SYNTACTIC ANALYSIS AND IDENTIFICATION OF THE SOCIAL PROPERTIES IN SPATIAL ARRANGEMENTS OF BUILDINGS: THE CASE OF THE HOUSES CALLED DIAR CHARPENTI IN EASTERN HODNA, ALGERIA

Hynda BOUTABBA
Department of Architecture, University of Biskra, 07000, Algeria
hynda.boutabba@yahoo.fr

Abdallah FARHI
Département of Architecture, University of Biskra, 07000, Algeria
farhi.a@voila.fr

Abstract
This paper focuses on the spatial study of a new type of habitat which appeared in the past decade in an agro pastoral region of Algeria: the Eastern Hodna, a domestic habitat whose stylistic expressions are diverse and at the same time opposed to the local rural references. The goal is to know whether, contrary to the variety of its exogenous facades, this type of habitat is a homogeneous space scheme that could be identified as being architecturally genotype. The approach used is the syntactic analysis of Hillier and Hanson (1984, 1996, and 1998). It offers the possibility to identify the structures of the socio-cultural expression and social logic embodied in the spatial distribution of domestic forms.

Keywords: Space syntax, architectural genotype, architectural phenotype, new type of habitat: Diar Charpenti, Hodna, Algeria.

1. INTRODUCTION

The socio-economic and political changes, in the form of a liberal economy favouring the emergence of the private sector together with the outcomes of the dramatic situation experienced by Algeria during the 1990’s, promoted fundamental changes, not only in socio-economic areas but also in architecture and urban design, throughout the country and the region of the Eastern Hodna particularly.

Fueled by the economic boom generated by the anarchic economy developed during the period of political instability, by the barons of the informal sector (Nait Messaoud, 2009), this region has been submitted to a process of change at all levels which have led to the creation of a new physical environment materialized by a domestic architectural framework that bears little relationship to its predecessor. (Ghellab, 2006) Indeed, the last decade of the 2000’s had known the emergence of a new type of domestic habitat, usually called by the Hodni, inhabitants of this region, "Diar Charpenti".
Characterized by a large number of architectural loans; qualified in other contexts by Lévi-Strauss. C (1958) as semantic fission; this new type of dwelling of "Diar Charpentii" displays ostentatious, outrageous formal and stylistic characteristics and outwardly oriented, in a region where the family intimacy seems yet dignified (Yahyaoui, 2006). Also, it should be noted that the facades of this new type of dwelling, are slate of indigenous architecture and show no sign of the traditional form. It is in fact a real architectural pastiche superbly both ignoring the spirit of the place as that of the society. Strange appearance, the outer envelope appears to be the result of a secular alliance between neo-classical and Asian styles related to architectural fairy tales (Moore, 1978).

The objective of this article is to try to understand if this home habitat, in contrast to what its facades let appear, could maintain, at the level of its spatiality, any coherence which could be identified as architectural genotype manifesting a certain socio-cultural unity.

2. THE AREA OF STUDY: A FRACTION OF RURAL EASTERN HODNA

Algeria, from the green banks of the Mediterranean to the vast desert, follow three large longitudinal zones: the Tellian Atlas, highland steppe and the Saharian Atlas overlooking the great desert. The median area is one of the most extensive sets of arid and steppe which stretches an 8500 km² basin: the Hodna (Sebhi, 1987). The study area spans part of the Eastern Hodna. It includes five agglomerations: Berhoum, Magra, Belaiba, Djezzar and Barika which spread at different time its cultural rural space (Figure 1). With different urban size, Barika is a medium-sized town; Magra and Berhoum are important urban centers developing to small towns, while Djezzar and Belaiba are small villages which, from agricultural centers were developed to rural centers.

This spatial development has taken place in a relatively short period of time (about a quarter of a century), and continues to evolve with considerable speed. This space extension is attributed to two
national roads: RN 28 and RN 40 crisscrossing the area of study from one end to another, making it an important area of transition and passage.

3. GENERAL CHARACTERISTICS OF THE DOMESTIC NEW TYPE OF HABITAT, "DIAR CHARPENTI"

"Diar Charpenti" are large massive blocks shaped buildings whose facades reveal richness in construction materials and architectural elements. The ground floor supports, with the exception of the entrance door, several remarkable sliding doors. The top floor has a roof composed of several superimposed slopes, with a large central pyramid at heptagonal base, or two pyramids superimposed on a rectangular base overlooking the staircase. This last feature, the set of the slopes of the roofing formed of several frameworks, generally pagodas, gave to this new type of domestic habitat its denomination of "Diar Charpenti" and allowed its demarcation and distinction in relation with other types of urban forms that the region had known since its first urbanization in the year 1875. (Despois, 1953; Cote, 1983 and Sebhi, 1987) (Figure 2).

