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Belakehal A., Tabet Aoul K.* and Bennadji A.**

Department of Architecture, University of Biskra,
46, rue Okba Ibn Nafaa 07000 Biskra Algeria.
E-mail : belakehal@caramail.com
**Department of Architecture, USTO Oran, Algeria.*
***School of Design and Technology, Robert Gordon University,*
Garthdee Road, Aberdeen AB10 7QB,
E-mail: a.bennadji@rgu.ac.uk

1. INTRODUCTION:

In buildings, daylight is a commonly used health being source, delightful maker and an energy economic strategy. For all these purposes, architects make use of daylight as one of the main parameters considered in the design of buildings. Methods used by designers in the architectural discipline may be quantitative and / or qualitative. In general, these methods are expressed by detailed figures, charts, graphs…. Two criticisms may be noticed about these methods particularly for the case of daylighting in architectural design. Firstly, a figure or a chart could not be of great help for an architect at the first stages of his design but could be of use only to evaluate the final outcome. Secondly, they are based on research works where the occupant and its needs (in term of preferences and behaviour) is ignored or mostly considered as universal [Belakehal and Tabet Aoul, 2003; O'Donell et al, 1999].

Besides, several architects use their intuition to establish their own rules to design daylighting which are often in conflict with the occupant's of the buildings they conceive (i.e. :Le Corbusier) [Fontoynont, 1999]. Yet, various research works revealed that occupant's behaviour and preferences in terms of daylight and the overall design are of a great importance to the building's success [Nazzal, 2001]. Thus, it would be inescapable for architects and daylighting designers to define this area of knowledge.

Moreover, it would be imperative that this knowledge could be of use by architects at the preliminary steps or decisions of their design. Thus, occupant's preferences and behaviour should be translated in terms of relationships between the components of the architectural space (envelope, window and its devices, position of furniture, colours, finishes…) in respect to the particularities (climatic, socio-cultural,…) of the context where the building will be construct (Figure 1).

A hard research work must, then, be carried in this field of research and in particular for the case of the contexts not very investigated such the hot dry regions characterised by a clear sunny sky [Belakehal and Tabet Aoul, 2003]. For this purpose, a first step should be to decide on the appropriate method for assessing daylighting quality in

buildings (subjective by way of the occupant's point of view and / or objective by means of physical measurements). Whilst the survey is generally chosen for large cases study or for experimental research, the post-occupancy evaluation (POE) seems to be the most suitable method for a particular building assessment. This method was applied and adopted to evaluate several aspects of a building [Behloul, 1991]. Daylight is also a parameter that a POE was established for [Baker and Steemers, 2002; Fontoynont, 1999].

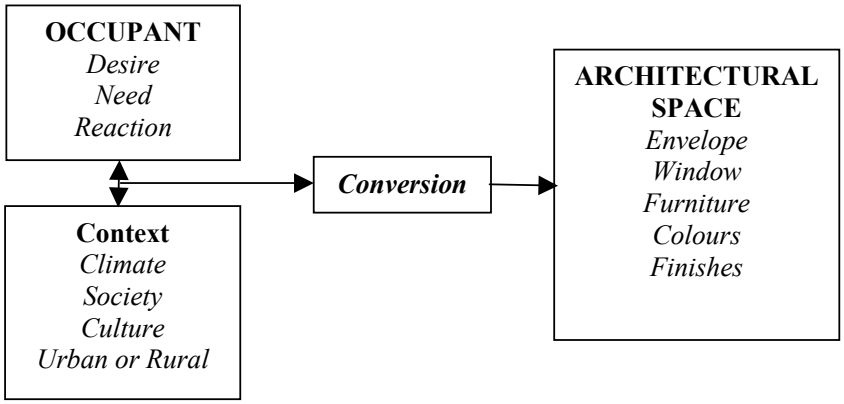

Figure 1: The occupant's and context's particularities related to daylight must be converted to spatial properties to be useful by designers at their first stages of the architectural design.

The daylight's POE method was adopted and used to assess the daylighting quality in two kinds of South Algerian contemporary buildings: offices and flats within multifamily housing projects. This paper presents the why of these changes and how they were accomplished.

2. THE POE FOR DAYLIGHT:

POE is defined as "an examination of the effectiveness for human users of occupied designed environments" [Zimring and Reizenstein, 1980]. It evaluates, systematically, a building upon a major criterion: the occupant's needs. The POE uses the methods and the techniques from social sciences (psychology, sociology, anthropology). According to the availability of the collected data and the deepness of the evaluation, the POE is regarded as indicative, investigative or diagnostic [Preiser and White, 1988]. Some authors consider that the latter is the real post-occupancy evaluation [Fischer and Vischer, 1997].

