the chosen. The sampling process can be described as a combination of stratified purposeful sampling, critical case sampling and extreme or deviant case sampling (Patton 1990). The main intention was to ensure, in the sampling, that the major characteristics of the Wad-Nubbawi district of Omdurman, the rare/unique and the complex in it are all represented.

The decision to concentrate on only a select number of the total sample is based on two reasons: first, the main approach and perspective of the study is to observe aspects rather than to reveal general statistical knowledge. Thus, informative cases and critical ones are selected. Secondly, the study was not concerned with quantification, because a limited number has the advantage of allowing for a more qualitatively in-depth discussion of the main focus of the overall research (Farah 2000). Nevertheless, the syntactic results of the small data will be submitted to statistical assessment for the accurateness.

The cases have been classified as traditional/modern, nuclear/extended family residences. A number of cases were selected, from each group. Within each group, some cases give a similar kind of information while others give information that is very much different and somehow unique. The selection includes cases that are similar to other cases but also different in pattern to the rest. Hence, the sample accommodates both the characteristic and the divergent cases. Moreover, most of the modern buildings (architect-designed buildings) were

included; they represent the 1/3 of the selected cases. The selection from each group was based on a qualitative classification of the designs and the ethnographical data. (Farah 2000:66-92)

The final sample for the space syntax analysis consists of 17 cases occupied by 29 households. The 17 cases include 12 buildings of traditional materials, and 5 modern buildings of reinforced concrete (architect-designed houses). 5 cases are nuclear family residences, 7 extended family residences inhabited by 17 households, and 5 cases are semi-independent sections within extended family residences. The sample will be presented as follows, the first twelve are traditional domestic buildings and the last five cases are modern buildings. The study will integrate both ethnographical and topological data.

The analytical approach

The layout of the house is viewed as a relationship between different, spheres, domains, and zones. First, the layout of the house has been viewed in relation to the street, i.e. the exterior and *public sphere* (E), and then with the interior and the *private sphere* of the home (I).

Secondly, based on the empirical findings, the latter sphere is identified as a relationship between two main *domains*, Family and Male (F&M). The family domain is further differentiated into three sub-domains (or zones) in relation to users and use. A zone for the family of both genders to gather (Fg), a zone for a personal private and rather individual use by

family members (Fp), and finally a zone which accommodates spaces that are solely for the females (Ff). Thus, we can say that the private sphere (I) is a combination of M, Fg, Fp, and Ff; all in configurational relation to the public street (E).

The preceding discussion can be formulated as follows:

The exterior public sphere E: This is the street, which is defined mainly as the public sphere. There is no “privacy” in such a zone. It is the sphere of the strangers.

The interior private sphere I: This is the private territory of the inhabitants, which is used by the inhabitants and their visitors. It is a private sphere in relation to the exterior public sphere. This sphere usually contains two domains, the male domain and the family domain (M and F).

The male domain M: Male members of the household and their male guests dominate this domain. It usually consists of a number of spaces that serve multiple functions. This domain, although part of the private territory of the inhabitants, is the least private area of the house (in relation to strangers).

Female family members are expected to be alert while using this zone due to reduced privacy, therefore their entrance to this area is permissible only under certain circumstances.

The family domain F: Family members use this domain in different ways. Yet, it is dominated by the females and the children, and thus identified by the inhabitants as a females and children's sphere. The male guest, from the Muharam category, may enter this domain under controlled conditions, while female guests are permitted into and received in this part of the private sphere of the house.

The Gathering zone Fg: This is a sub-domain of the private family domain where the family members, of both genders, gather for social activities, such as chatting, watching TV etc. It is dominated and used by the female members and the children. Thus a certain

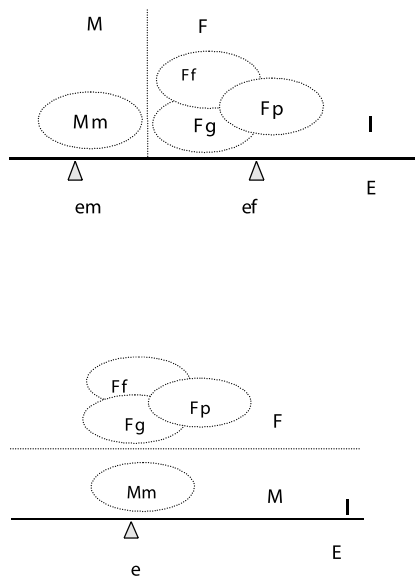


Figure 1. The parallel model, relations between exterior and different domains/zones. For abbreviation, see text.

