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SPATIAL ARRANGEMENTS IN TRADITIONAL M'ZABITE HOUSES

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Abstract

This paper aims to study the morphology of M'zabite traditional houses. The study uses the space syntax method. Space syntax proposes a fundamental relationship between the configuration of space in a house and the way that it functions. It is the aim of this research work to test this proposition in an M'zab cross settlement sample. The study particularly focuses on the measure known as " difference factor ". The concept of difference factor has been widely used as a technique to measure the strength of a spatial genotype. As a preliminary conclusion, four characteristic patterns of integration are found, the first one centred on the Ammas N'tadart [Berber for Wast Eddar], the second on the Ikoumar or arched portico, the third on the stairs, and the last but not the least, is centred on the Tigharghart or upper courtyard.

Keywords *: Space syntax, Difference factor, Genotype, traditional housing, M'zab.*

Résumé

Cet article a pour but l'étude de la morphologie de l'habitat traditionnel au M'Zab. L'étude utilise la méthode de la syntaxe spatiale. La syntaxe spatiale met en évidence la relation fondamentale qui existe entre la configuration d'un espace et la manière dont il fonctionne. C'est l'objectif de ce travail de recherche de tester cette proposition sur un échantillon de maisons traditionnelles au M'zab. L'étude focalise particulièrement sur le concept de facteur de différence. Ce concept a été largement utilisé comme technique de mesure de la solidité de génotype spatiale. Comme conclusion préliminaire, quatre modes d'intégration viennent caractériser ce cas d'étude: le premier est centré sur Wast Eddar; le second, sur l'Ikoumar, le troisième sur les escaliers; par contre, le dernier mode est centré sur Tigharghart.

Mots clés *: Syntaxe spatiale, Facteur de différence, Génotype, Habitat traditionnel, M'zab.*

T. BELLAL
A. TACHERIFTE
Département d'Architecture
Faculté des Sciences de l'Ingénieur
Université Farhat Abbas
19000 Sétif, Algérie

ملخص

إن الغرض من هذا المقال هو دراسة مرفولوجية البناء التقليدي للمزاب. تعتمد الدراسة طريقة التركيبة المجالية. إن التركيبة توضح بجلاء العلاقة الأساسية الموجودة بين هيئة المجال و الطريقة التي يسير بها. إن الهدف من العمل البحثي هذا هو تجريب هذا الاجتهاد على عينة من المنازل التقليدية في المزاب. تركز هذه الدراسة أساسا على مفهوم عامل الاختلاف. لقد استعمل هذا المفهوم بشكل واسع كتقنية قياس مدى صلابة الموروث المجالي. و كخاتمة أولية، نجد أربعة أنماط اندماج تميز دراسة الحالة هذه. الأول مركز على وسط الدار التالي الايكومار. الثالث على الإدراج بينما الأخير على تيغريموت.

الكلمات المفتاحية: *التركيبة المجالية، عامل اختلاف، الموروث، سكن تقليدي، مزاب.*

The traditional domestic architecture has been a neglected field at both academic and practical levels in Algeria. Moreover, the house seldom treated by researchers, architects; planners and decision-makers, as the social artefact of its users. In Algeria, traditional domestic buildings are found both in rural and urban areas. The prime conception of this working paper is that a house is a cultural phenomenon. Its form and organisation are greatly influenced by the cultural milieu to which it belongs. Although, a small number of Algerian research projects, concerning houses, have been done, just a few of them dealt with space as social artefact, and none of them has comprehensively studied the house in urban traditional built environment. The objective of this work is to study the house in a traditional environment. The intention is to analyse a number of dwellings, located in a specific climatic and geographical context, having the same social framework and a specific point in time. The advantage of such built environment is its stability. One of the oldest traditional environment in Algeria, the M'zab region has been selected.

The M'zabite house, which is the subject of this paper, refers to the type of dwelling that was built between the 11th and 14th centuries in the M'zab Wadi or valley, a particularly arid region of the Sahara in

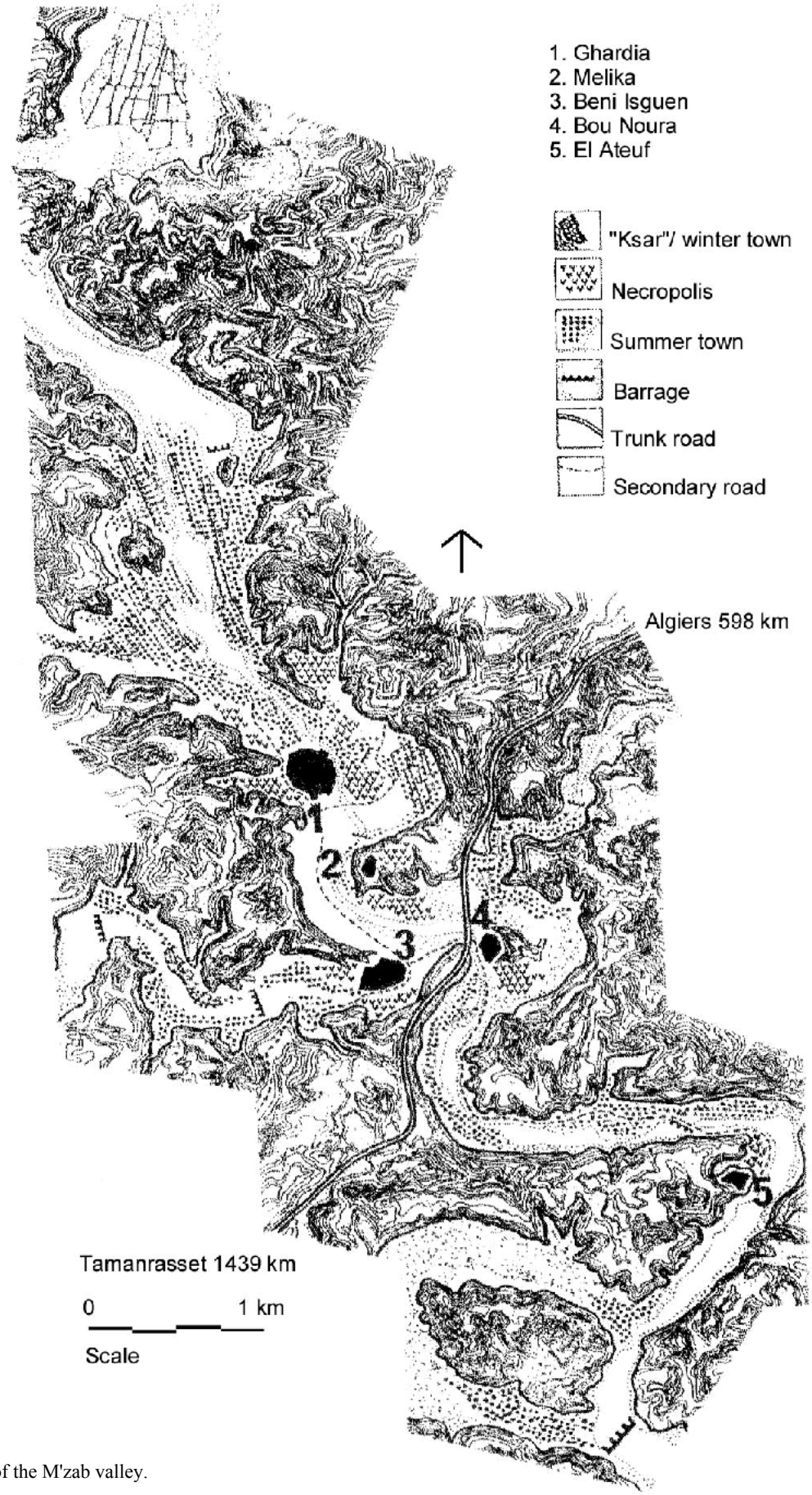

Figure 1: Map of the M'zab valley.

Algeria. The examples are drawn from the five Ksours [Ksar in singular] or settlements that form the 'pentapolis', five walled towns of varying size and importance comprising 4487 houses established on an area of 67 ha: Ghardaia [1053] is the chief settlement [surface area: 29,6 ha, total number of houses: 1806] while El Ateuf [1011] is the oldest [surface area: 8,58 ha, total number of houses: 524]. Beni Isguene [1347] is the sacred town of the M'zabite league, barring all non members of the sect from some sections of the town and all strangers from spending the night within its walls [surface area: 16,5 ha, total number of houses: 1010], Bou Noura [1046] built on a rock overhanging the river bed is the poorest of the settlements [surface area: around 6 ha, total number of houses: 720], Melika [1124] contains large cemeteries [surface area: 7 ha, total number of houses: 427]. Two other eccentric settlements were built during the 17th century further away north of the valley, Berriane fifty kilometres and Guerara approximately one hundred kilometres. These settlements are built in close proximity to one another. All lie between a latitude of 32°30' north and a longitude 3°45' east [see Fig.1]. They are situated at a mean high level of 500 metres above sea level. Algiers , the capital city is 600 kilometres away northwards. The settlements are located on the Hamada rocky plateau, the Chebka, Arabic for the net The area is characterised by the torrid excesses of the heat in the summer, by considerable variations in temperature and by the extreme dryness of the air. The UNESCO listed the M'zab Wadi as a world heritage site in 1982.

Beni M'zab or M'zabites are members of a Berber people who inhabit the M'zab Wadi [1]. They are members of the Ibadiyah subsect of the Muslim Kharijite sect. The M'zabites are descendants of the Ibadi followers of Abd Ar-rahman Ibn Rustom who were driven from Tiaret and took refuge [probably in the 9th century] in the desert. According to tradition, they arrived at Sedrata, near present-day Ouargla, in 911, and a century later, choosing, for reasons of defence, the most inhospitable region that they could find, they settled along the M`zab Wadi, their first settlement being El-Ateuf, in approximately 1011. The form of Islam practised by the M`zabites is extremely strict, egalitarian, and separatist. The code of morals is rigid, and the standards of religious purity are high. For this reason, M`zabites do not marry outside their sect, and in consequence they are physically quite homogeneous, tending to be short and thickset and to have a short, broad face[2]. The women are heavily veiled and never leave the community. The men, however, are found throughout Algeria, running small businesses, often groceries, but returning to the oasis periodically. The M`zabites produce a variety of handicrafts, including pottery, brassware, jewellery, and carpets; there is a carpet festival in the spring.

The houses were originally surveyed by C.& P. Donnadieu / H.& J.-M Didillon [3]. The houses are generally two to three storeys in height and are inward looking, centring on the Wast eddar, a large living space surrounded by small rooms. The Wast eddar performs a dual role: as a transition space, which controls access to the remainder of the rooms beyond and as a function space- it is there that the main female activities take place. Actually, it is the largest space in the house. It is lit by means of a large skylight situated in the centre of the ceiling and protected by an iron grille. No windows give onto the outside. The main living spaces of the house are all situated on ground floor level. The first level suite of rooms is multi-functional; being used as bedrooms, storage or changing rooms. The first floor or Emess Enej, Berber for the upper centre, is mainly used for sleeping, but may contain a few living spaces: the Ikoumar or arched portico, is used by women and their female visitors as a tea and coffee space.

