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The Impact of Sunlight and Daylight on the Dwelling's Occupancy. Case of the Hot Dry Regions of Algeria.

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1. INTRODUCTION:

It is often asserted that the sun and traditional dwellings were in a perfect harmony whereas the last 50 years old produced built environment have marginalized most of the climatic factors. Nowadays, an important effort is increasingly made for recovering this lost relationship. Energy conscious, passive solar and high environmental quality designs are the current architectural ways translating this challenging attempt.

The use of sunlight and daylight to light up interiors of buildings is one of their main issues. Qualitatively natural light becomes obviously healthy and quantitatively energy economic. Several investigations demonstrated that sunlight and daylight are well-appreciated inside buildings. Moreover, they prove that lighting physical standards could not be sufficient and underline the importance of non physical factors (psychological, cultural...) [Lam, 1986]. A second related point is that these latter vary with context (climatic and cultural), season of the year, time of the day, persons and tasks. Thus, it would be pointless to deny the flimsiness of excessive generalisation reasoning in daylighting matter.

The hot arid region with sunny clear sky is the context of this study. In these areas, sunlight penetration is combined with thermal discomfort and glare problems. So, people attitudes would be different from the case of the northern region's societies where the presence of sunlight is more enjoyed.

This paper aims to study the impact of sunlight and daylight on the affective relation between home and its occupants by the way of their occupancy's frequency of the home's spaces. In this work, the home is considered as the behavioural setting. Thus, the vernacular dwellings of the southeast region of Algerian present the context of this research. This preliminary outcomes presented in this paper are part of a broader research including people's reactions and attitudes, of an Islamic culture, towards various daylighting and sunligniting strategies in different working and living spaces.

2. INVESTIGATING DAYLIGHTING IN TRADITIONAL DWELLINGS:

Usually, qualitative aspects of daylighting are examined through socio-psychological surveys. In actual fact, the idea of using the same method for old buildings case is somewhat misleading seeing that they are not lived at present in the same way they were built for. In that case, another way of looking at that claim is to examine the daily experience of home and the related affective meanings [Barbey, 1990]. These ones are necessary in the mental world of home and can be interpreted as the territorialisation of domestic behaviour anchored in spatial archetypes. Appropriation is a phenomenological concept allowing the investigation the affective meanings related to home.

Appropriation translates a self-identification of the inhabitant within his home and can be presented as a high level of homeliness. It is dealing essentially with space's occupancy and time of use. A case in point is the internal organisation of the various domestic activities.

A previous study [Belakehal et al, 2000] investigating the spatial configurations relating to sunlighting in dwellings, it appears that the current typology in the hot dry arid regions consists on two kinds of courtyard: i) open to sky, and ii) covered with a top opening. In respect to this typology, the phenomenological concept, appropriation, is applied to three case studies chosen from separate areas of the south of Algeria varying in geographical locations and topography (Figure 1). The case studies are: i) M'chounech on the southern hillside of the Aures Mountains, ii) El-Oued in the region of Souf desert, and iv) Ghardaia in the M'zab valley.



Figure 1: The situation of the three case studies of the research.

3. THE HOUSE OF THE AURES MOUNTAINS:

The Aures massif is situated in the eastern part of the Saharan Atlas in the Algerian country and bordering the northern side of the Sahara desert. This massif is geographically structured by several valleys from north to south. Whilst the northern side of the massif have a moderately temperate climate, the southern one is

characterized by a semi-arid, hot and dry climate with clear sunny skies the most time of the year.

The Aures villages, namely *Dechra*, offer the sublime image of clustered dwellings hanging on a hillside facing the valley and often south oriented. Houses are of rectangular forms with variable sizes (Figure 2). Their doors are opened to the east or by default to the south [Riché, 1959]. The dwellings, in M'chounech, are generally with open courtyard [Belakehal and Amrane, 1991] (Figure 3). This latter allows to daylight the surrounded spaces.



Figure 2 a: A view of the *Dechra* of M'chounech on the southern side of the Aures mountains.

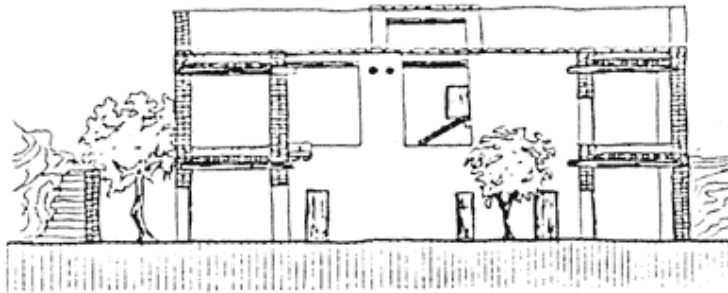


Figure 3: The dwelling is organised horizontally and vertically around an open courtyard [Belakehal and Amrane, 1991].