This new type of domestic habitat is also distinguished by its linear urban combination, along the most important national road axes (NR 28 and NR 40), located usually at the end of the agglomerations, far from the centers of the former “douars” (villages) which, according to the owners, do not respond well to the new requirements of merchandise delivery and parking of private transport. Externally, these "Diar
charpentli" formalize the architectural features of a growing urbanity in a still rural home site. The layouts are composed of three to four floors which display a false tendency to extroversion of their domestic spaces through the use of glazed bays, loggias, terraces and balconies. In fact and in practice, these spaces are used for ventilation and lighting of interior space reflecting an ambiguity in the will to call themselves urban without sacrificing the privacy of the interior space and disrupt the habits of the occupants.

4. SPACE CONFIGURATION OF THE "DIAR CHARPENTI"

"Diar charpentli" homes occupy very large plots. Their land areas exceed the 1000 m\(^2\) and can reach sometimes two hectares, divided between large areas built on the ground and huge posterior open spaces.

Examination of their spatiality identifies three modes of grouping of their built spaces. They are either:

- **Complex**: consisting of independent contiguous and adjacent two houses, including the single intersection and communication space, apart from the posterior space, is the courtyard at the first level. The volume of this whole thus constructed gives the impression of one and unique residence of which the architectonic treatment of the facades reinforces this unit and doesn't allow to note the limits of each of them in no way. Complex residences are the private property either of two brothers or of a father and his son.

- **Twin**: consisting of two houses with a single entry, facing the same open posterior space and separated from each other by an internal street. However, and unlike "complex" houses, the volumetric shows two different blocks with distinct elevations but connected to one main entry materialized on the ground floor by a large gate. Therefore the only junction and communication space is a domestic private street giving, on the one hand, on the national road, and on the other, on common open space.

- **Simple**: formed spatially of one only and unique house belonging to only one owner. They are designed as buildings of several apartments, serviced independently by a stairwell. Despite the fact that all of the floors are fully completed on the plan of implementation, only the first two levels are actually exploited.

On the ground floor, the spatial organization is in two ways. Either that space is fully occupied by local warehouses and depots for the storage of goods and parking of equipment of transportation of the owner. In this case, the body of the dwelling is entirely relegated to the first level. Either, that the ground
floor space is shared between a part reserved for the trade and another for the reception of the male guests. The rest of constituent spaces of housing are then relegated to the first floor.

5. PRESENTATION OF THE ANALYSIS METHOD

The analytical approach used in this research is based on the instruments of Space Syntax approach (Hillier et al., 1984; Hillier et al., 1987; Hillier, 1996; Hanson, 1998). This approach permits to dissect the bipolarity that unites the architectural setting via the built space to the human setting via the cultural norms and the social conventions that dominate at the time of the realization of the buildings. This approach draws its methodological and analytic basis of the translation of the architectural plans into a set of objective data easily comparable. It is defined as the set of the rules that governs the architectural compositions as can be apprehended by the graphs that give the representation of it while putting them at the disposal of appropriate mathematical tools for the treatment of a built spatial field that presents clearly all features of a network. The abstraction of the plans in graphs, space syntax is not interested in information relating to the geometry of the architectural plans such as the dimensions and forms (Hillier and Hanson, 1984), its interest is credited to spatial configurations and the generating process of spaces of buildings, seen as necessary in the social organization and intrinsic components. It consequently seeks to discover the depth of the "socio-spatial" structures or architectural "genotypes"
by establishing its own analytical tools. The analysis process relies on a qualitative approach and a quantitative reflected in a number of formulas:

- **Mean Depth**: \( MD(n) = \frac{TD(n)}{K-1} \)
- **Relative Asymmetry**: \( RA = \frac{MD-1}{K-2} \)
- **Real Relative Asymmetry**: \( RRA = RA \times X = \frac{6.644K\log_{10}(K+2) - 5.17K + 2}{K^2 - 3K + 2} \)
- **Base Difference Factor**: \( BDF \)

\[
H = \sum \left[ \frac{a}{t} \ln \left( \frac{a}{t} \right) \right] + \left[ \frac{b}{t} \ln \left( \frac{b}{t} \right) \right] + \left[ \frac{c}{t} \ln \left( \frac{c}{t} \right) \right]
\]

\[
H^* = \frac{H}{\ln 2/\ln 3} \]

6. SYNTACTIC ANALYSIS OF THE CORPUS OF STUDY OF "DIAR CHARPENTI"

Of the five towns that form the study area, thirty specimens along the two major national highways (RN 28 and RN 40) were chosen for the study. It is a comprehensive sample that meets the requirements of the method and that go with the objectives assigned to this research to the assertion of architectural genotypes (Hanson, 1998).