Past studies on the M'zab settlements and vernacular

House N°	C.S	SLR	M.D	Integration With Exterior			BDF	Integration Without Exterior			BDF
				Mean	Min	Max		Mean	Min	Max	
1.	28	1.07	4.33	1.21	0.70	1.80	0.83	1.19	0.71	1.68	0.83
2.	24	1.04	5.08	1.48	0.85	2.22	0.88	1.48	0.87	1.70	0.84
3.	29	1.10	3.92	1.12	0.60	1.61	0.82	1.13	0.62	1.61	0.82
4.	21	1.00	4.90	1.19	0.57	1.87	0.80	1.15	0.54	1.95	0.77
5.	24	1.08	5.17	1.18	0.68	1.87	0.81	1.42	0.91	2.10	0.86
6.	20	1.05	4.15	1.30	0.73	2.02	0.80	1.26	0.68	1.84	0.78
7.	22	1.09	4.47	1.41	0.78	2.06	0.82	1.43	0.79	2.13	0.82
8.	30	1.06	4.48	1.26	0.88	1.70	0.91	1.27	0.90	1.76	0.91
9.	19	1.10	3.66	1.00	0.59	1.35	0.86	0.99	0.62	1.33	0.86
10.	29	1.03	4.75	1.29	0.73	1.97	0.82	1.30	0.74	1.97	0.82
11.	50	1.06	5.22	1.17	0.76	1.76	0.86	1.18	0.77	1.77	0.87
12.	27	1.07	4.11	1.10	0.51	1.54	0.79	1.09	0.50	1.54	0.78
13.	29	1.03	5.00	1.39	0.76	2.26	0.78	1.42	0.77	2.34	0.77
14.	20	1.05	4.15	1.28	0.73	1.77	0.85	1.29	0.71	1.75	0.85
15.	34	1.09	5.24	1.31	0.82	1.99	0.85	1.31	0.80	1.98	0.84
16.	17	1.05	5.00	1.40	0.81	1.98	0.85	1.35	0.79	1.93	0.85
17.	18	1.00	3.82	1.09	0.56	1.55	0.81	1.08	0.58	1.54	0.81
18.	23	1.04	4.72	1.28	0.72	1.90	0.82	1.27	0.73	1.89	0.83
19.	22	1.00	5.09	1.61	0.98	2.35	0.85	1.61	0.96	2.35	0.85
20.	18	1.00	4.76	1.31	0.68	2.04	0.78	1.27	0.68	2.01	0.78
21.	16	1.00	4.20	1.21	0.60	2.05	0.72	1.18	0.55	1.57	0.80
22.	21	1.09	4.55	1.14	0.62	1.70	0.81	1.11	0.67	1.45	0.88
23.	14	1.28	3.92	1.22	0.67	1.83	0.81	1.18	0.60	1.70	0.80
24.	27	1.03	4.38	1.37	0.70	2.32	0.74	1.39	0.73	2.36	0.75
25.	29	1.03	4.82	1.25	0.67	2.19	0.74	1.25	0.70	2.27	0.74
26.	25	1.08	4.00	1.16	0.69	1.72	0.82	1.15	0.68	1.76	0.83
27.	27	1.07	4.15	1.26	0.81	1.97	0.86	1.26	0.81	2.00	0.84
28.	22	1.04	3.80	1.11	0.58	1.55	0.82	1.10	0.60	1.56	0.82
29.	41	1.07	5.52	1.24	0.70	1.91	0.81	1.23	0.69	1.92	0.80

Table 1: Basic syntactic data. Convex Spaces. **CS:** Convex Spaces - **SLR:** Space Link Ratio - **MD:** Mean Depth – **BDF*:** Relativised Base Difference Factor.

housing in the M'zab valley have been chiefly confined to record detailed architectural drawings and compile information about building materials and traditional methods of construction [4]. Other contributions were mainly in the form of broad surveys of historical and social aspects of these settlements [Huguet D., 1906; Bourdieu P., 1958; Merghoub B., 1964; Addoun A.D., 1977].

Also, previous studies have focused on specific problems ranging from geographic exploration [Ville, 1872] and religious concerns such as the Ibadhite schism [Duveyrier H., 1878] to more extensive linguistic and historical issues [Masqueray E., 1878; Motylinski, 1904; Basset A., 1959; Aymo J., 1959; Manouz S., 1968] and studies on the legislative and juridical structures [Merghoub B., 1970]. Most of the writings where the morphology of the houses and settlements has been studied have focused on descriptive, picturesque and aesthetic aspects. Extensive photographic compendia have been published [Roche M., 1970; Pavard C., 1980] praising the " moving and many faceted beauty of these miracle towns which human determination has caused to rise from the desert [5].

Other studies, similarly regard the M'zabite house as a unique and extraordinary example in the history of architecture, as " Une leçon d'architecture " and judged as being the best and most efficient response to topographic, climatic conditions and clearly defined social requirements [6]. Room functions are occasionally noted, but there is little systematic analysis or exploration of the way in which the organisation of the domestic interior relates to everyday living patterns. In the few attempts to describe the functional characteristics of the M'zab house, stress tends to be laid upon its inherent adaptability rather than on those features, which relate to human activities and needs [7]. As a result little progress has been made in identifying the spatial patterning of the M'zab houses in terms of their domestic living arrangements. One aim of this paper is to see whether it would be possible to fill this gap in the vernacular record by using the "space syntax" methodology.

Space syntax is a set of techniques for the representation and quantification of spatial patterns. The step towards quantification can be achieved by considering the space pattern as two-dimensional convex structure. This structure is then represented as a graph, which is, called a justified graph. The justified graph shows how the arrangement of convex spaces [vertices] and their entrances [linking lines] control access and movement. It is organised in a particular way: all the spaces are aligned above a certain space [normally the site in which the dwelling sits, which is sometimes referred to as the carrier of the system] in levels according to their depth from that space until the furthest convex space is reached. Depth is an important configurational property of spatial patterns and indicates how many steps one must pass through to arrive at a particular space in the configuration. It forms the basis of a quantitative form, which is called integration [which gives the relative depth of a particular space from all others in the complex]. The justified graph represents the permeability of a system, whereas integration values extend these descriptions by expressing how the graph looks quantitatively. It will be of interest in this paper to see how far syntactic analysis might reveal the underlying spatial structure of M'zabite house and how far will it be possible to express this structure quantitatively.

Composition in the M'zabite traditional house

As noted above, amongst scholars who have conducted extensive research into the M'zabite traditional architecture are Ravereau A., and C.& P. Donnadieu / H.& J.-M Didillon. They developed the concept of " type less " (Maisons sans type) Mzabite houses [8]. Accordingly to the authors, every single house is a model of its own. Although, their description of the M'zabite houses put more emphasis on the house difference rather on similarities, they do identify certain unifying feature of the house, such as the ground floor courtyard the Wast eddar, and the Ikoumar or arched portico at first floor level [9]. The M'zabite house inherited the fundamental spatial dispositions of Maghreban houses: central open space, sometimes bordered by arcades and leading to surrounding living spaces. This spatial arrangement can be found in many Saharan oases [10]. In the M'zab, the Ibadhites brought a major modification, probably for climatic reasons; the ground floor open courtyard has been covered in such a way, that it leaves just a small opening in the ceiling, the Chebek, that allows light in. The central open space has just been projected up to the first floor or the Emess enej, and unlike the Maghreban courtyard, it has no opening looking onto it. The houses in the M'zab settlements are invariably built around the Wast eddar. Plan drawings indicate an irregularity of house layouts, an inconsistency in house size and shape.

However, it is difficult to discern how such variation in house layouts affects the internal spatial arrangement. Another morphological characteristic shows the lack of formal and geometrical properties that suggest conscious planning and design. Although, the aggregation of the houses is extremely irregular, appearing disorganised and chaotic, historical evidence indicates that definite rules and principles of spatial arrangement governed the morphology. The principles of the building process and framework were derived from the Islamic 'Fiqh' [Islamic Jurisprudence]. In this respect, the 12th century Ibadhite manuscript written by Sheikh Abu Al Abbas Ahmed Ibn Mohamed Ibn Abi Bakr Al Nafoussi represented the essential core of knowledge of the organisational framework and associated techniques used in creating the built product as well as the guidelines and principles used during the building process. The written work consisted of eight chapters and is considered to be the oldest Ibadhite manuscript on architecture and urbanism. The third chapter: foundation and implementation of the Ksours or settlements dealt with the development of building and urban design principles and was centred on housing, access and circulation [11]. Two other Ibadhite manuscripts also dealt with building principles such as building height, opening in the walls, street width etc.: " Takmil lima akhala bihi kitab Al'nil " by Abdelaziz Ibn Ibrahim Al Thamini [17th century] and " Mokhtassar Al'Imara " by Sheikh Ahmed Ibn Youssef Tfiech [19th century].

General description of the M'zabite house

The following description of the following houses is based on the examination of the published plans of about 29 houses taken from the five settlements that form the pentapolis of the M'zab valley. The access from the street to the house is always through the Skifa, or chicane, which plays an important role in the functioning of the house. Opposite the front door, a wall protects the Wast eddar from the view of possible visitors. The door leading to the Wast eddar is set off from the axis of the front door, and that front door gives direct access to the male reception quarter: the Houdjrat on the ground-floor level or the Aali on the first floor. On one side of the Skifa, there is a room used for keeping the domestic animals. Sometimes in this chicane, there is a recess in the wall in which a hand-quern is kept, allows easy access for the male neighbours who do not have one [12]. Also, water jars used to be kept in this space so that the professional water porters could deliver water to the individual houses without exposing the women to their presence. In most of the examined houses, a morphological feature may be noted; two separate pathways exist to the interior. The first or family path, leads to the Wast eddar, the large living space surrounded by small rooms. A staircase links the ground floor to the first-floor consisting of multi-functional rooms, the Ikoumar and the Tigharghart or the upper courtyard. Another staircase links the upper floor to the Stah or the terrace. The second pathway leads up from the chicane through another staircase to the Aali [a separate quarter reserved for the male visitors]. The Aali, which is very richly furnished and decorated, consists of one large room, with usually a small window giving onto the street. Sometimes, a bedroom annexes this male reception room.

The Wast eddar, as mentioned earlier, is by no means the largest space in the house. No furniture exists in it except for the loom, the built in shelves for the cooking utensils and an oven that occupies one side of it. The Tisifri, [women's living room] gives onto the Wast eddar. It is used for women visitors and it is in this room where the women move after giving birth. The other rooms that give onto the Wast eddar do not have specific usage. The dimensions of the rooms are modest, they barely exceed two metres in width whereas the length varies and may be relatively important. The toilets are usually located in a remote corner off the Wast eddar. The house is equipped as well with a traditional bathroom. From the Wast eddar, a staircase leads up to the first-floor, which consists of the Emess enej or the upper centre, surrounded by small rooms. The ceiling height is very modest, less than two metres twenty centimetres, and in some cases [old houses] less than two metres. On the first-floor the whole family for sleeping at night during the summer uses the Ikoumar. It is there, where the women do their washing, sometimes cooking or take their afternoon coffee or tea alone or with their female visitors [13]. In most of the analysed houses the Ikoumar or arched portico is oriented towards the south or the Southwest. Another staircase leads up from the Emess enej, to the Stah or terrace access to, which is exclusively reserved for women.

Although in this paper, the primarily concern is about the spatial analysis of M'zabite vernacular houses, it is intented that the subsequent one, will use the spatial structures as a basis to investigate the possible socio-cultural themes that might have been built into them. It should be taken into account that the houses were situated within a static society, which has not seen any substantial changes impinged upon their organisation for one thousand years.

Space configuration in the traditional M'zabite house

The survey carried out by C. & P. Donnadieu/ H. & J.-M Didillon covered about thirty house plans, mosques, market squares, shops, watchtowers and gateway access, which make up the research work carried out by the M'zab workshop [under the supervision of Donnadieu & Didillon]. All the plans show the ground floor, the first -floor, and if it exists, the second-floor, the accessible terrace and the cellar. The thirty house-plans on which this paper is based, are drawn among these cases. The sample is therefore broadly representative of C.& P. Donnadieu/ H.& J.-M Didillon house plan types. The space outside, usually a dead-end, an alley or a lane, is represented as a single convex space. Within the interior of M'zabite houses, it seems that a niche or a couple of steps may be sufficient to define a separate space, which serves a specific function. This architectural elaboration's have been treated as equivalent to convex spaces. For example, the loom site in the Wast eddar could be taken as distinct convex space, although it is not clearly delineated spatially in all cases.