Figure 2. The sequential model, relations between exterior and different domains/zones. For abbreviation, see text.

“symbolic” regulated habit is expected of the male members when entering this zone, thereby providing some freedom to the female members. This is especially important as female guests are usually received in this zone. It is more private than the male zone in relation to male visitors, yet it is less private for the inhabitants.

*The personal/individual zone **Fp*** Each gender or both could use this zone, yet its use is considered more personal. For instance, the bedroom, although seldom used in the Wad-Nubbawi cases, it is a personal and private space. Some sort of permission is needed to enter this space.. The family bathroom is usually used by both genders of the family members. Thus, these spaces are rather private and for personal use.

*The female zone **Ff*** This zone accommodates a number of spaces that serve different functions and is dominated by the female family members, who perform different types of activities within this zone. Some of the spaces are exclusively used by women (kitchen and female toilet); while some other spaces, e.g. the kitchen veranda might be occupied, for short time, by the male members of the family (we will refer these spaces as Ffg).

In the following two sections syntactic analyses of the user zones for each case will be conducted twice.

- The first analysis will consider three domains, the exterior stranger domain and the two interior inhabitant/visitor sections of the house represented by the family and male domains. The latter ones will contain all spaces that are located in them, including transition spaces (T).
- The second analysis will consider five zones including the exterior. Here only the function spaces will be included; transition spaces and storerooms will be excluded. The spaces will be sorted into the identified five zones (Mm, Fg, Ff, Fp and E). The argument for including and discussing the syntactic properties of the exterior is based on the fact that the exterior represents the third corner of the triangle of spatial spheres of the three prime categories of users, i.e. stranger, visitor and inhabitants

The categorisation of each space in a certain zone is based mainly on the information received from the inhabitants themselves, how do they use each space and how do they define each space in terms of the selected users zones. In the questionnaire, respondents, from both genders, were asked “which place he/she considered as male, female, personal, and family collective space?”. They were asked where the family usually meets and for what reasons and if this or that space has duality of use. The respondents were also asked to tell how he/she had spent the previous day, and how does he/she usually spend his weekdays including Friday. The respondents were asked to state the time of day, location and company while using the space.

The syntactic analysis of each house is carried out by making convex maps, i.e. establishing the fewest and largest convex spaces of the house plan. In a significant number of the cases in the survey, the shower or bathroom has two doors. The actual use of this room (bathroom) suggests that when one door is open the other will be closed (endpoint). This eliminates the probability of misinterpreting the use of this room as a transition space, which is not the real function of these two doors (Farah 2000:104). Justified graphs and syntactic calculations were made. Then, the mean of the syntactic properties (control and integration) of the domains and/or zones are compared for all the 17 cases. Finally an analysis of variance, ANOVA, will be applied to the syntactic properties.

Each entrance is separated in the syntactic calculation. I.e. the entrances from the street are not connected into one space, which is the normal practice in space syntax analysis. Farah (2000:91-110) presents arguments for why this must be done so when studying houses of the Arab-Muslim cultural area. The main reason is that it is not possible, for gender separation reasons, to use the exterior as an intermediate space between the entrances. In other words, the exterior cannot be on a ring of the house configuration. Or, that the exterior spaces belonging to each entrance are always a-type spaces.

The layout plans of the houses and the justified graphs (figure 3, see Appendix at end) of each case display the previous identified spheres and domains of the Sudanese house (figures 1&2).

Syntactic analysis of three domains (E, M and F)

Depth property

The depth of each space from the street is calculated. Where there is only one entrance the male domain is generally more shallow than of the family domain. When there are more than one entrances some of the function spaces of both male and family domains are shallow.

Relations of category and control are mapped into space in a pattern constructed out of depth and rings. Depth among a set of spaces always expresses how directly the functions of those spaces are integrated with, or separated from each other, and thus how easy and natural it is to generate relations among them. (Hanson 1998:78)

By testing and comparing the mean depth of both domains we found out that in all cases the mean depth of the family domain is greater than that of the male domain, from the exterior (table 1). The mean depth of the family domain ranges from 2.82 to 6.53 while for the male domain the mean depth ranges from 1.66 to 3.80. The mean depth differ most in all houses with a sequential model layout, which seems natural, and in houses containing many spaces, not quite natural.

Table 1. Family and male domains. Number of convex spaces and mean depth from the street in the seventeen cases. Type: T=traditional, and M=modern house; N=nuclear, E=extended and S=semi-independent family; P=parallel and Q=sequential model.