It should be noted that, for reasons of reliability and accuracy, our study will be limited to the "body of dwelling" represented by the cells constituting the house and whose the communication is done from Interior. Cells which take exclusive access from outside like exploitation's premises will be excluded from the calculations. We define by "body of dwelling", the main living spaces. The open spaces such as loggias, balconies and patios, whose function is limited to lighting and ventilation will be excluded (Steadman, 2003). Courtyards constitute the exceptions because they are considered in the Hodna's society as real living spaces - in the same way as the different spaces of occupation and activity of the House- since they allow the conduct of major daily functions. Spaces of the thirty specimens were transformed into nodes "breaking spaces into elements" in order to draw justified graphs. The various constituent spaces of the "Diar Charpenti" have been codified as shown in Table 1.

### TABLE 1- CODIFICATION OF CONSTITUENT SPACES OF HOUSES

<table>
<thead>
<tr>
<th>Espace</th>
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<th>Espace</th>
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<tr>
<td>Carrier 'Laita'</td>
<td>X</td>
<td>Hall 'Westeddar'</td>
<td>H</td>
<td>Grand-parents room 'Dar Ladjouz'</td>
<td>Cha</td>
<td>Internal street 'Trig'</td>
<td>Ri</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living room 'Dar layel'</td>
<td>Sej</td>
<td>Corridor 'Sabet'</td>
<td>Clr</td>
<td>Bathroom 'Hamam'</td>
<td>Sdb</td>
<td>Vestibule 'Dakhla'</td>
<td>V</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deposit 'Makhzen'</td>
<td>Dp</td>
<td>Lounge 'Dardhiaf'</td>
<td>Sl</td>
<td>Moorish bath 'Hamam Skhoun'</td>
<td>Bm</td>
<td>Girls' room 'Dar layellette'</td>
<td>Chf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staiwell 'Drof'</td>
<td>C</td>
<td>Kitchen 'Nouala'</td>
<td>Cu</td>
<td>Toilet 'Bit Elma'</td>
<td>Wc</td>
<td>Boys' room 'Dar rejal'</td>
<td>Chf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior open space 'Mrah lawrani'</td>
<td>Ep</td>
<td>Courtyard 'Mrah'</td>
<td>Co</td>
<td>Shower bloc 'Lmaghsel'</td>
<td>Bs</td>
<td>Parents' room 'Dar Chikh'</td>
<td>Chf</td>
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</table>
Boutabba H. and Farhi A.

Syntactic analysis and identification of the social properties in spatial arrangements of buildings: The case of the houses called Diar Charpenti in Eastern Hodna, Algeria

FIGURE 4 - PLANS AND JUSTIFIED GRAPHS OF A FEW SPECIMENS Bh2 Bh3 Bh4 AND Bh5 GRAPHS
Justified graphs have been drawn by adopting the topological types (Hillier, 1996) and we have calculated the distributivity index (Id), asymmetry (Is) which allowed us to have an idea of the movement that takes place. (Figure 4). Two series of measures have been executed (the encrypted values presented were essentially obtained using AGRAPH software). The first series will be limited to the calculation of basic syntactic parameters, solely for the “body of lodgings” in its internal connections, named by Bill Hillier as "minimum living system ". The second series will spread in addition to the latter, to “the outside” or “Carrier” (NR 28 and NR 40), it will be treated like an undifferentiated spatial field, a neutralized platform taken as root of the justified graph.. Table 2 shows syntactic properties of the whole corpus database taking into account the two sets of measures cited above with and without "outside".

### TABLE 2 - SYNTACTIC DATA BASE

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<tr>
<th>N°</th>
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<th>CS</th>
<th>SLR</th>
<th>MD</th>
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<th>H*</th>
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</tbody>
</table>

Note: SP = Code specimens; CS = convex spaces; SLR = Space Link-Ratio; MD = average depth; BDF = difference in basic factor.

- The value of Real Relative Asymmetry RRA of all of the specimens forming the corpus is 1.08 if the Carrier is included, the RRA is 1.15 if it is excluded from, this mean values indicate in a general way, the good integration of all of the body of specimens, they indicate as well the strong connectivity of constituent areas of different specimens thereof. Comparison of the
average value of integration with and without outside (Carrier) across the corpus of the study reveals another indication of size. Indeed the weakness of difference of these two values indicates that the architectural program of "Diar charpenti" structure essentially internal relations and highlights the supremacy of the residents-residents interface.