The twenty nine houses were broken down into their convex organisation. Permeability graphs were drawn for each house from the point of view of the house plot. Therefore plans and justified graphs from the outside have been drawn for each example, in order to clarify the space configuration and permeability patterns of the houses. A syntactic analysis is presented first, on a house-by-house basis, in order to group the houses configurationally, and then a statistical and functional account is attempted for the data as a whole, in order to see if space pattern and space use relate systematically to one another. The houses are analysed randomly in figures [2-12]. Basic syntactic data for the set of examples are tabulated in table 1 showing the number of convex spaces, space link ratio, the mean integration value, and the relativised base difference factor when the exterior is counted and discounted. The rank order of the integration values of the constituent spaces in each house is given in table 2.

Before starting the analysis, some clarifications need to be drawn to the attention of the reader about the measure 'difference factor'. It is an entropy-based measure developed by Bill Hillier & colleagues at University College London, to quantify the degree of difference between the integration values of any three spaces or functions in a complex [14]. Where the rank order of the integration of significant household functions remain stable across a sample of dwellings, and where differences in the relative integration

values are pronounced, then the configuration can be said strongly to structure the form of the dwelling. Conversely, where spaces are not found in a consistent rank order, then the sample does not embed a functional genotype, and where this exists but integration values are very similar to one another, the configuration of the dwelling may be said to homogenise functions and render them spatially interchangeable with one another. This measure is based on two concepts: the integration value [quantitative form of depth] which expresses the relative depth of that space from all others in the graph. It expresses how directly the functions of those spaces are integrated with, or separated from each other, and thus with how easy and natural it is to generate relations among them. The second concept is that of choice that expresses the degree to which these relationships are controlled, or marked by an absence of alternative routes, forcing permeability from one space to another to pass through specific other spaces. Such differences are one of the keys to the way in which social relations express themselves through spaces.

The degree of differentiation among integration values is one of the means of showing how strongly social relations expresses themselves through space [15]. This can be expressed as a difference factor, which measures how strongly or weakly a consistency is maintained within a spatial pattern, by calculating the degree of difference among the integration value of three or more spaces. This 'difference factor' can be relativised between In 2 & In 3 to give a 'relative difference factor' H*, between 0 [the maximum difference, or minimum entropy] and 2 [the minimum difference or maximum entropy, that is all values are equal]. To give a feel of this measure, the difference factor for, say, 0.4, 0.5, 0.6 is 0.97 [that is close to 1 or very weak], whereas that of 0.3, 0.5, and 0.7 is 0.84 or considerably stronger, and that of 0.1, 0.5 and 0.9 is 0.39, or much stronger still.

Glossary

The following are the main spaces that constitute the M'zabite traditional house. The numbering that precedes each constituent space will be used in the description of the house drawings and in the justified graphs that will be shown in figures [2-12].

X: Exterior
1: Skifa, Taskift or chicane.
2: Intermediate space.
3: Tissounane or stairs.
4: Houdjrat or ground floor male reception room.
5: Dahlis or cellar.
6: Wast eddar, Ammas N'Tadart, or centre of the house.
7: Tisifri or women's living room.
8: Inayen or kitchen.
9: Ajmir or toilets.
10: Lamghassal or traditional bathroom.
11: Tazeka N'El Aoulet or storage room.
12: Ikoumar or arched portico.
13: Tazeka or room.
14: Tigharghart or upper courtyard.
15: Aali or first-floor male reception room.
16: Tazadit or animal room.
17: Stah or terrace.

SYNTACTIC PROPERTIES

House 01 from the Ksar of Ghardaia [figure 02]:

This house is from the old part of Ghardaia settlement; it is a perimeter parcel [contiguous with the street network edge, in this case the alley]. Its justified graph shows a deep and a tree-like structure which branches at the Wast eddar. The Skifa, which is the entrance space, is at depth one whereas the terrace is the deepest space. The Wast eddar [covered ground floor courtyard] links all the living spaces at ground floor level as well as the first floor through the stairs those are at depth 03. The Wast eddar is the most integrating space in the house with an integration value of 0.70. Also, it is the largest space in the cluster. The most segregated spaces are, the basement, which has an integration value of 1.80 and the animal room with a value of 1.76. The basement and the animal room, therefore form two segregated poles in the justified graph. House 01 turns to have a mean integration value with exterior of 1.21 and the relativised base difference factor is 0.83 that indicates a strong degree of differentiation among values. The mean integration value for the Wast eddar, the Ikoumar and the Tigharghart is 0.57 and the relativised base difference factor for the three functions is 0.72 that indicates a strong degree of differentiation. If the Skifa is substituted for the Wast eddar, then the relativised base difference factor is less strong at 0.99. For the Wast eddar, room 01 and the toilets at ground floor level, the BDF*[relativised base difference factor] is still strong at 0.90. If the exterior is substituted for the Wast eddar, then the BDF* is weak at 0.99. The Wast eddar of house 01 turns out to possess a striking set of syntactic properties; it is the most integrating space in the dwelling.

House 02 from the Ksar of Ghardaia [figure 02]:

The house is accessed through a dead-end since it is located in the interior of the block. Its morphological character indicates a roughly rectangular shape. The justified graph shows a tree-like structure that branches at the Wast eddar, then at the Ikoumar. Like the previous example, the Wast eddar is the most integrating space in the house, and unlike house 01; the toilets and the traditional bathroom are the most segregated spaces of all. As assumed, in Islamic traditional spatial arrangement, these two spaces are located in a remote area of the cluster. The men's reception room, where male guests are received has an integration value of 1.42. The difference factor highlights the importance of the Wast eddar in structuring configurational relationship within the domestic interior. However, the BDF* with exterior is such strong at 0.82. For the Wast eddar, the Ikoumar and the Skifa, the BDF* is weak at 0.99. The degree of differentiation shares the same previous value of 0.99 for the Ikoumar, the Tigharghart and the Skifa whereas it is stronger at 0.97 for the Ikoumar, the Tisifri and the Aali on the first floor. These suggest, that the Wast eddar integrates and structures rather strongly the main living spaces in house two.

House 03 from the Ksar of Ghardaia [figure 02]:

The house is situated deep in the interior of the block. Like the previous case, it is accessed through a cul-de-sac. The justified graph shows that house three is relatively shallow in comparison to the former example. It presents a degree of permeability which allow for the choice of an alternative route,

House number	Order of Integration
01.	Wast eddar < stairs < Intermediate space < Tigharghart < Skifa < Store room < Ikoumar < Tisifri = room 01 < 0.70 0.80 0.90 0.92 0.99 1.01 1.09 1.10 rooms 2 & 3 < Exterior < Toilets < Animal room< Basement. 1.20 1.36 1.68 1.76 1.80
02.	Wast eddar < Stairs < Ikoumar < Intermediate space < Tigharghart <Tisifri = room 1< Skifa = Room 2< 0.85 0.88 0.96 1.00 1.25 1.27 1.39 Exterior < Room 3 < Toilets = Traditional bathroom. 1.82 1.95 2.22
03.	Wast eddar < Stairs < Ikoumar < Skifa < Houdjrat < Store room < Room 1= Tisifri < Room 2 < Tigharghart < 0.60 0.70 0.77 0.79 0.90 0.93 0.98 1.02 1.07 < Room 3 < Exterior = Animal room < Kitchen =Store room < Room 4 < Toilets = traditional bathroom 1.16 1.18 1.32 1.53 1.61
04.	Wast eddar < Stairs < Tigharghart < Store room < Tisifri = Kitchen < T.bath< Toilets < Ikoumar = Room 1 < 0.57 0.74 0.93 1.00 1.03 1.19 1.20 1.39 Skifa <Room 2 = Store room < Exterior = Houdjrat 1.41 1.46 1.87
05.	Ikoumar = Stairs < Wast eddar < Tigharghart < Tisifri = Room 1= Toilets = Kitchen = Store room < 0.68 0.71 1.12 1.13 Rooms 2 & 3 < Terrace < Toilets < Exterior 1.25 1.64 1.77 1.87
06.	Ikoumar = Stairs < Wast eddar < Tigharghart < Skifa <Room 1 < Tisifri = Kitchen = Store room < 0.72 0.78 1.11 1.14 1.19 1.25 Rooms 3 & 4 <Rooms 5 & 6 < Exterior < Toilets < Houdjrat 1.45 1.53 1.56 1.87 2.02
07.	Wast eddar < Stairs < Skifa=room 1 < Tisifri < Ikoumar < Room2 =Kitchen< Room3 0.78 0.87 1.18 1.22 1.26 1.44 1.62 = Traditional bathroom = Exterior < Tigharghart < Room 4 < Basement < Toilets 1.67 1.71 2.02 2.06
08.	Wast eddar <Stairs < Ikoumar < Skifa < Aali <Tisifri=Room1 <Tigharghart=Room2 0.88 0.91 0.94 0.99 1.04 1.26 1.29 < Rooms 3 & 4 < Room 5 = Kitchen <Exterior < Room 6 < Toilets = T.Bathroom 1.32 1.34 1.37 1.62 1.70
09.	Wast eddar = Ikoumar = Stairs < Tigharghart < Skifa < Aali <Tisifri = Kitchen = 0.59 0.82 0.88 0.96 1.07 Store room = Room 1< Rooms 2 & 3 < Exterior = Toilets = Traditional bathroom 1.08 1.36
10.	Stairs < Ikoumar < Wast eddar < Tigharghart < Skifa < Room 1 < Tisifri = Room 2 < 0.73 0.75 0.77 0.89 1.08 1.12 1.16 Rooms 3 & 4 < Rooms 5 & 6 < Exterior < Toilets 1.26 1.28 1.46 1.97
11.	Wast eddar 1 < Stairs < Ikoumar1 = Tigharghart1 <Wast eddar 2 < Ikomar2< Stairs <Skifa <Tigharghart 2 < 0.76 0.81 0.85 0.88 0.94 1.00 1.01 1.03 Tisifri 2=Room 1<Room 2 < Aali 1<Rooms 3&4=Kitchen1= Toilets 1< Room 5< Kitchen < Exterior< 1.05 1.06 1.10 1.15 1.19 1.25 1.32 Room 6=Store room <Toilets 2 < Rooms = Houdjrat< Terrace < Toilets 1.36 1.53 1.56 1.63 1.76
12.	Ikoumar < Stairs < Wast eddar < Tigharghart < Rooms 3&4 < Skifa < Tisifri = Kitchen = 0.51 0.60 0.73 0.87 0.90 1.09 1.12 Rooms 1&2 < Room 5 < Room 6 < Room 7 = Toilets < Exterior < Terrace = Room 8 1.15 1.19 1.27 1.48 1.54
13.	Wast eddar < Stairs < Ikoumar < Intermediate space < Tigharghart < Tisifri = Room1= 0.76 0.80 0.87 0.98 1.09 1.15 Kitchen < Room 2 < Toilets < Room 3 < Exterior < Room 4 < Terrace < Aali 1.23 1.45 1.53 1.61 1.62 2.10 2.26
14.	Tigharghart < Stairs < Wast eddar < Skifa < Tisifri < Room 1= Store room < 0.73 0.75 0.86 1.09 1.32 1.40 Exterior < Aali < Toilets < Room 2 < Room 3 & 4 1.56 1.61 1.63 1.73 1.77