Case #	Type	Male spaces	MD	Family spaces	MD
1	T N P	5	2.40	11	2.90
2	T E P	11	2.27	19	3.79
3	T N P	12	2.50	12	4.17
4	T N P	6	2.00	13	3.38
5	T E P	6	2.33	16	3.12
6	T E Q	9	3.55	19	6.53
7	T S Q	9	3.22	6	3.83
8	T S Q	4	1.75	11	4.18
9	T S Q	4	1.75	9	3.55
10	T S P	6	2.33	11	2.82
11	T E P	10	3.80	46	6.06
12	T E P	7	3.00	52	6.36
13	M S P	7	2.57	11	5.45
14	M S P	5	2.40	12	3.33
15	M N P	5	2.00	20	4.60
16	M S Q	5	2.20	9	3.55
17	M S P	3	1.66	24	5.71

Accessibility between the interior domains

The permeability (see figure 3) between the two interior domains (M and F) shows that, only in six out of the seventeen cases is there a single internal link between these two domains (cases 1-5, 8 and 12). No space from the male domain in these cases belongs to a ring. Ringiness is an important aspect of houses. Hanson says:

The presence or absence of rings expresses the degree to which these relationships are controlled, or marked by an absence of choice, forcing permeability from one space to another to pass through specific intervening spaces. It is these spatial potentials which are used to make a culturally-intelligible pattern of space within the domestic interior. (Hanson 1998:78)

Notable here is the fact that, these six cases are traditional houses. The rest of the cases, eleven in number, show that there are more than one option connecting the two domains; at least one ring is found. Case 11, 13, 14 and 17 have one ring. Here the head of the family or the male members of the family can choose to enter the *divan* directly through the family domain or through the courtyard, which acts here as transition area. Case 6 has two rings crossing the gender border, while cases 7, 9, 10 and 15 have three rings. Case 16 has four rings. Notice that we here are only considering rings that cross the boundary between the male and family domains.

In some cases there are also internal rings within the domain itself, i.e. family domain (cases 10-12). It seems that the permeability choice is found in most cases, particularly in modern ones. This choice offers easy and direct accessibility between the two domains. Of course this choice of movement is still controlled by social codes. In the traditional houses, the distinction between the two domains is sharp, and mobility is more controlled. This might perhaps mean that the mobility between the two domains is very low.

Concerning the accessibility between each domain and the exterior, we have found that in twelve out of the seventeen cases, each domain has independent access to the outside world. In four cases (6, 7, 9 and 16) out of the five, this single exit to the exterior is mainly due to the shape of the plot. These four cases are independent sections of extended family residences; thus, the female may use indirect access through neighbouring houses to avoid male gatherings (if there is any). Yet, the mobility of the female outside the house is usually very seldom after sunset.

Integration properties

The mean integration of each domain for the 17 cases is presented in table 2. It shows that in ten cases out of the seventeen, the mean integration of all the convex spaces that fall in the family domain is more integrated than the mean integration of the male domain spaces. The male domain is the most integrated in only six cases. In one case (case 2), they have equal

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Case #	Type	M	F	E	Rank order
1	T N P	1.46	1.23	1.46	F>M=E
2	T E P	1.15	1.15	1.47	F=M>E
3	T N P	1.67	1.46	2.23	F>M>E
4	T N P	1.30	1.10	1.67	F>M>E
5	T E P	1.21	1.37	1.86	M>F>E
6	T E Q	1.21	1.35	1.89	M>F>E
7	T S Q	0.99	1.15	1.40	M>F>E
8	T S Q	1.31	1.18	1.44	F>M>E
9	T S Q	0.91	0.97	1.25	M>F>E
10	T S P	1.21	1.14	1.63	F>M>E
11	T E P	1.45	1.66	2.23	M>F>E
12	T E P	1.77	1.55	1.96	F>M>E
13	M S P	1.23	1.13	1.51	F>M>E
14	M S P	1.58	1.39	2.14	F>M>E
15	M N P	1.22	1.13	1.53	F>M>E
16	M S Q	0.72	0.96	1.23	M>F>E
17	M S P	1.40	1.32	1.91	F>M>E
	mean	1.28	1.25	1.69	

Table 2. Mean integration values (RRA) of the three domains (M, F and E) for each case and for all. M=male, F=family and E=exterior domains.

value. Notice that a higher RRA value means low integration and vice versa. If we look at the mean of all the family domains (1.25) it is somewhat more integrated than the mean of all male domains (1.28), while the exterior is the most segregated (1.69).