- The value of total average depth of all specimens forming the corpus of the "diars charpenti" of the Hodna is 3.13. With the largest number of convex spaces, the second part of the sixth house selected for the study in the city of Barika (Bk6b) is the deepest specimen. It's average depth culminates with 3.92; monitoring of (Bk6a) which has a depth of 3.67 and a nearly similar number of convex spaces of the order of 22. The shallowest is the seventh specimen (Bk6a) which displays the lowest value of 2.58 and is at the same time, the least developed in the constituent nodes, with only 13 cells.

- Comparison of the values of the Base Difference Factor (BDF) with and without exterior "Carrier" indicates a big similarity, if not some slight variations. (Figure 5)

![Figure 5 - Base Difference Factor with and without exterior "Carrier"](image)

- Similarly, the values of integration range in most part of the case in the same way, that we take or not exterior into account, which shows the low impact of the exterior on the way in which present each cell is in the configuration of the building in question.

- On the structuring of the domestic interior of the houses that the "space syntax" is to highlight, it is obtained by comparing each space of the house to other places of the same house, according to its degree of integration and to take a rank on a scale. Such ordinations on the
graphs would lead not only to a better understanding of morphology and therefore the spatial logic, but insofar as the functions of each space and regularly related activities are well known, these ordinations would lead to the understanding of the social logic. If these ordinations and numerical differences in the functions remain in a consistent order in a sample, Hillier and Hanson (1987) attest that the cultural models can be traced (Hanson, 1998).

7. DISCUSSIONS

While reference books on socio-spatial of domestic architectural studies of Hodna continue to make very few cases, the component inherent in the domestic architecture in the world, has been studied in detail in the specific architectural literature. The home was described as the most multi-dimensional territorial center (Saegert, 1985).

As part of the goal of any paradigm of the built environment, several studies have focused on objective and practical functionality of the different areas of the house, so the technical and sociological needs of individuals in their domestic housing were very shelled early in their every detail (Kennedy, 1975; Rapoport, 1981; Baudrillard, 1997). In addition to this feature, these observations of behavior, other studies have focused on the lived reality, of psychological and socio-symbolic architecture of the house (Goffman, 1978; Amphoux. et al, 1989) especially to the emotional function spaces of residential housing (Gazron-Serfaty, 2003). In the same order of ideas and as part of the excitement brought to the study of domestic housing, several studies have focused, since 1980, following the work of Professor Bill Hillier and his colleagues at the Bartlett school, the cultural model of habitat by the analysis of spatial patterns especially those that are an important aspect of the human factor (Cuisenier, 1991; Orthurn et al, 1995; Brown et al, 2001; Malhis, 2003). They consider the architectural space, in general, and domestic space, in particular not under a single viewing angle, as a physical complex reality, with geometrical and structural absolute properties or even according another angle of attack as the geographers want (Murdoch, 2005) and mean by the term "Spatial Turn": a relational structure, deeply imbued, composed and split by human practices, but using an approach which considering the both at once (Hillier, 2005).

In following this trend which refuses to treat the material components and non-material of the domestic spatiality in isolation, our research tried to apprehend the domestic architectural space of Hodna through the analysis of the configuration of the "Diar Charpenti" as so as the analysis of the complex dialogue which unites this framework built to this society, which is in full effervescence.
Syntactic analysis and identification of the social properties in spatial arrangements of buildings: The case of the houses called Diar Charpenti in Eastern Hodna, Algeria

by Choosing the theory of space syntax, which by exploring morphological structure of spatial arrangements of housing, permits to discover their underlying spatial configurations and allowing to show in depth, the socio-spatial structures: the "famous" genotype of architecture. The results of this research are new and are a supplement to bibliographical contributions in this field of research. But before presenting these results, we would like to draw attention to the definition of an architectural genotype and its difference with the phenotype. From the biological sciences, genotype and phenotype are concepts used by Bill Hillier and Julienne Hansson (1987) to try to make intelligible the spatial distribution of individual buildings and to try to identify the mechanisms that govern the production and reproduction of the architectural types.