The diagnostic POE includes complementary techniques to the questionnaire (subjective responses) consisting on observations of the investigated place and physical measurements taken with instruments (objective observations). The diagnostic POE should be thus more appropriate for a daylighting evaluation because it puts the subjective and objective aspects of daylight together.

Within the framework of the Daylight Europe Project, a POE focused on daylight was undertaken [Hygge, 1996] and applied in eight buildings in different regions of Europe. The included questionnaire is considered as a worldwide used one. However, this questionnaire was too limited to the related daylighting parameters and has not so

considered the other functions of the window (ventilation, view out, privacy…). Yet, daylighting quality and its appreciation could be different or changed due to the kind of accomplishment of these functions by the window (and / or other openings) [Tabet Aoul and Sharples, 1989; Belakehal et al, 2002]. A more recent research uses also the diagnostic POE [Parpairi, 2002] and shows the necessity of its adaptation to the kind of the investigated context as well as its effectiveness for a daylighting quality evaluation in buildings.

The use of this method (diagnostic POE for daylight) within the context of the contemporary buildings in southern Algeria required also some changes due in particular to the climate, social and cultural characteristics of this context and to the function of the studied architectural space.

3. THE IMPACT OF CLIMATE ON THE POE FOR DAYLIGHT:

The hot dry regions such as the southern Algeria are characterized by a clear sunny sky almost of the year. Sunlight for indoor spaces produces not only glare but also overheat. The changing direction of daylight, during the day, causes that inside space receive different quantities of natural light in respect to each direction. The problem becomes more complex than the case of the overcast sky [Belakehal, 1995; Evans, 1980]

Because of these particularities, some specific changes and additions must be applied to the standard POE for daylight method. These ones concern both the subjective responses and the objective observations. It must be noticed that for the case of the daylighting evaluation under clear sunny skies the current methods are limited to a sequences of pictures of sunlight penetration qualitatively described (Figure 2) [Fontoynont, 1999].

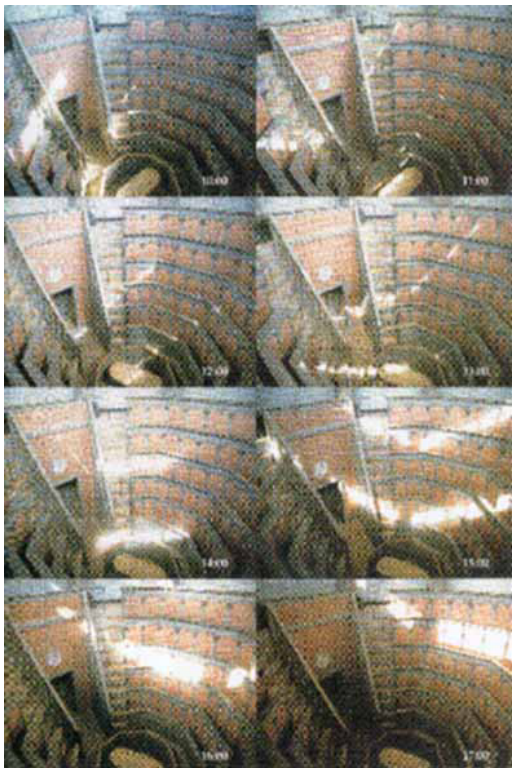

Figure 2 : the current evaluation method of the luminous conditions of buildings under a clear sunny sky consists on the qualitative analysis of the sunlight penetration allowed by sequences pictures at referenced hours and dates. [Source: Fontoynont, 1999]

Firstly, the overheat problem is considered within the questionnaire and observations only and without measurements of temperatures. The related questions and notes are about the occupant's recourse to artificial lighting (and other solutions) after completely occulting the window by means of curtains (or other devices) due to its direct exposition to the intense sunlight (Figure 3). A second question is about the choice between the fact of being in a well daylit hot space or in a cool gloomy one. The latter luminous ambience (often provided by means of shading) presents, in this context, a cultural and psychological perception of clemency [Belakehal and Tabet Aoul, 2000]. Another impact of overheating that is observed is the fact that occupants could change their desks to a nearest position from air-conditioners or far away from windows.