House number	Order of Integration
15.	Ikoumar < Stairs < Wast eddar < Tigharghart < Aali < Room 1 = Tisifri < Room 2 < Skifa < 0.82 0.87 0.90 1.06 1.20 1.26 1.27 1.29 Houdjrat < Kitchen < Room 3 = Terrace < Exterior < Toilets < Room 4 1.32 1.33 1.43 1.65 1.67 1.99
16.	Wast eddar <Stairs < Ikoumar < Tigharghart < Aali < Kitchen < Skifa < Room 1 0.72 0.73 0.75 0.99 1.03 1.12 1.14 1.15 Rooms 2 & 3 < Room 4 < Toilets < Room 5 < Exterior < Terrace = Toilets 1.27 1.39 1.42 1.52 1.53 1.76
17.	Wast eddar < Stairs < Ikoumar <Skifa < Tisifri = Kitchen = Store room <Tigharghart 0.79 0.89 1.01 1.13 1.16 1.28 < Terrace < Rooms < Toilets = Traditional bathroom < Aali 1.48 1.55 2.15 2.73
18.	Stairs < Wast eddar = Ikoumar < Tigharghart< Tisifri = Room 1< Room 2 < Skifa< Terrace = Toilets < Exterior 0.81 0.85 1.02 1.37 1.64 1.67 1.98 2.19 2.19
19.	Wast eddar < Stairs < Skifa < Room 1 = Tigharghart =Kitchen = Store room = 0.56 0.68 0.99 1.05 Animal room < Terrace = Room 2 < Exterior < Toilets 1.18 1.48 1.55
20.	Wast eddar < Stairs < Ikoumar < Tigharghart < Tisifri = Room 1< Animal room < 0.72 0.74 0.80 1.11 1.15 1.24 Skifa < Room 2 < Room 3 < Toilets < Exterior < Terrace 1.26 1.51 1.55 1.65 1.70 1.90
21.	Ikoumar = Tigharghart < Stairs < Wast eddar < Room 1 < Skifa < Tisifri =Room 2= 0.98 1.02 1.11 1.33 1.47 1.55 Kitchen < Exterior < Room 3 =Toilets < Terrace 1.91 1.95 2.36
22.	Wast eddar < Stairs < Tigharghart < Room 1 = Kitchen = Store room < Ikoumar < 0.68 0.74 0.86 1.17 1.36 Skifa < Toilets < Exterior < Terrace 1.49 1.61 1.98 2.04
23.	Tigharghart = Stairs < Wast eddar < Ikoumar < Skifa < Tisifri = Toilets = Room 1 < Terrace < Exterior 0.67 0.77 1.15 1.24 1.35 1.73 1.83
24.	Wast eddar < Stairs < Tigharghart < Skifa < Tisifri = Kitchen < Rooms 3 & 4 < 0.71 0.79 0.90 1.07 1.10 1.30 Room 1 & 2 = Toilets < Ikoumar < Exterior < Room 5 < T. bath < Store room 1.41 1.44 1.47 1.84 2.21 2.32
25.	Wast eddar < Stairs < Ikoumar < Tigharghart < Tisifri = Room 1 = Kitchen=Store 0.69 0.70 0.75 0.99 1.08 room < Rooms 2-4 < Skifa < Room 5=Kern < Room 6 < Terrace <Houdjrat<Aali 1.13 1.14 1.38 1.42 1.74 1.83 2.19
26.	Wast Eddar < Stairs < Houdjrat < Ikoumar < Room & 2 =Tisifri=Kitchen < Tigharghart < 0.68 0.81 0.83 0.92 1.10 1.12 Aali < Skifa < Room3 < Room 4 = Room 5 = Store room < Exterior < Toilets 1.22 1.33 1.45 1.54 1.54 1.72
27.	Wast Eddar < Stairs < Ikoumar <Tigharghart < Skifa < Houdjrat < Tisifri = Room 1 & 2 < 0.81 0.83 0.85 1.05 1.18 1.20 1.21 Room3 & 4 < Kitchen < Room 5 < Aali < Exterior < Room 6 < Toilets 1.25 1.33 1.46 1.54 1.58 1.70 1.97
28.	Wast eddar < Stairs < Ikoumar < Houdjrat < Tigharghart < Tisifri=Skifa < 0.58 0.62 0.71 0.88 0.97 0.98 Kitchen < Aali < Room 4 < WC < Room2=Room3 < exterior < Room1=Terrace. 1.15 1.24 1.28 1.37 1.42 1.43 1.55
29.	Ikoumar < Stairs < Wast eddar < Tigharghart < Tisifri < Kitchen < Rooms 1 & 2 < 0.70 0.71 0.74 0.78 1.04 1.06 1.08 Room 3 < Room 4 < Skifa < Room 5 < Exterior < Toilets < Terrace 1.15 1.26 1.31 1.34 1.64 1.73 1.91

Table 2: Order of integration of main functions with exterior.

and has two distinct pathways, one leading to the men's reception room and the other leads up to the Wast eddar where the main female activities take place. The structure branches at the Wast eddar and at the Ikoumar. The relativised base difference factor with exterior for the house is strong at 0.82. Again, the Wast eddar is the most integrating space in the house with an integration value of 0.60. The toilets and the traditional bathroom are the most segregated spaces of all and share the same value of 1.61. The Wast eddar, the Ikoumar and the Tigharghart are on the integrated side of the mean with values of 0.60, 0.77 and 1.07 respectively. The degree of differentiation [BDF*] is not particularly strong at 0.92 for the Wast eddar, the Ikoumar and the Tigharghart, whereas it is less strong at 0.98 if the Tisifri is substituted for the Wast eddar. This demonstrates the vital role of the Wast eddar in drawing together and structuring the domestic interior spaces of house 03.

House 04 from the Ksar of Ghardaia [figure 03]:

The house is accessed through a cul-de-sac as it is situated into the interior of the block. It has two storeys and a terrace. The justified graph shows a very deep tree like structure branching at the Wast eddar, then at the Tigharghart on the first floor level. Again, the house presents two separate pathways, one leading to the male's quarter and the other leading to the family quarter. The Wast eddar is the most integrating space in the house and has an integration value of 0.67. The terrace and the exterior are the most segregated spaces of all with values of 1.46 and 1.87 respectively. The BDF* for the house is strong at 0.80. The degree of differentiation with exterior for the Wast eddar, the Skifa and the terrace is still strong at 0.87. For the Tisifri, the Skifa and the terrace the BDF* is relatively weak at 0.99. All these suggest, the important role that the Wast eddar performs in structuring and integrating the main functions in house 04.

House 05 from the Ksar of Ghardaia [figure 03]:

Again, the house is located deep into the block. The access to it is through a dead-end. It has two storeys and a terrace. The justified graph shows a tree-like structure branching at the Wast eddar, then at the Ikoumar. The non-resemblance to house 04 is confirmed by the way in which the degree of differentiation indicates the importance of the Ikoumar and the stairs in structuring the configurational relationship within the house. The Ikoumar and the stairs share the same and identical integration value with exterior of 0.68. Once again, the toilets and the exterior are the most segregated spaces in the cluster. The mean integration value with exterior for the Ikoumar, the exterior and the average relative integration is 1.14 and the relativised base difference factor is strong at 0.80. For the Ikoumar, the Skifa and the terrace, the degree of differentiation amongst values is still strong at 0.85. If the Wast eddar is substituted for the Ikoumar, then the BDF* with exterior is less strong at 0.86. For the Ikoumar, the Wast eddar and the Tigharghart, the BDF* is 0.93 whereas when the Tisifri is substituted for the Ikoumar, then the degree of differentiation is less stronger at 0.95. These suggest, the vital role that the Ikoumar performs in structuring house 05.

House 06 from the Ksar of Ghardaia [figure 03]:

The house is situated on the edge of the block and accessed through an alley. It has two storeys. The morphological character indicates a roughly rectangular shape. The justified graph shows a tree-like structure branching at two different vertices: the Wast eddar and the Ikoumar. Again, the Ikoumar and the stairs are the most integrating spaces in the house with a value of 0.73. The Houdjrat, or ground level male reception room and the toilets are the most segregated spaces of all with values of 2.03 and 1.87 respectively. The mean integration value without exterior for the house is 1.26 and the BDF* is strong at 0.78. For the Ikoumar, the Tigharghart and the Skifa the degree of differentiation is less strong at 0.95. If the Wast eddar is substituted for the Ikoumar, then the BDF* with exterior is less strong at 0.97. Yet, the Ikoumar as well as the stairs appear to be the most integrating space in the house and like the previous example, they structure and integrate rather strongly house 06.

House 07 from the Ksar of Ghardaia [figure 04]:

This house is situated deep in the interior of the block. It is accessed through a dead-end. It has two storeys. The morphological character indicates an irregularity of the parcel layout. Also, it shows the lack of formal and geometrical properties that are normally associated with conscious planning and design. The justified graph shows a tree-like structure branching at the Wast eddar, then at the Ikoumar. Once again, the Wast eddar is the most integrating space in the house with a value of 0.78. The basement and room 05 are the most segregated spaces of all with values of 2.02 and 1.71 respectively. The mean integration value with exterior is 1.41 and the degree of differentiation is strong at 0.83. For the Wast eddar, the Skifa and the Tigharghart the BDF* is 0.89. If the Ikoumar is substituted for the Wast eddar, then the BDF* is less stronger at 0.97. The Wast eddar structures and integrates rather strongly the different functions in the dwelling.

House 08 from the Ksar of Ghardaia [figure 04]:

This house is located on the edge of the block that faces the famous Ghardaia market square. It is situated on the other side of the block, and is accessed through an alleyway. Unlike the previous examples, the house is relatively shallow and presents a degree of permeability allowing an alternative route. It branches at the Wast eddar, the main stairs and the Ikoumar. The relativised base difference factor with exterior for the house strong at 0.91. The Wast eddar, the Ikoumar and the Skifa are on the integrated side of the mean. The mean integration value for the Wast eddar, the Ikoumar and the Tigharghart is 1.02 and the BDF* is 0.96. If the Skifa is substituted for the Wast eddar, then the degree of differentiation is less strong at 0.97. Yet, the Wast eddar is the most integrating space in the house.

House 09 from the Ksar of Ghardaia [figure 04]:

This is the smallest case in the Ghardaia sample. The house is situated in a block facing a Rahba, Berber for an open small square. The house is located deep in the interior of the block and it is accessed through a Sabat [covered dead end]. The justified graph shows a tree-like structure branching at the Wast eddar and the Ikoumar. Also, it shows that there is a degree of permeability allowing for the presence of an alternative route deep within the domestic interior. There are two separate pathways in the house [the male guest room path and the family quarter path]. The two paths connect at the Tigharghart through the men's reception room. The relativised

base difference factor is amongst the strongest of the study sample with a value of 0.86. The Wast eddar and the Ikoumar are the most integrating spaces of all and share the same value of 0.59. The degree of differentiation with exterior for the Wast eddar, the Ikoumar and the Skifa is still strong at 0.95. For the Wast eddar, the Ikoumar and the Tigharghart, the mean integration value with or without exterior is 0.66 and the BDF* is 0.97. For the Tigharghart, the Skifa and the Tisifri, the BDF* is less strong at 0.98. All these suggest, that the Wast eddar and the Ikoumar draw the entire configuration together and structure the relationship between the main living spaces.

House 10 from the Ksar of Ghardaia [figure 05]:

The house is situated on a narrow block that borders Ghardaia market square, but is located on the other side, which faces the residential quarter. It is accessed through an alley. It has three storeys. The morphological feature indicates an irregularity of the parcel layout. The justified graph shows a deep tree like structure, branching first at the Wast eddar, then at the Ikoumar and finally at the Tigharghart. The relativised base difference factor with exterior is strong at 0.82. The most integrated spaces are the Ikoumar and the main stairs with integration values of 0.75 and 0.73 respectively. The most segregated spaces are the toilets with an integration value of 1.97. The degree of differentiation without exterior for the stairs, the Ikoumar and the Wast eddar is 0.97. If the Tigharghart is substituted for the Ikoumar, then the BDF* is weak at 0.99. For the Ikoumar, the toilets and the average relative integration, the BDF* is more stronger at 0.82. These suggest, that the different sections and spaces and the different functions within the dwelling are drawn together by the Ikoumar and to a less degree by the dwelling's main stairs.