The performing Analysis of Variance (ANOVA) compares different domains, family, male, and exterior within each house (blocking for house), table 3. We can conclude from the comparisons that there are significant differences between the male and the exterior zones, between the family and the exterior zones, but not between the male and the family zones, at the 1 % confidence level.

Table 3. ANOVA of integration values for the three domains (M, F and E).

Domains	Mean estimate		Mean estimate		
			M	F	E
Male	1.281	M	-		
Family	1.249	F	1	-	
Exterior	1.694	E	0.0001	0.0001	-

Control properties

The control values in table 4 show that in all cases, except for case 10, the male domain has higher control value than the family domain. The control value, in each internal domain, is a property of the degree to which a space “controls” its neighbouring spaces. It is a local property. However, it must be observed that this does not necessarily mean that the male domain controls the family domain. It just means that the male domain has a greater proportion of controlling spaces, and is generally a result of containing more a-type spaces (see Hillier 1996:318-321). The mean of the control value for all male domains is 1.15, while the mean for the family domain is 1.03.

Table 4. Mean control values of the three domains (M, F and E) for each and all cases including rank order.

Case #	Type	M	F	E	Rank order
1	T N P	1.17	1.05	0.29	M>F>E
2	T E P	1.12	1.05	0.29	M>F>E
3	T N P	1.10	1.05	0.42	M>F>E
4	T N P	1.19	1.01	0.33	M>F>E
5	T E P	1.18	1.03	0.42	M>F>E
6	T E Q	1.25	0.91	0.33	M>F>E
7	T S Q	1.08	0.99	0.33	M>F>E
8	T S Q	1.23	0.99	0.20	M>F>E
9	T S Q	1.20	1.00	0.20	M>F>E
10	T S P	1.07	1.09	0.29	F>M>E
11	T E P	1.02	1.00	0.50	M>F>E
12	T E P	1.15	1.09	0.50	M>F>E
13	M S P	1.21	1.02	0.25	M>F>E
14	M S P	1.11	1.06	0.42	M>F>E
15	M N P	1.19	1.04	0.23	M>F>E
16	M S Q	1.18	1.00	0.25	M>F>E
17	M S P	1.08	1.05	0.33	M>F>E
	mean	1.15	1.03	0.33	

According to the analysis of variance we can conclude that there are significant differences between all domains, male and exterior, between family and exterior and between male and family, at the 1 % confidence level (table 5)

Table 5. ANOVA of control values for the three domains (M, F and E).

Domains	Mean estimate		Mean estimate		
			M	F	E
Male	1.148	M	-		
Family	1.025	F	0.0002	-	
Exterior	0.328	E	0.0001	0.0001	-

Syntactic analysis of five zones (Mm, Fg, Ff, Fp and E)

The family domain will now be differentiated into three zones and together with the male and exterior domains/zones it results in five zones (Mm, Fg, Ff, Fp and E). These consist of agglomerations of function spaces. Definitions and classification of each space are mainly based on the ethnographical data (of how this or that space is used and by whom).

Depth properties

In general, and by observing figure (3) we may say that the male spaces are shallower than the female ones in relation to the external world. Although, some of the shallowest spaces, when there are more than one access, are female spaces in cases 3, 4, 13, 14. These cases include both the traditional and modern (architect-designed houses). We found that in most of the cases that the family gathering space is one to three steps deeper from the exterior than the male courtyard, except in four cases (10, 13, 14 and 15). In these four cases these spaces of both family and male are at the same depth from the exterior. Three of these four houses represent the modern architect-designed house (cases 13, 14 and 15).

Integration properties

The integration properties show in table 6 that the family gathering zone (Fg) is the most integrated area of the 17 cases. The female zone (Ff) is the second most integrated space in 14 out of the 17 cases. The third most integrated zone is the male zone (M) in 10 out of the 17 cases. The personal zone is the fourth integrated zone in 12 cases, while the exterior is the most segregated zone for 16 out of the 17 cases. Moreover, when examining the mean of the mean integration values (RRA) of the five zones we found that the family gathering zones have a mean of 0.97. The female zones follow having a mean value of 1.17, the male zones of 1.27, while the personal zones and the exterior zones have mean values of 1.42 and 1.69 respectively.