When they exist, windows on external walls are located at the upper floors and used for ventilation. The first floor spaces are widely opened on the courtyard, south oriented and providing fascinating views on the gardens of the valley (Figure 4).



Figure 4: The first floor spaces are widely opened on the courtyard and providing views on the Valley's gardens.

At the ground floor, rooms have rarely small windows giving on the courtyard. Hence, the doorway is the principal component allowing sunlight and daylight penetration inside them (Figure 5).

Sunlight acts strongly upon the course of domestic activities within the various spaces of the dwelling. Females use the courtyard for their daily work during summer season and to be protected against the intense sunrays, the courtyard could have a covered part (Figure 6). The *Skifa* (entrance space) is a cooled and shaded, so less bright, space which serves as a place for taking an afternoon nap.

Inside rooms, the weaving work indicates the importance of sunlight in structuring spaces. It is often located at the best daylit place, generally facing the doorway (Gaudry, 1929). The other parts of the room are darker and used essentially for storing and sleeping. A bed, constituted by masonry and branches is placed in one dark corner. At the first floor, the wide opened space (*Askif*) is well sunlit and often used during the coldest season for economic domestic activities (i.e.: drying dates).



Figure 5: Whilst the upper floor spaces are widely opened to courtyard, the rooms at the ground floor are daylit by means of the door and small windows.



Figure 6: A covered area in the courtyard provides a protected against heat and glare space.

4. THE HOUSE OF GHARDAIA:

Ghardaia is the capital city of the M'zab valley. The climate in this area is hot and dry with a very sunny clear sky. The city is generally located on a hill facing south-east (Figure 7). The house is of two storeys with a central covered courtyard. An opening located at the centre of the courtyard ceiling allows penetrating sunlight inside (Figure 8). Thus, the different spaces surrounding the courtyard are indirectly daylit [Ouahrani,1993].



Figure 7: View of the city in the M'zab Valley [Ravéreau, 1981].

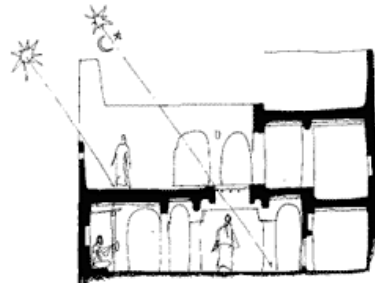


Figure 8: An aperture at the ceiling level allows the daylighting of the covered courtyard [Ravéreau, 1981].

The sunlight related appropriation of the courtyard at the ground floor and the covered arcades at the first floor is revealed by the fact that the former is used during the hottest period and the latter during the coldest one (Figure 9). Whilst the aperture of the courtyard is covered by daytime and opened by night during the summer, the opposite is done in the course of winter month's [Donnadiou et al, 1977]. At the first floor level, the covered part (*Ikomar*) is another example of the seasonal appropriation of a living space. It is occupied during the wintertime when sunlight is softer than the hottest season.



Figure 9: The *Ikomar* is appropriated during the coldest season (even for weaving work) because it provides a very well daylit space [Ravéreau, 1981].



A particular place in the house is the women's reception room namely *Tizefri* (Figure 10). It is widely opened toward the courtyard with south or south-east orientation for catching the best natural light. Its use includes female guest's reception or weaving or even being a restful place for a giving birth woman [Bousquet, 1983]. It permits so an individual and/or familial privacy and appropriation. When the tasks performed inside the *Tizefri* require good daylighting, such as weaving work, the space is investigated during the morning.

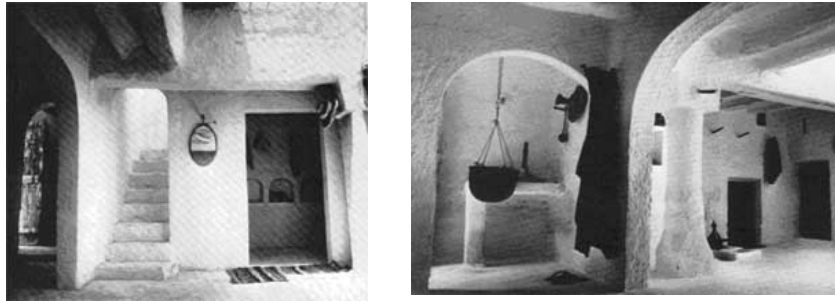


Figure 10: The courtyard is mainly daylighted by means of an aperture located at its ceiling and its surfaces redirect the falling natural light towards the surrounding rooms [Ravéreau, 1981].