House 11 from the Ksar of Ghardaia [figure 05]:

This house is situated deep in the interior of the block. It is accessed through a dead-end. The block itself is large and irregular in shape. The morphological character of the parcel presents a roughly rectangular shape. The dwelling is a large complex consisting of two houses, but accessed through only one entrance, the Skifa. The dwelling has a spatial arrangement which allows for the existence of alternative routes from one space to another, and hence a degree of choice in moving about the domestic interior. Also, there is in this example a split, into two at the entrance, which is at depth 01. One route leads up to the Aali or men's guest room on the first floor level and the other route to the Wast eddar where the daily main female activities take place. House 11 is the only example in the study sample, where there is another male quarter but this time at the cellar level. It includes a living room, a kitchen and three rooms. The justified graph has similar properties to those of house 10, but the graph depth is even more pronounced. The main access to the house passes through the Skifa, the Wast eddar 01, then it splits into two routes: one leading to the Wast eddar 02, on to the Ikoumar 02 then to the Tigharghart 02. The other route leads up to the Ikoumar 01, on to the Tigharghart 01, which links, with the Ikoumar 02 creating an alternative route. The Wast eddar 01, the Ikoumar 01, the Tigharghart 01, the Wast eddar 02 and the Ikoumar 02 are on the integrated side of the mean. They are the most integrated spaces in the complex. The most segregated spaces are the toilets and the terrace. This fact supports what Donnadieu & Didillon wrote: " One eminent importance in a house is the roof terrace, the domain par excellence of women " [C. & P. Donnadieu/ H.& J.-M Didillon, 1977, Habiter le desert, p 84].

The configuration of house 11 seems to require a more complex interpretation than the previous examples. There is a split into two paths at the Skifa, each leading to a different set of rooms. The focus of integration is centred on the Wast eddar 01 and the Ikoumar 01 but it diffuses a more integrated domain. At the opposite pole is a set of separate, segregated rooms, the terrace and the toilets. The mean integration value with exterior for the complex is 1.17 and the relativised base difference factor is 0.93. For the Wast eddar 01, the Ikoumar 01 and the Tigharghart 01, the BDF* is 1.00. If the Skifa is substituted for the Wast eddar 01, then the BDF* is 0.99. All these degree of differentiation among values demonstrate that the relationships amongst the constituent spaces are unstructured. This suggests, that the different functions within the complex, be separated from each other as much as possible.

House 12 from the Ksar of Beni Isguen [figure 06]:

This house is situated deep in the interior of the block. The first step from the cul-de-sac outside, leads into the Skifa. The Wast eddar is directly accessible from the latter. The Tisifri, or women's living room, the kitchen and rooms 1 & 2 are adjacent to the Wast eddar on the ground floor level. The stairs lead up to the first floor, where the Ikoumar, the Tigharghart and rooms 3-6 are located, From the first floor another staircase leads up to the terrace. The justified graph shows a deep tree like structure. The Ikoumar is the most integrated space in the house with an integration value without exterior of 0.50. The terrace is the most segregated space and shares an equal integration value without exterior of 1.54, with a storage room and room 07. The degree of differentiation for the house is strong at 0.78. For the Ikoumar, the Tigharghart and the Skifa , the BDF* with exterior is still strong at 0.89. If the Tisifri is substituted for the Ikoumar, then the BDF* with exterior is less stronger at 0.97. It follows that the Ikoumar plays an important role in drawing together the different levels of the house.

House 13 from the Ksar of Beni Isguen [figure 06]:

This house is located on a block that is opposite Beni Isguene triangular shaped market square. The house is situated deep into the interior of the block. It is accessed through a cul-de-sac. The morphological character indicates that house 13 has a roughly rectangular shape. It has a justified graph, which has certain differences from the previous example. It shows a split at the Skifa, the entrance. One route leads up to the male guest quarter, the other to the Wast eddar, which branches into the Tisifri, The kitchen, room 01, the toilets and the stairs that lead up to the first floor. It follows that it branches at the Ikoumar, which is at depth 05, into rooms 2 & 3, the Tigharghart and the toilets. Yet again the Wast eddar is the most integrated space in the house and the terrace is the most segregated one, within the dwelling. The relativised base difference factor with exterior for the house is strong at 0.81. If the Ikoumar is substituted for the Wast eddar, then the BDF* with exterior is less stronger at 0.85. These, indicate that the Wast eddar draws the entire configuration together and structures the relationship between the different spaces within the house.

House 14 from the Ksar of Beni Isguen [figure 07]:

This house is situated deep into the older part of Beni Isguene. It is accessed through a cul-de -sac, since located into the interior of the block that is opposite the old mosque. The morphological character indicates an irregularity of the parcel layout. The house has a tree like justified graph showing an alternative route deep into the structure. There is a split at the Skifa: one path leading to the Aali or first floor male guest quarter and the other leads to the Wast eddar that branches into the Tisifri, the Kitchen, the toilets and the stairs. The Tigharghart is the most integrated space of all with a value of 0.73. The upper level rooms are the most segregated spaces with a an equal value of 1.77. The BDF* with exterior for the house is strong at 0.85. The relativised base difference factor for the Tigharghart, the Wast eddar and the Skifa is 0.96. If the Tisifri is substituted for the Tigharghart, then the BDF* is still identical at 0.96. In this case the house tends to homogenise its component parts and render them spatially equivalent.

House 15 from the Ksar of Beni Isguen [figure 07]:

This house is located on a block situated on the edge of Beni Isguene settlement. The block itself is thin and rectangular in shape. The house occupies the whole width of the block. One enters the Skifa from the alley outside, but the ground floor rooms are reached through an intermediate space. The resemblance to the previous case is confirmed by the way in which a split at the Skifa branches into two, one path leading up to the Aali and the other; to the family quarter. The justified graph shows a degree of permeability between the male guest room and the Ikoumar on the first floor level. Once again the Ikoumar is the most integrated space of all within the complex with an integration value with exterior of 0.82. Room 04, which is situated at the terrace level, is the most segregated space with a value of 1.99. The BDF* with exterior for the house is strong at 0.85. The degree of differentiation with exterior for the Ikoumar, the Aali and the Wast eddar is strong at 0.78. The BDF* for the Aali, the Wast eddar and the Tigharghart is weak at 0.98. This indicates that the Ikoumar integrates rather strongly the different spaces in house 15.

House 16 from the Ksar of Beni Isguen [figure 07]:

This house is located deep into the interior of the block. It is accessed through a cul-de-sac. It has two storeys. One enters the Skifa from the dead end. At the Skifa, the route splits into two pathways; one leads up to the Aali or male reception room and the other gives onto the Wast eddar, where the female activities take place. The Wast eddar or the ground floor courtyard branches into the women's living room, room 1 & 2, the kitchen, the toilets as well as the stairs which lead up to the first floor, where the arched portico branches into the Tigharghart, and rooms 3 & 4. The justified graph shows a tree like structure with a choice of an alternative route from the Ikoumar through the male guest room. The Wast eddar is the most integrated space of all within the house with a value of 0.72. The terrace and the toilets are the most segregated spaces with an equal value of 1.76. The BDF* with or without exterior for the house is strong at 0.84 and 0.85 respectively. The relativised base difference factor for the Wast eddar, the Ikoumar and the Skifa is 0.94. If the Tisifri is substituted for the Wast eddar, then the BDF* is much stronger than before at 0.88. If hey are not taken into account, the remaining spaces are homogenised in value, and separated from one another by the pattern of permeability.

House 17 from the Ksar of Beni Isguen [figure 07]:

This house is situated at the angle of a block besides Beni Isguene gate. It is accessed through a lane, which runs along the rampart wall. The morphological character indicates a quiet rectangular shape of the dwelling. The house has two storeys and a cellar. The justified graph shows a deep tree-like structure with a degree of permeability between the male guest room and the Tigharghart on the first floor. Once again, there is a split at the Skifa; one route leads up to the first floor male guest room and the other leading to the family quarter. One enters the Skifa, which is at depth 01 from the lane or thoroughfare, but the Wast eddar, and the whole set of spaces that are adjacent to it, are reached through an intermediate space. The relativised base difference factor with exterior for the house is strong at 0.71 and without exterior is even stronger at 0.66. The mean integration value with or without exterior is 1.47 and 1.45 respectively. The Wast eddar is the most integrated space in the house with an integration value of 0.79. The Wast eddar, and the Ikoumar are on the integrated side of the mean whereas the Skifa, the Tigharghart and the Tisifri are on the segregated side of the mean. The degree of differentiation for the Wast eddar, the Ikoumar and the Skifa is 0.72. If the Tisifri is substituted for the Wast eddar, then the BDF* is less stronger at 0.94. These demonstrate the key role-played by the Wast eddar and to a lesser degree the Ikoumar, in structuring the domestic interior of the house.

House 18 from the Ksar of Beni Isguen [figure 08]:

This house is situated on a block located in the lower part of Beni Isguene settlement. The block is regular in shape contrasting with the irregularity shown on the upper part of the settlement. The house is located on the edge of a block and it is accessed through a thoroughfare. It has two storeys and a terrace. By comparing it, to the previous case, the house is small in size. The justified graph shows a deep tree like structure branching at the Wast eddar. The first step from the lane outside, leads into the Skifa, which is at depth 01. The ground floor covered courtyard is directly accessible from it, and a staircase leads up to the first floor where the Ikoumar, the Tigharghart, a room and the toilets are located. The ground floor main functions include the women's living area, the kitchen, and room 02 as well as the toilets. Unlike the previous example, the most integrated space in the house are the stairs, with a value of 0.81. The Wast eddar and the Ikoumar share an identical integration value of 0.85 and are on the integrated side of the mean. The relativised difference factor for the house with or without exterior is the same at 0.85. The BDF* with exterior for the stairs, the Wast eddar and the Ikoumar is 1.00. If the Skifa is substituted for the stairs, then the BDF* is 0.99. All these suggest that the different functions within the house are separated from each other. House 18 homogenise its component parts and render them spatially equivalent.

House 19 from the Ksar of Beni Isguen [figure 08]:

This house is situated in the interior of a block and is accessed through a cul-de-sac. The justified graph shows a tree like structure branching at Wast eddar. It presents certain differences from the previous case. The animal room is accessed from the opposite side of the entrance, which is at depth 01. Also, it shows that this house is relatively shallow as

compared to house 18. The relativised difference factor with or without exterior for the house is the same and strong at 0.81. The Skifa, the Wast eddar and the stairs are on the integrated side of the mean, with a mean integration value with exterior for the house of 1.09. The BDF* with exterior for the Wast eddar, the Skifa and the Tigharghart is strong at 0.91. The degree of differentiation for the Skifa, Room 01 and the terrace is weak at 0.99. For the Tigharghart, the Skifa and the terrace, the BDF* is still weak at 0.99. This house is yet, another case where the Wast eddar and the stairs are the most integrating spaces, which link and structure a homogenised and separated set of living spaces, and relate these to the exterior.

House 20 from the Ksar of Beni Isguen [figure 08]:

This house has two stories and a terrace, and is relatively deeper from the space outside than the previous example. The depth of the graph is more pronounced. The morphological character of the site indicates a steeping slope, the flat roof of the house, becomes an entrance to the animal room from above. Once again, the Wast eddar is the most integrated space with a value with exterior of 0.72. The terrace is as segregated as the toilets. The terrace is the most segregated space of all at 1.90. The degree of differentiation with exterior for the house is strong at 0.82. The BDF* with exterior for the Wast eddar, the Ikoumar and the stairs equals 1.00. If the Skifa is substituted for the Wast eddar, then the BDF* is strong at 0.70. These suggest, that the different functions within the house be separated from each other as much as possible. Between levels, the Wast eddar does not structure the space to a significant extent. This house homogenises its component parts and renders them spatially equivalent.