Case #	Type	M	Fg	Ff	Fp	E	Rank order
1	T N P	1.46	1.11	1.27	1.55	1.46	Fg>Ff>M>E>Fp
2	T E P	1.16	1.07	1.12	1.24	1.47	Fg>Ff>M>Fp>E
3	T N P	1.58	1.13	1.43	1.94	2.23	Fg>Ff>M>Fp>E
4	T N P	1.3	0.76	1.13	1.27	1.67	Fg>Ff>Fp>M>E
5	T E P	1.28	1.03	1.26	1.65	1.86	Fg>Ff>M>Fp>E
6	T E Q	1.24	1.06	1.35	1.38	1.89	Fg>M>Ff>Fp>E
7	T S Q	0.99	0.84	1.12	1.29	1.4	Fg>M>Ff>Fp>E
8	T S Q	1.26	0.71	1.02	1.34	1.44	Fg>Ff>M>Fp>E
9	T S Q	0.88	0.61	0.87	1.03	1.25	Fg>Ff>M>Fp>E
10	T S P	1.17	0.97	1.12	1.22	1.63	Fg>Ff>M>Fp>E
11	T E P	1.49	1.43	1.6	1.79	2.23	Fg>M>Ff>Fp>E
12	T E P	1.83	1.33	1.68	1.84	1.96	Fg>Ff>M>Fp>E
13	M S P	1.18	0.87	0.98	1.31	1.51	Fg>Ff>M>Fp>E
14	M S P	1.49	1.13	1.25	1.45	2.14	Fg>Ff>Fp>M>E
15	M N P	1.27	1.07	1.19	1.22	1.53	Fg>Ff>Fp>M>E
16	M S Q	0.69	0.54	0.65	1.22	1.23	Fg>Ff>M>Fp>E
17	M S P	1.26	0.89	1.21	1.52	1.91	Fg>Ff>M>Fp>E
	mean	1.27	0.97	1.19	1.43	1.69	

Table 6. Mean integration values (RRA) of the five zones (M, Fg, Ff, Fp and E) for each case and for all including the rank order. M=male, Fg=family_gathering, Ff=family_female, Fp=family_personal and E=exterior zones.

Analysis of Variance (ANOVA) is used to compare different domains, Fg, Ff, Fp, M and E, while blocking for house. From table 7 we can conclude that there are significant differences between all domains at the 1 % confidence level, except between male (M) and female (Ff) zones. (Bonferroni correction was used to allow for multiple comparisons).

Zones	Mean estimate		Fg	Ff	Fp	M
Family-gathering	0.973	Fg	-			
Family-female	1.191	Ff	0.0001	-		
Family-personal	1.427	Fp	0.0001	0.0001		
Male	1.266	M	0.0001	0.7687	0.0029	-
Exterior	1.694	E	0.0001	0.0001	0.0001	0.0001

Table 7. ANOVA of RRA values for the five zones (M, Fg, Ff, Fp and E).

Control properties

The mean value of control and the rank order for the five zones for each case and all 17 cases in table 8 is examined. The result is that family gathering zones (Fg) have the highest control value in 16 out of 17 cases. This indicates that this zone generally have a great proportion of highly controlling spaces. It is followed by the female zone (Ff) being the second highest value for 13 cases, and is in turn followed by the male zone as the third controlling zone for 13 cases. The fourth high control value is the personal zone (Fp) in 11 cases, while the fifth rank order for 11 cases is the exterior with the lowest mean control value.

Table 8. Control values of the five zones (M, Fg, Ff, Fp and E)

Case #	Type	M	Fg	Ff	Fp	E	Rank order
1	T N P	1.27	1.53	1.06	0.33	0.29	Fg>M>Ff>Fp>E
2	T E P	1.5	2.41	1.65	0.3	0.29	Fg>Ff>M>Fp>E
3	T N P	1.33	1.08	1.47	0.33	0.42	Ff>M>Fg>E>Fp
4	T N P	1.4	3.74	1.6	0.27	0.33	Fg>Ff>M>E>Fp
5	T E P	0.88	1.92	1.25	0.7	0.42	Fg>Ff>M>Fp>E
6	T E Q	1.03	2.35	1.31	0.36	0.33	Fg>Ff>M>Fp>E
7	T S Q	0.71	2.33	1.06	0.23	0.33	Fg>Ff>M>E>Fp
8	T S Q	1.58	2.09	1.2	0.67	0.2	Fg>M>Ff>Fp>E
9	T S Q	1.37	1.97	1.6	0.37	0.2	Fg>Ff>M>Fp>E
10	T S P	1.12	1.76	1.39	0.33	0.29	Fg>Ff>M>Fp>E
11	T E P	0.98	1.26	1.12	0.68	0.5	Fg>Ff>M>Fp>E
12	T E P	1.6	1.61	1.3	0.6	0.5	Fg>M>Ff>Fp>E
13	M S P	1.22	2.64	1.77	0.5	0.25	Fg>Ff>M>Fp>E
14	M S P	1.07	1.86	1.46	0.23	0.42	Fg>Ff>M>E>Fp
15	M N P	1.06	2.05	1.41	0.19	0.23	Fg>Ff>M>E>Fp
16	M S Q	1.23	2.27	1.74	0.32	0.25	Fg>Ff>M>E>Fp
17	M S P	1.29	2.07	1.38	0.31	0.33	Fg>Ff>M>Fp>E
	Mean	1.214	2.055	1.398	0.395	0.328	