After several background metamorphoses including the substitution of the sociological concept of mechanisms to recover the ability to describe the scene to the biological concept of centre manager; Bill Hillier and his colleagues consider the recurrence of certain features of structure as the index of genotyping and therefore treat the variety of architectural compositions observed as phenotypes. So an application of this concept to the architecture implies a qualitative constancy translated by a constancy of justified plans and another quantitative in the interpretation of the digital data related to the average depth to the degree of control, the relative asymmetry and the value of integration. The purpose of the space syntax or the analysis configuration of a several models allows highlighting the properties which constitutes the generic rule of the space in question: its genotype. The particular physical implementation of these rules constitutes its phenotype (Letesson, 2009)

8. CONCLUSIONS

These results suggest, based on the indices made by Base Difference Factor BDF, the existence of two characteristic modes for structuring the Hodni domestic interior: one focused on the "West eddar": Hall, regarded as the more integrated and more integrator space. Another, centered on the "Sabet" or the corridor which is also, in this case, the less segregated space and more integrator one; while the third residence of the town of Magra and the eleventh specimen of the corpus of study: Mag3 is only structured around the "Dakhla": the vestibule; and seems distinctly non-genotype, or would be regarded, at least, the phenotype of another genotype (Figure 6 and Figure 7).

On the other hand, the values generated from the BDF for a group of socially important and significant spaces have betrayed a weakness of their values for all of the "Diar Charpenti". This argues for configurations which tend to promote a functional differentiation of spaces that constitutes them, in other words, they gather effectively spaces which must or can be combined and keep away from the other the
spaces that must be kept separate; as they bear witness, in the end, an extreme coherence and strength of these genotypes. The strong regularity and consistency which reflects the metric route of residences and the spatial arrangement of some of their elements can extend, in light of this research, the basic syntax of their configurations.
Given that the analysis of the space syntax has, among other concerns, the dissection of the complex relationship between the built environment and the human factor; and although it is clear that the understanding of society cannot be limited to the mere fact of the intellection of its built environment and therefore, the only architecture is far to suffice this requirement. However, the configurational analysis permits by relying on the topological types to expand reflections on the impact of the environment built on the occupation and the movement.

Thus, as a result of this research, we are in possibility of drawing this spatial logic that controls these "Diar Charpenti", a few dominant traits that are at the origin of the social logic of space which under tend this Hodni society. Similarly to study anthropological in particular those of Paul-Levy and Segaud (1983) which showed that the spatial organization is the result of the symbolic practice and the expression "of idéalités materialized. The masculine and the feminine are a part of these "meaningful units" to which human societies have, according to Guettat-Bernard (2011), use to direct their world and give a comprehensible framework, this study led, like these various companies studied by various disciplines (Satazaki, 2001), to explaining through the space syntax, the geography of these spatial structures of the "Diar Charpenti". These genotypes which evolves, in a patriarchal world are highly sexual and portend automatically use that is made. They impose in their entirety a real concern for precise demarcation, as well between the internal domain and the outside world and between private intimate family and the area of male visitors "go through one door is a mundane Act, but it can mean so many different ways to enter" (Douglas, 2001); and this despite the existence of connections, which are actually " fictive" because all the time barricaded", this is the case for example between "Westeddar" and "Dar dliaf". More than that , the movement of this male reception space is managed by the vestibule "Dakhla" filter space, adhering to the theoretical concept of "Tran spatial solidarity", tries to block unwanted interference, same visual, of this group of users. Thus reinforces this order of ideas the segregation of this male reception space, because the segregation (in addition to its confirmation by encrypted data) is based, among other things, on an impossibility of access. On the other hand, the reception area of women, the space stay "Dar Alayelel" is relatively integrated into the system and distributed by the "Westedar". This space represents the geometric centrality, the psychological and symbolic figure of the House. The filter Space, represented in most case by the vestibule, which permits to separate the movements within the residences, was not built to separate the private functions of reception functions, but in practical terms, separate the genera that are associated with. On the other hand, although some spatial realities of a few other residences manifest the existence of more than one entry, which runs counter to this concern for control and materialized this space of "Spatial solidarity", the latter is invested by spaces of transition (hall, corridor, posterior space) and in the best of cases by...
the Hall "Westeddar"; This leads us to postulate that, despite the existence of this type of spatial configurations, the resident/visitor interface is not as involved as relations between residents.

As is the case of Diar Charpentti's facades which are decorated with several doors and windows, as is also is the case of this connection which really exists between the living room and hall, but which remains closed all the time or blocked by furniture; the social fact through the analysis of the spatial fact of this new type of habitat show that despite the fact that it gives the impression of being evolving, stay in reality frozen. Relations that structure it are still static. They are stable and suggest that they are in continuous search for a new report may be symbol of modernity.

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