House 21 from the Ksar of Beni Isguen [figure 09]:

The house has a justified graph, which has similar properties to those of house 20, but the depth is less pronounced. It shows a tree-like structure branching at the Wast eddar, which is at depth 02. The most integrated main spaces are, the Ikoumar and the Tigharghart on the first floor with an equal value of 0.98 whereas it is the Tigharghart which the most integrated space when discounting the exterior with a value of 0.96. The terrace and the exterior are the most segregated spaces in the complex with values of 2.35 and 1.91 respectively. The mean integration value with exterior for the house is 1.59 and the BDF* is strong at 0.85. The degree of differentiation with exterior for the Wast eddar, the terrace and the Ikoumar is strong at 0.80. The difference factor with exterior for the Ikoumar, the Skifa and the Tigharghart is still strong at 0.96. If the Tisifri is substituted for the Ikoumar, then the BDF* is still equals 0.96. House 21 tends to homogenise its component parts and tends to render them spatially equivalent.

House 22 from the Ksar of Beni Isguen [figure 09]:

The house has two storeys and a terrace. It is another case of the integrating Wast eddar and segregating terrace type. It has a justified graph that shows a tree like structure branching at Wast eddar, which is at depth 03. The Wast eddar and the Tigharghart are on the integrating side of the mean. The Tigharghart is amongst the most integrated spaces in the house with a value with exterior of 0.87. The mean integration value with exterior for the house is 1.31 and the BDF* with exterior is strong at 0.87. The difference factor without exterior, for the house is stronger at 0.78. The BDF* with exterior for the Wast eddar, the Tigharghart and the terrace is strong at 0.68. If the Skifa is substituted for the Wast eddar, then the BDF* is less strong at 0.86. The degree of differentiation with exterior for the Wast eddar, the Tigharghart and the Skifa is still strong at 0.86. If Room 01 is substituted for the Wast eddar, then the BDF* is less strong at 0.94. The effect of configuration of spaces in this house is that; once again, house 22, is another case of the Wast eddar centred house.

House 23 from the Ksar of Melika [figure 10]:

It is the smallest example of the whole study sample. The house is situated at Melika settlement and has two storeys. The justified graph shows a tree like structure branching at the Wast eddar, which is at depth 02. The mean integration value for the house with or without exterior is 1.22 and 1.18 respectively. The relativised base difference factor for the house, with or without exterior, is 0.81 and 0.80 respectively. The Tigharghart is the most integrating space in the house with a value with exterior of 0.67. The Tigharghart, the Wast eddar and the stairs are on the integrating side of the mean. the exterior is the most segregated space of all in the house, with a value with exterior, of 1.83. The BDF* with exterior For the Tigharghart, the Wast eddar and the terrace is strong at 0.76. If the Skifa is substituted for the Tigharghart, then the degree of differentiation is less strong at 0.88. For the Tigharghart, the Tisifri and the Ikoumar, the relativised base difference factor is still strong at 0.91. If room 01 is substituted for the Tigharghart, then the degree of differentiation is less strong at 0.99. The effect of configuration of spaces in this house is that, the Tigharghart draws the entire configuration together and structures the relationships between it and the rest of the spaces.

House 24 from the Ksar of Bounoura [figure 10]:

This house is situated in Bou Noura settlement. It has two storeys. The justified graph shows a degree of permeability at a deeper level within the interior. The structure branches twice, first at the Wast eddar, which is at depth 02, then at the Tigharghart on the first floor. The mean integration value with exterior for the house is 1.37 and the relativised base difference factor is strong at 0.74. The Wast eddar is the most integrating space in the house with a value with exterior of 0.70. The toilets and a storing room are the most segregated spaces of all, with values of 2.21 and 2.32 respectively. The BDF* for the Wast eddar, the Tigharghart and the Ikoumar is strong at 0.95. If the Skifa is substituted for the Wast eddar, then the BDF* is less strong at 0.99. The degree of differentiation for the Wast eddar, the Tisifri and room 05 is strong at 0.81. If room 01 is substituted for the Wast eddar, then the BDF* is less strong at 0.89. Yet, once again, this case suggests that this example too, is a Wast eddar centred house. The Wast eddar draws together the entire configuration of spaces in this house.

House 25 from the Ksar of El Ateuf [figure 11]:

This house is situated in El Ateuf, the oldest settlement in the M'zab valley. It is located on the edge of a block and it is accessed through an alley. The justified graph shows a deep tree-like structure branching first, at the Wast eddar that controls the access to the adjacent spaces including the Tisifri

or women's living area. Then, the structure branches at the Ikoumar on the first floor, leading to a set of multi-functional rooms as well as to the Tigharghart. The division into two paths occurs at the Skifa; one route leads up to the male's reception room on the first floor or the Aali, the other path leads to the Wast eddar or the family quarter. The mean integration value with exterior for the house is 1.25 and the relativised base difference factor with exterior is strong at 0.75. The Wast eddar, the stairs and the Ikoumar are on the integrated side of the mean. The Aali is the most segregated space of all within the complex with a value of 2.19. The BDF* with exterior for the Wast eddar, the Ikoumar and the Skifa equals 0.93. If the Aali is substituted for the Wast eddar, then the BDF* is stronger at 0.76. For the Wast eddar, the Tisifri and the Tigharghart, the BDF* with exterior is weak at 0.96. If room 01 is substituted for the Wast eddar, then the degree of differentiation equals 1.00. All these, suggest that the different functions within the house are separated from each other. The house homogenises its component parts and render them spatially equivalent.

House 26 from the Ksar of El Ateuf [figure 11]:

This house is situated in El Ateuf settlement. It has two storeys. The justified graph shows a deep tree like structure branching at the Wast eddar, then twice on the first floor at the Tigharghart or upper courtyard and at the Ikoumar or arched portico. The mean integration value for the house is 1.11 and the relativised base difference factor is strong at 0.82. The Wast eddar is the most integrating space with a value of 0.58. The Stah or the terrace is the most segregated space in the house with a value of 1.55. The Aali or male guest room is accessed through the Wast eddar on ground floor level with a value of 1.24.. For the Ikoumar, the Skifa or the entrance, and room 03, the relativised base difference factor is strong at 0.87. If the Wast eddar is substituted for the Ikoumar, then the BDF* is stronger at 0.81. The BDF* for the Wast eddar, the Tisifri and the Tigharghart, the degree of differentiation is still strong at 0.93. If the Houdjrat is substituted for the Wast eddar, then the BDF* is less strong at 1.00. All these suggest, that the Wast eddar plays an important role in integrating, structuring and linking the different spaces within the dwelling.

House 27 from the Ksar of El Ateuf [figure 11]:

This house is situated on the edge of a block in El Ateuf. It is accessed through an alley. The justified graph shows a deep tree-like structure branching at Wast eddar's and ikoumar's levels. The entrance is the space where the house splits into two. One route leads up to the male quarter and the other to the Wast eddar where the main female activities take place. The two paths connect on the first floor through the Ikoumar. The Wast eddar and the Ikoumar are the most integrated spaces in the house with values of 0.82 and 0.83 respectively. The mean integration value for the house is 1.26 and the relativised base difference factor is strong at 0.86. The Wast eddar and the Ikoumar are on the integrated side of the mean. The Aali, or first floor male guest room, and the exterior are on the segregated side of the mean with values of 1.54 and 1.58 respectively. The toilets are the most segregated space of all with a value of 1.97. The relativised base difference factor with exterior for the Wast eddar, the Skifa and the Ikoumar is strong at 0.96. If the Tisifri is substituted for the Wast eddar, then the BDF* is still strong at 0.97. For the Wast eddar, the Tisifri and the Tigharghart, the Degree of differentiation is still identical to 0.97. If the kitchen is substituted for the Wast eddar, then the BDF* is less strong at 0.99. These suggest that the Wast eddar integrates and structures rather strongly the main living spaces in this house.

House 28 from the Ksar of El Ateuf [figure 12]:

This house is situated in El Ateuf settlement, located on the edge of a block and accessed through an alley. There is a split into two at the entrance, which is at depth 01. Despite its tree-like structure, the house has an alternative choice of moving about the domestic interior. The two paths connect at the Wast Eddar, then at a deeper stage at the Tigharghart or upper courtyard. The dwelling has two stories. As mentioned before, the justified graph shows a deep tree like structure. The relativised base difference factor is strong at 0.82. The Wast eddar at ground floor level is the most integrated space with a value of 0.68. The Wast eddar, the Ikoumar, arched portico, and the Houdjrat, or ground floor male guest room is on the integrated side of the mean with values of 0.68, 0.81 and 0.83 respectively. The exterior and the toilets are on the segregated side of the mean with values of 1.54 and 1.72 respectively. The relativised base difference factor for the house is quiet strong at 0.94. The degree of differentiation with exterior, for the Wast Eddar, the Skifa and the Tigharghart is still strong with the same and identical value of 0.94. If the Tisifri, or women's reception room, is substituted for the Wast eddar then the relativised base difference factor is less strong at 0.99. For the Wast eddar, the Aali and room 01, then the degree of differentiation is strong at 0.87. If room 02 is substituted for the Wast eddar, then the BDF* is less strong at 0.97. All these, suggest that this example is a Wast eddar-centred house. It structures and links the different spaces in the dwelling.

House 29 from the Ksar of El Ateuf [figure 12]:

This house is another case of the integrating Ikoumar and segregating terrace type. It has a justified graph, which has similar properties of those of the previous house. The depth of the graph is even more pronounced and it is identical in that, the house splits into two at the entrance, which is at depth 01. The main access passes through the Wast eddar, the other leads up to the male reception room. The Ikoumar is the most integrated space in the house with values , with or without exterior, of 0.69 and 0.70 respectively. Also, the Wast eddar and the Tigharghart are on the integrating side of the mean. The exterior is as segregating as the terrace with values of 1.64 and 1.90 respectively. The mean integration value for the house with exterior is 1.24 and the relativised base difference factor is strong at 0.81. The BDF* for the Ikoumar, the Wast eddar and room 01 is strong at 0.93. If the Tigharghart is substituted for the Ikoumar, then the BDF* is less strong at 0.95. The degree of differentiation for the Ikoumar, the terrace and the Tisifri is strong at 0.79. If the kitchen is substituted for the Ikoumar, then the BDF* is less strong at 0.89. Once again, this case suggests that this example is an Ikoumar-centred house.

Discussion

The primary hypothesis of space syntax analysis is that the topological structure of space is a fundamental mean by which society constitutes itself, and thus, the spatial patterns

of buildings both embody and shape social patterns, which are [the socio-spatial principles], in some sense, the inverse of each other. The approach used in this study is to interrelate and integrate topological data and adopt descriptive and numerical methods in the analysis process.

The preliminary results of this analysis using the concept of " relativised difference factor " suggest four characteristic modes for structuring the M'zabite domestic interior, [see table two 02]. The sample justified graphs reveal the tree-like configuration of M'zabite traditional homes. Different functions occupy separate branches. Approximately 59% of the houses tend to be configurationally integrated, deep core and tree-like and offer no possibility of fine-tuning to take account of different social situations. There is a strong emphasis on keeping the dwellings deep from the exterior, so they are not easily accessible [the sample average depth is 4.55]. This M'zabite planning strategy is associated with spatial configuration in which no direct casual encounters between the residents and the visitors are seen as valuable opportunities for social exchange. 27% of the houses are deep core and ringy and can be considered to be the most obvious manifestation of the fine-tuning of configuration to modulate the social dynamics of the houses occupants: guests/hosts, men/women. The remaining houses are characterised as being shallow and ringy and thus, offer their residents an alternative and route choice. Hillier & Hanson, suggest that these configurations support patterns of 'spatial solidarity' in which household members and visitors are brought together by the dwelling's spatial configuration [16].