The mean of all cases shows that the spaces of the family gathering zone is generally more internally controlling than the other zones while the exterior zone is the least controlling.

From the analysis of variance (ANOVA) we conclude in table 9 that there are significant differences between these zones, except between female (Ff) and male (M) zones, and between exterior and family personal (Fp) zones at the 1% confidence level.

Table 9. ANOVA of control values for the five zones (M, Fg, Ff, Fp and E).

Zones	Mean estimate		Fg	Ff	Fp	M
Family-gathering	2.055	Fg	-			
Family-female	1.398	Ff	0.0001	-		
Family-personal	0.395	Fp	0.0001	0.0001	-	
Male	1.214	M	0.0001	0.9109	0.0001	-
Exterior	0.328	E	0.0001	0.0001	1	0.0001

Conclusions and discussion

Spaces of the home are usually defined according to their functions. We have explored the user identity and gender designation of the various spaces of the house, as identified by the inhabitants themselves. In general the spatial relationship of the house and its surroundings can be seen as a relationship between strangers' exterior sphere and inhabitants' interior sphere. The interior of the house can be seen as an integration of two prime domains, family and male. This can be interpreted further as interaction of four zones in contrast to the zone of the exterior.

In all houses, there is always a high external boundary wall separating the house from the exterior world. The houses have normally more than one exit to this sphere (E), although in cases 6-9, there is only one exit mainly due to the shape and location of the house plot. The existence of a single house entrance, leading first into the male domain in front and then to

the family domain, suggests a sequential relationship to the street. When there are two entrances leading to each domain it suggests a parallel relationship. These are shown in the two models, figure 4, which are based on empirical findings.

The Sudanese house can thus be understood as sequential and parallel in relation to the exterior world (the carrier). The parallel model suggests that the two spatial domains are equal, but different. One of them is for the exclusive use of the males and male guests, and the other is predominantly for the female members as well as a reception area for their female guests. In relation to the street, both domains are shallow and are rather in a front position to the street, yet they are in a “back” position relative to each other. The sequential model, which is found in few cases, display a front and back position of the gender zones in relation to the street. The male domain is in the front and the family/female domain is in the back. In some cases the transition areas adjacent to the entrances (examples 7 and 9) act as distribution zones to each of the domains without crossing the gendered occupation zones.

The spatial zones of the family (gathering and personal), female, and male users, consist of a number of functional spaces. In traditional houses, both male visitors and male inhabitants use the male zone. In the architect-designed houses, this zone became more of a formal reception area mainly for the use of the visitor, although there are some relaxing furniture such as beds in all cases, except for one (case 17). The female inhabitants of the traditional house have a more defined zone, while in some cases of the architect-designed houses, the female inhabitants do not have this privilege.

The syntactic approach shows that the family domain is always more integrated than the male domain and the exterior, $F > M > E$. However, the Analysis of Variance shows that there was no statistically significant difference between the family and male domains in integration values. Of course, the differences are significant when each of these two domains was compared to the exterior world. While, when comparing the control values of each domain, the male domain had higher control values than the family domain, and with statistically significant differences.

When the five zones are examined syntactically, the results of integration and control values shows that the rank order of zones are for both measures: family gathering zone > female zone > male zone > personal zone > the exterior ($F_g > F_f > M > F_p > E$).