5. THE HOUSE OF EL-OUED:

El-Oued is the most important town of the Souf Region in the oriental Erg of the Sahara. This latter can be described as a vast desert with a monotonous topography with palms planted in excavations. The region is exposed to frequent sandstorms and the climate is very hot dry with big differences between daytime and night time temperatures [Najah, 1971]. The town is located close to the palm groves along a dry driver bed stretching from the north to the south (Figure 11).

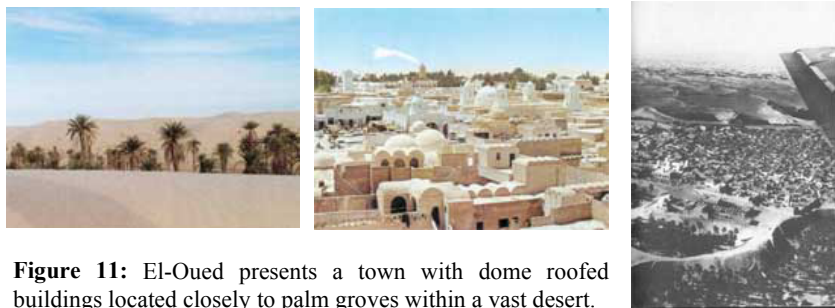


Figure 11: El-Oued presents a town with dome roofed buildings located closely to palm groves within a vast desert.

The house is generally of one storey, a rectangular slightly irregular shape with domed roofing and a sandy uncovered courtyard. The rooms and other spaces surrounding the courtyard have their openings orientated to it. Thus, there are no windows looking outward [Tinedert, 1986]. All natural lighting is thus coming from the courtyard side of the rooms most of the time through the doors. The southern side of the house, and in some cases the northern one, have a covered but opened on its elevation to the courtyard namely *Sabat* (Figure 12).

The dwelling's spaces are organised relating to sunlight. Whilst the southern and northern side are used to be multipurpose, the eastern and western sides house usually toilets and stable. These spaces are orientated to this direction to catch the most of sunrays for cleanliness and for reasons of hygiene. The southern and northern sides are, also, occupied in respect to season. The northern *Sabat*, orientated to the

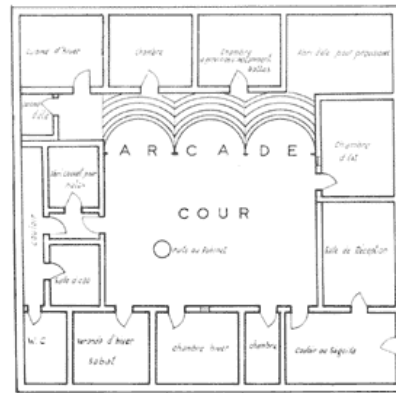
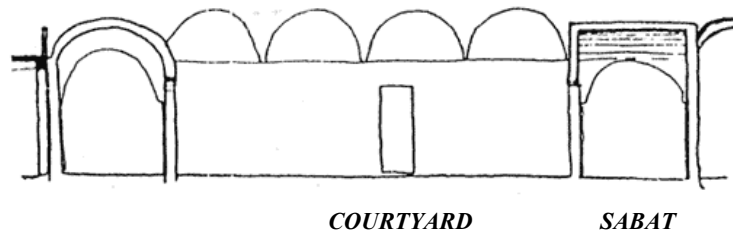


Figure 12: A section [Tinedert, 1986] and a plan [Najah, 1971] of a house in El-Oued.

south, is used during wintertime. The spaces located behind the *Sabat* are sunlit from the same direction and are also used during the same period of the year. The southern *Sabat* is directed to the north and thus is protected from sunrays. It is used during the hottest season and likewise the spaces at the back.

6. CONCLUSION:

Traditional dwellings reveal the importance given to the space's appropriation in respect to sunlighting. This paper highlights several occupancy ways of the home closely related to the direction, season and time of sunlight.

The studied case studies are traditional houses catching sunlight at their centres through a courtyard spatial configuration. But due to the climatic difference of their locations ones are opened (M'chounech) whilst the others may be partly covered (El-Oued) or totally covered (Ghardaia). Each of them includes several spaces of various levels of appropriation. It would be impossible to exaggerate the importance of the courtyard for the home's affective feelings and meanings related to sunlight. Also, it should be stressed that some places with particular orientation are often chosen as the most familiar for the inhabitants.

However, the new tendencies exposed by the contemporary dwellings show that the appropriation of the dwelling's spaces related to sunlight is more and more abandoned. Thus, the idea of recovering the impact of sunlight on the dweller's occupancy of the home could go beyond the objective of exploring daylight appreciation's to either the rehabilitation process of old buildings and the whole design of contemporary dwellings.

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