The syntactic interpretations of the studied sample reveal that 2/3 of the houses are Wast eddar -centred, a little more than 1/5 are Ikoumar-centred, and 1/10 are Tigharghart-centred. As far as the first genotype is concerned, the Wast eddar is the most integrated space with the properties of being shallow, and linking the different levels of the houses through the stairs. The toilets, the terrace, the exterior, and to a less extent the Aali, are relatively segregated. Houses 1-4, 7-8, 11, 13, 16-17, 19-20, 22, 24-28 inclusive, are examples of this type. This genotype structures significant configurational differences between the Skifa and the rest of all living spaces on the first-floor, and relates these spaces as a whole to the exterior of the house [strong relativised base difference factor]. The remaining rooms are held apart within the configuration, but the relations amongst these are not structured to anything like the same degree. They are segregated and multi-functional accommodating a variety of domestic activities. This finding suggest that the Wast Eddar which is a female space by excellence contraries the many architectural research reports that claim and interpret the spatial position of the female in the house as a “segregating and secluding” sphere which is embedded in religious tenets[17]. It rather underlines the spatial structure of M’zabite home , in terms of zones of users that embed gender codes. It might be significant to this debate to clarify two points. The first point is that there is no certain obligation in Islam concerning the spatial location of the female in the house; as a matter of fact; there is nothing mentioned in the Quran , the holy book, about the segregation and seclusion of the female in the house or anywhere else. The second issue is the use of the terms of “seclusion and segregation” by scholars in the identification of the female “sphere”. Most of these scholars, unfortunately, have all too easily adopted these terms without providing empirical evidence or spatial interpretation that is built on empirical observation. These terms are not even used to describe the female occupation of home.

The second characteristic mode for structuring the domestic interior of the M'zab homes are the stairs with the properties of being the most integrating and linking the different levels of the houses, mainly the first and second floor. Houses 5-6, 10, and 18 are examples of this type.

The third genotype shows that the most important space in structuring interior relations, and those between the ground-floor living spaces and the Stah or the terrace is the Ikoumar, though in fewer examples the Tigharghart, or upper courtyard may also performs this role. From a topological point of view, the Ikoumar and the Tigharghart have the same characteristics. The houses with alternative, but interconnected routes to the upper-floor will be ones where high integration shifts to the Ikoumar. The main configurational differences are to be found between the Ikoumar, the Skifa and the upper floor rooms, which are located on different floors of the houses [strong difference factor]. The Wast eddar is also well integrated, but unlike the previous examples [first genotype] it is not the primary means by which significant configurational differences are created among the set of rooms on different floor levels. In these cases, the Ikoumar is amongst the most integrating spaces and the exterior; the toilets and the terrace lie on the segregated side of the mean. Houses 5-6, 9-10, 12, 15, 21 and 29 inclusive are examples of this type. The fourth genotype is the Tigharghart on the first-floor. It is the most integrated space with the properties of being deep in the configuration and linking the two branches of the structure. Houses 14, 21, and 23 inclusive are illustrations of this type. The syntactic interpretations reveal that these deep-core and ringy houses configure ways of life by constructing social interface between guests end hosts, men and women. The ring from the Skifa, through the Aali to the Ikoumar or the Tigharghart, permits a degree of the tuning of the host-guest relations in the house. The division into two separate domains, women/men, signify in terms of domestic life the influence of cultural norms on the spatial organisation of M'zabite traditional houses: the Wast eddar is the site of women's everyday activities, whereas the male activity within the house is rejected to the upper-floor, thus indicating the important role of women within the household. It is the gender occupation and use of space of home. This feature which is seldom found in Western houses today, is one of the main design necessities, not just for M’zabite house, but for the houses in most of the Arab Muslim society. It introduces the house as a composition of domains and zones of users.

This paper developed the same ideas as did Orhun et al with reference to a sample of Turkish traditional houses from the 17th to the 19th century [18]. Although, the main concern here was with M'zabite traditional houses, a comparative study between the two cases might open up new avenues. The discussion of this comparison will be the subject of a subsequent paper. As space syntax analysis seems to be revealing of traditional buildings with clear segmentation. It is considered to be a rear view rather a searchlight [19].

Another finding reached by this study and not the least contradicts what C. & P. Donnadieu / H.& J.-M Didillon and Ravereau A. developed in their books: "Habiter le désert, les maisons Mozabites" and "Le M'zab, une leçon d'architecture" that there is no specific type of housing in the M'zab valley. The preliminary results of this research work, using the space syntax methodology, come out with four architectural genotypes [the Wast eddar, the Ikoumar, the stairs and the Tigharghart], and identify these spatial patterning of the M'zab houses in terms of their domestic living arrangements. The identification of a common genotype for dwellings defines a pattern of cultural relationship: 'a social logic of space'. Now, it could be possible to fill this gap in the M'zab vernacular housing record.

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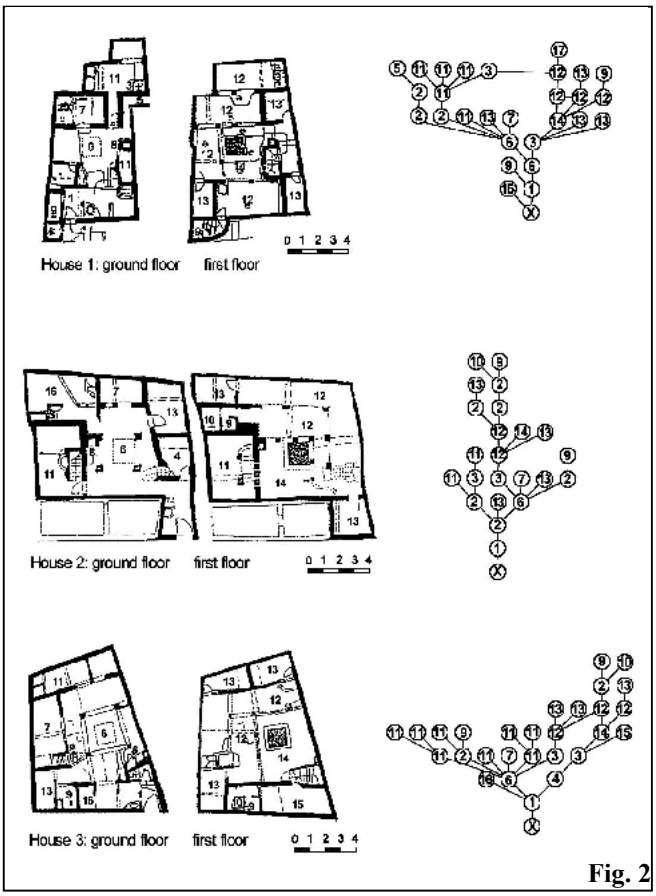
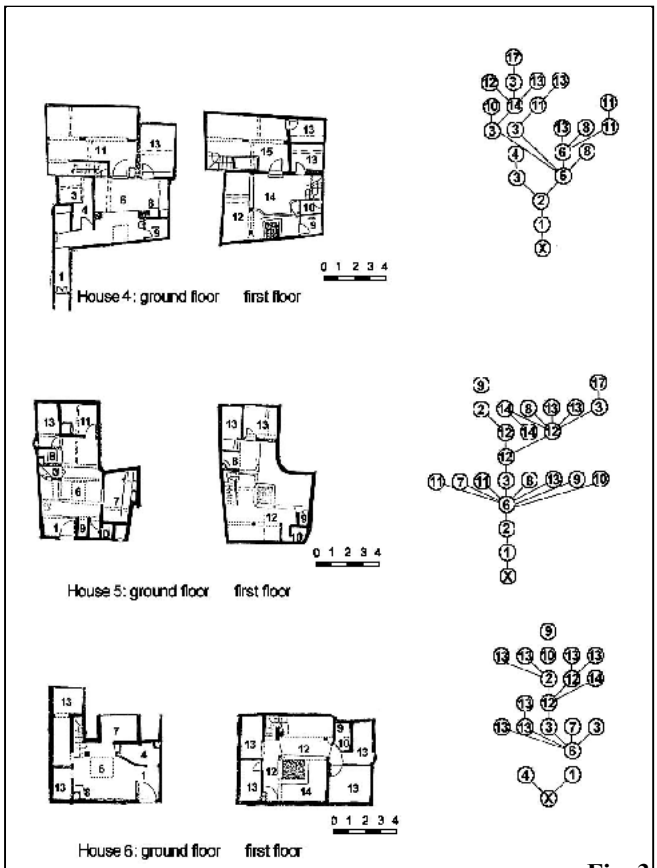


Fig. 2



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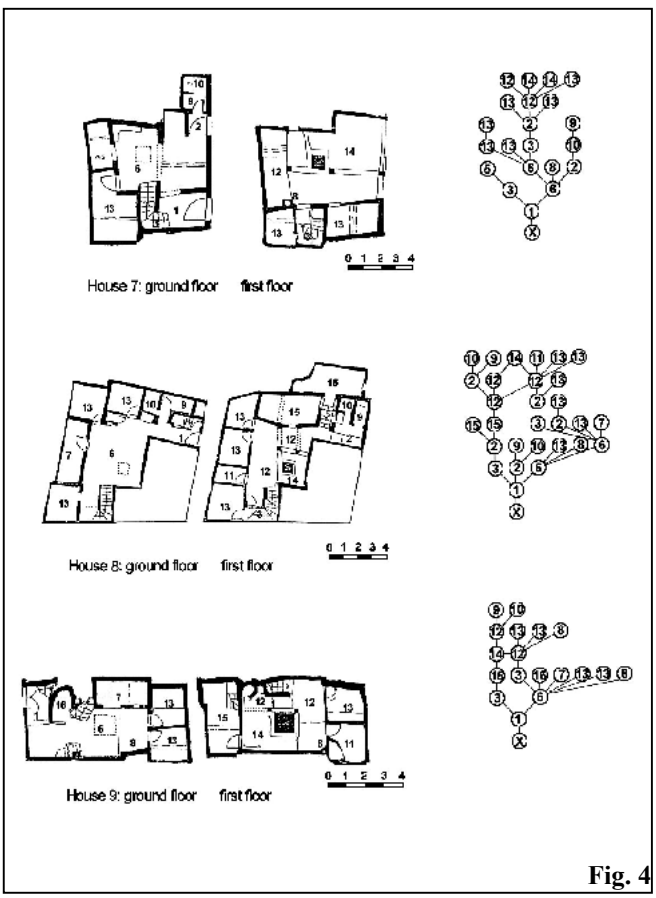

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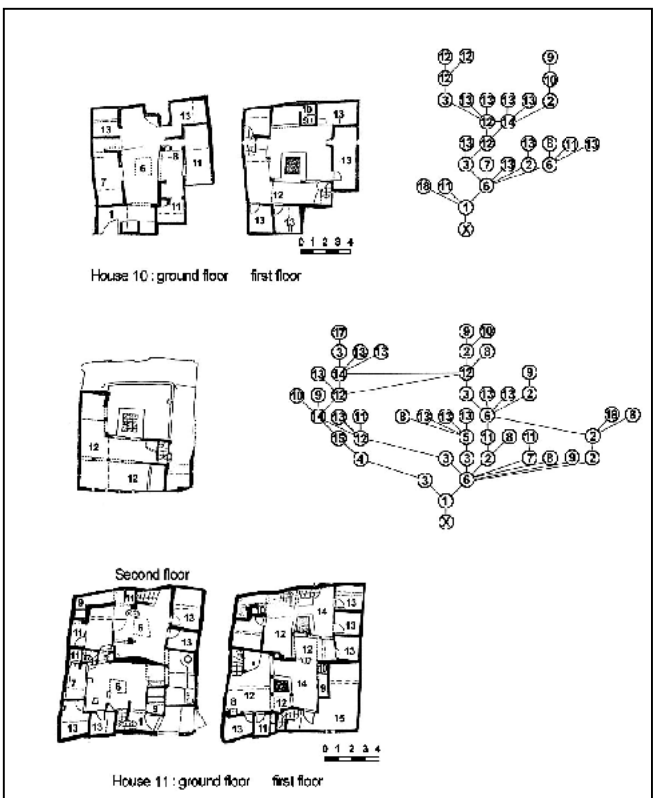