The results also show that the female zones, the spaces that are defined as such by the inhabitants themselves, are well integrated in the house. The results suggest that the idea, which many researchers adopt when describing the spatial sphere of the female inhabitants of the Muslim house, as secluded and segregated, needs to be re-defined. For instance, Petherbridge (1987:196) discusses the dominant emphasis of the Muslim house, on the “privacy” and “the seclusion and segregation” of women as two parallel design elements of the Muslim house, although he did not describe the spatial configuration of the seclusion and segregation of female members. The author did not distinguish between culture and religion. As stated earlier, there is not a single verse in the Koran, which says that women should be secluded and segregated during any periods of their lives. Islam as a religion, emphasises the importance of respecting other people’s privacy, male or female, and the sacredness of their houses.

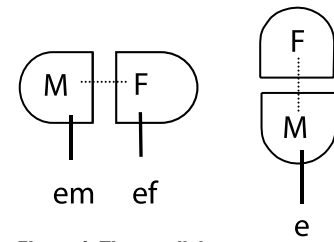


Figure 4. The parallel and sequential models.

In addition, and in relation to the street, this study is suggesting the rethinking of the terms used to describe the “location” and occupation of the female in the house (as back or front), bearing in mind the sequence and parallel models. Instead, this term of back and front is rather a relative term within the interior of the house rather than within the interior-exterior relationship.

Females traditionally used internal passages and openings between houses within the quarter to meet and communicate. In other Muslim cultures roof terraces are used in the same way. Women this way constituted solidarity islands much like the males in the computer-aided experiment by Hillier & Hanson (1984:228). Even when houses were structured sequentially women were perhaps not trapped within the household.

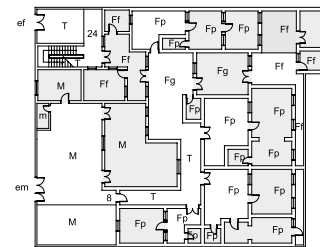
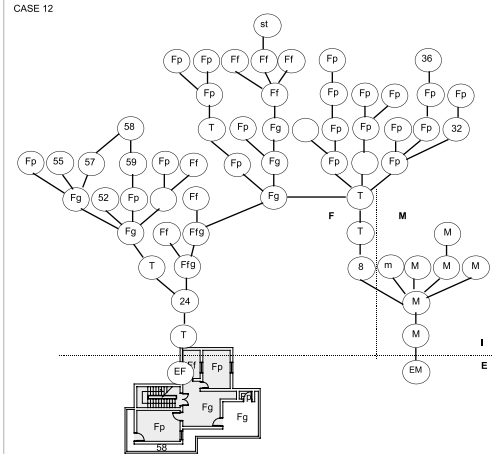
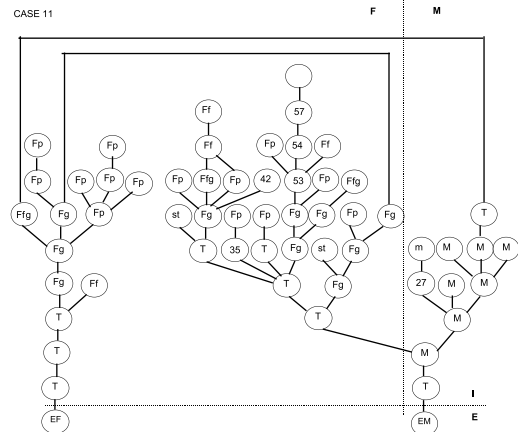
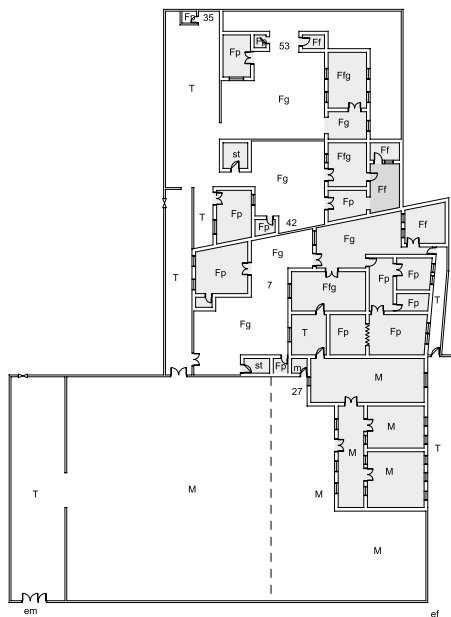
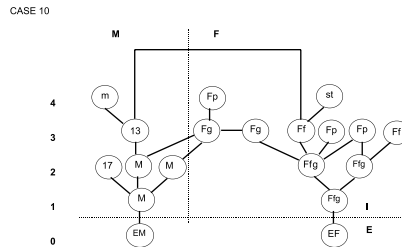
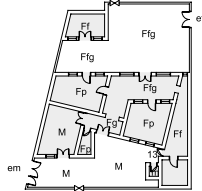
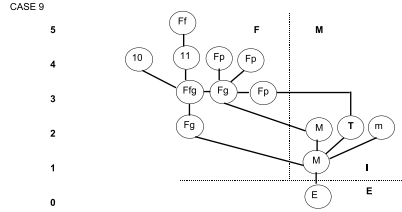
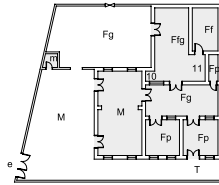
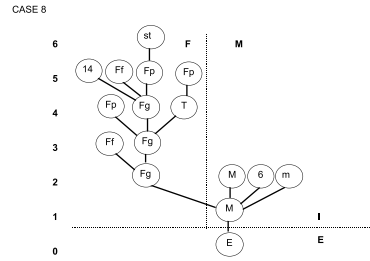
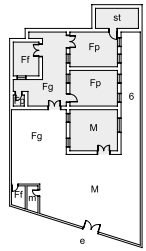
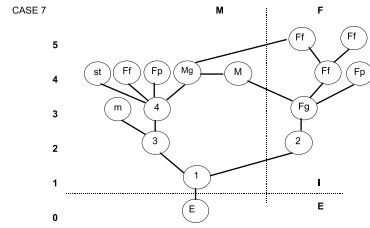
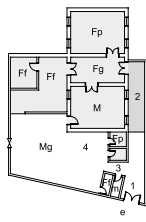
The internal passages within quarters tend however to be omitted nowadays. Sequential structures are only found in traditional houses of our sample. If we relate this to the fact that women tend more to be allowed to leave the houses through the street, the parallel structure throughout all modern houses seems to be relevant. Although, at the same time women tend to work outside home to a greater extent. This might lead to higher equality between the genders and perhaps also be reflected in the house design by having only one door to the house.