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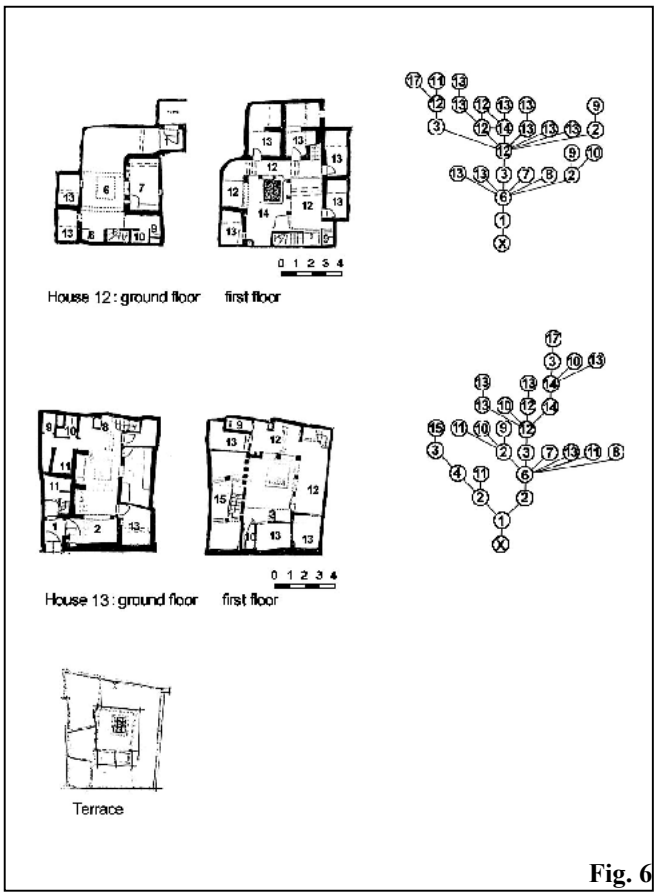

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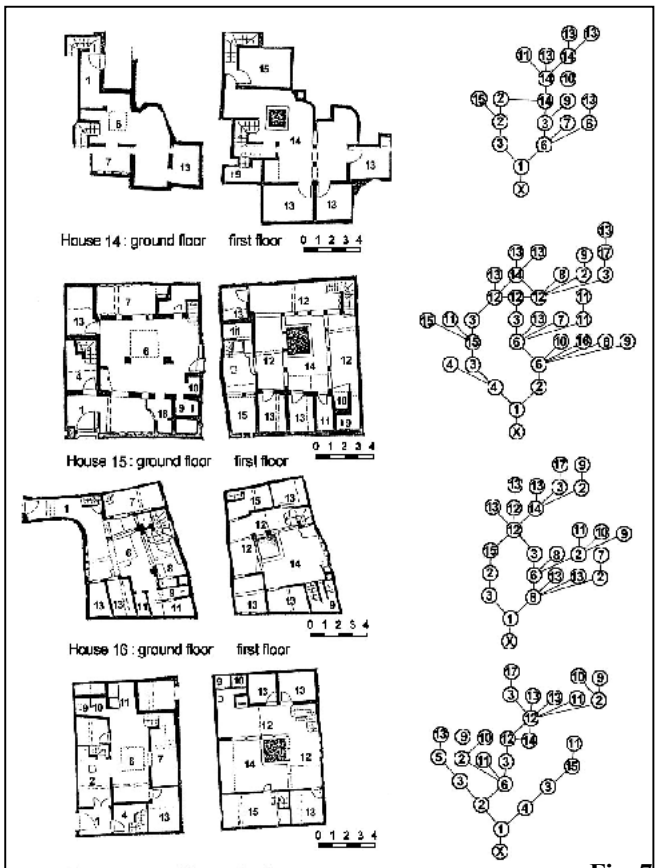

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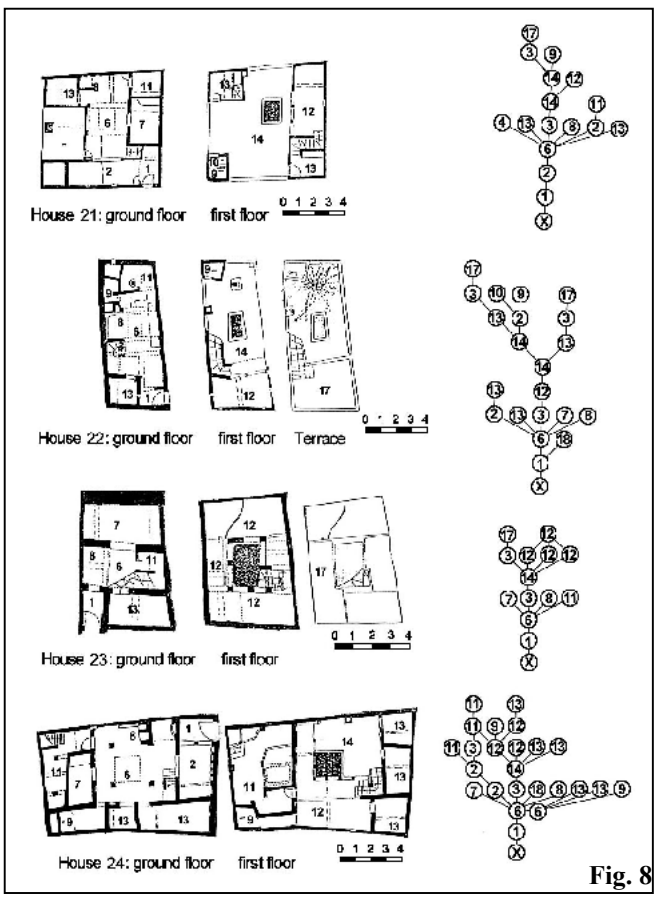

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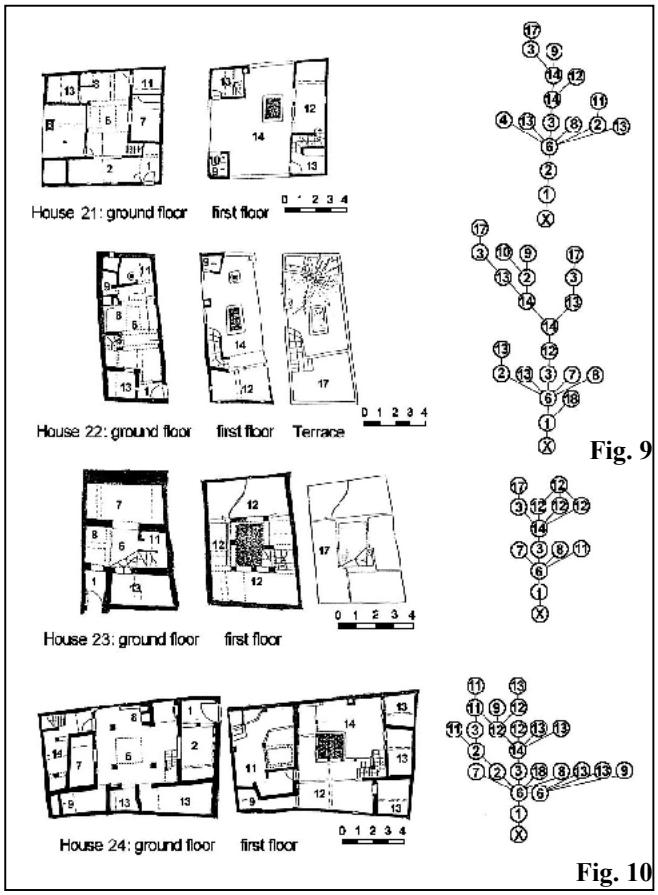

Fig. 9

Fig. 10

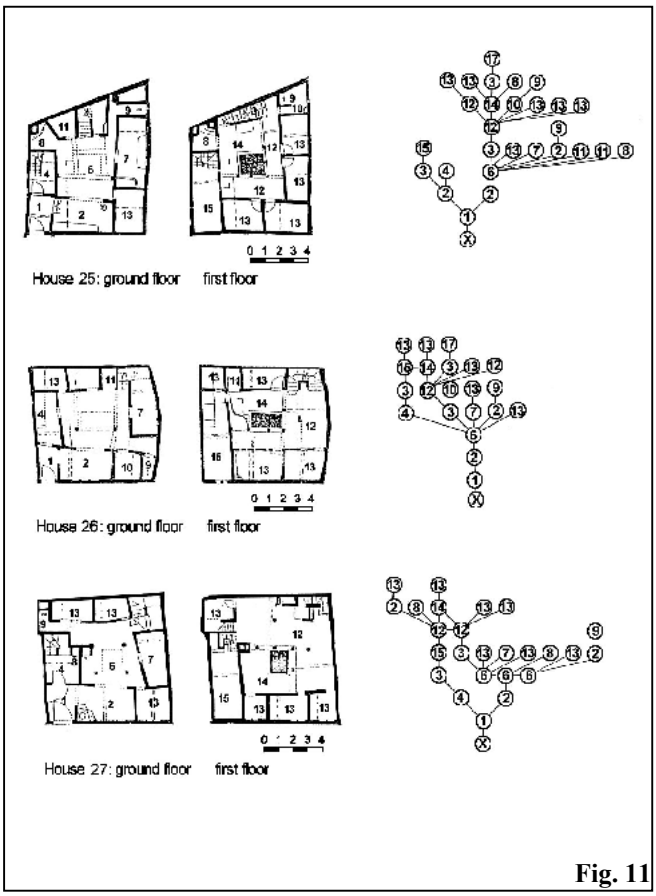

Fig. 11

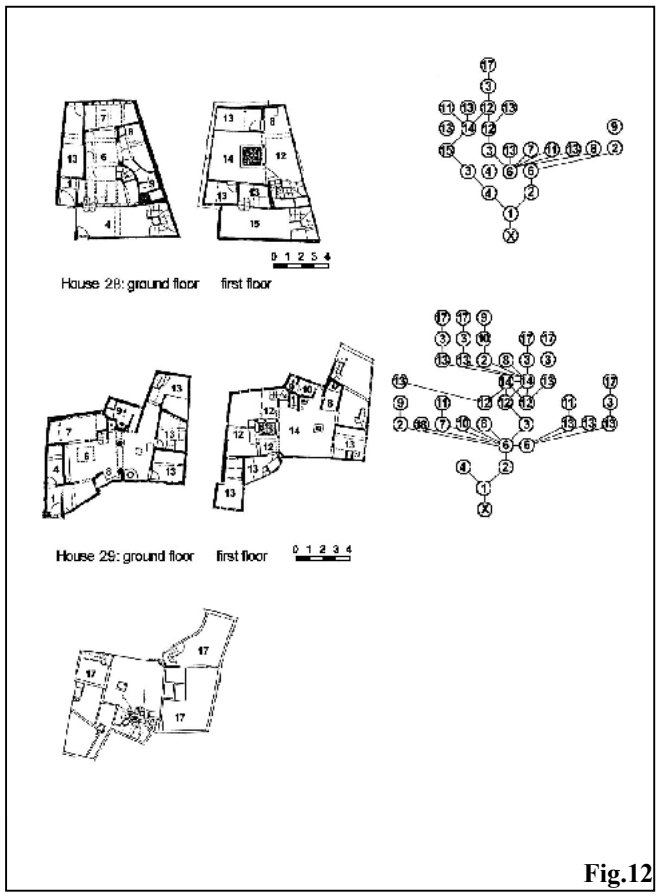

Fig.12

Figures 1-12: Houses 1-29 with their justified graphs.