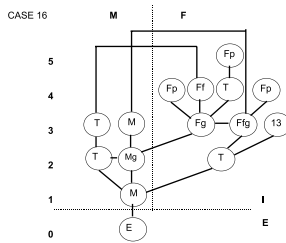
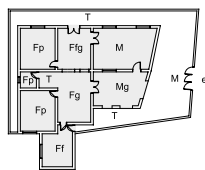
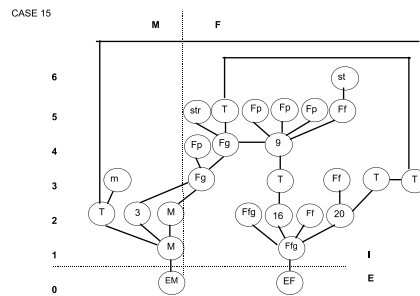
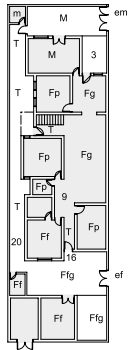
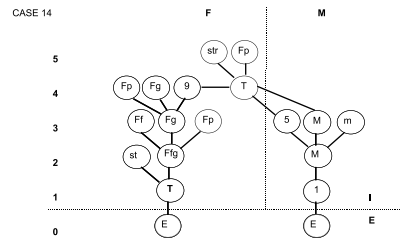
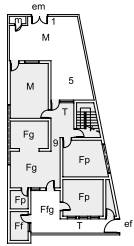
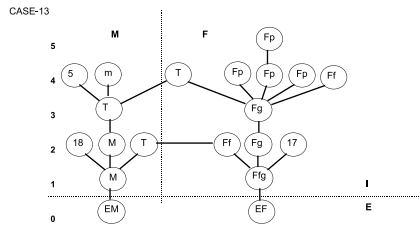
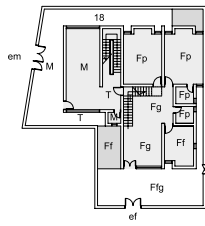
This study proves that, although the 17 house plans present different topological layouts, and that the number of domestic spaces for each domain and zones are not constant, there is a common pattern in the configuration properties of the zones throughout the sample. It also shows that the female domain is well integrated in the house and that women generally dominate the interior of the house spatially. The sample is nevertheless rather small to draw general conclusions from it, but the explorative study opens for interesting questions about the relation between culture and house design. And not least about the distinction between differential solidarity and inequality discussed in Hillier & Hanson 1984 and how this may be materialised.

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42.14





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