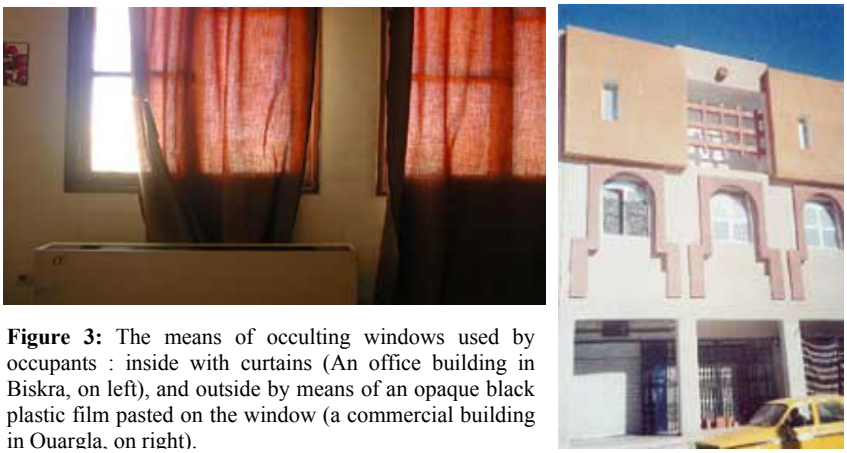

Figure 3: The means of occulting windows used by occupants : inside with curtains (An office building in Biskra, on left), and outside by means of an opaque black plastic film pasted on the window (a commercial building in Ouargla, on right).

Secondly, the daylight factor could not be computed as for the regions with overcast sky. Researchers have noticed this major difference and established a daylight factor for the case of the clear and sunny sky [Chavez, 1989]. Whilst, for the overcast sky, the daylight factor is the ratio between the illuminance measured on the useful places (i.e.: workplane) to the outdoor horizontal illuminance due to an obstructed sky, for the clear sunny sky the outdoor illuminance is not the same. Due to the changing direction of sunlight, outdoor horizontal luminance is not accurate for this ratio. Because, the vertical plane of the window receives, for a same moment, a different quantity of natural light than the horizontal one. So, the daylight factor is the ratio between the illuminance measured at the studied plane and the illuminance vertically measured on the centre of the plane of the window. The latter could be with or without obstructions as the occupant reacts to sunlight (Figure 4).

Thirdly, for the reason that disability glare and transient adaptation problems are with concern to luminance distribution it is common to measure luminance in different places of the studied space. The choice of these places must be carefully made [Berrutto, 1996]. Because a POE is with concern to places occupied for sometime, one could argue that occupant had a clear and overall idea of the space he works (or lives) in such a way that his visual field could be accurately limited the binocular one seen from his workplace (Figure 5).

Figure 4: an example of the reaction of an occupant against sunlighting penetration through the use of some curtains and that could be different from another occupant who could choose to draw the curtains of other windows.

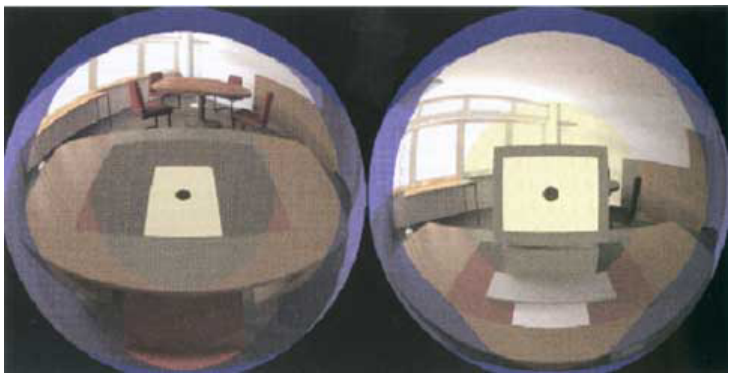

Figure 5: The field of vision of as perceived by worker in his office [Source: Baker and Steemers, 2002]

Effectively, after the time spent in this space, the occupant should exceed the sensation phase to the perception one and his eye's movements are less directed on the whole space. In addition, it was observed through the pilot study, that the occupants use different devices to equilibrate contrasts in their work and living spaces. They use curtains, thin (translucent) or thick (opaque) sheet… (Figure 6). Then, the luminance must be measured only at the visually contrasting places located in the vision field as described above. Also, luminance doesn't need to be measured for more one time during a day for the simple reason that the occupant found always the equilibrium between the contrasts, satisfying himself, inside his space despite the outdoor changing luminous conditions.

Figure 6a : views revealing the difference, at the window vertical plane and the overall space, between an uncontrolled and a controlled (by means of curtains) luminous ambience in an office of Biskra. (2 photos on top)

Figure 6b : examples of the materials used by occupants to obstruct sunlighting penetration plane of the window : translucent coloured thin sheet [Source:Fontoynont, 1999] and by a thick opaque sheet. (on right)

To define which contrasting zones that must be measured within the field of vision of an occupant, a particular procedure was established. A picture from the occupant's place is taken with a 20mm lens camera which is the most reproducible of the area limited by the human binocular field of vision (Figure 7) [Fontoynont, 1999; Berrutto, 1996]. This first picture is converted from a normal state to a second one consisting on an assembling of pixels one by means of a computer program (Figure 8). Within this second picture, the contrasting zones are easily identified (Figure 9) and the measures could be done on site (inside the space).

Figure 7: A picture taken with a 20 mm lens camera covering the field of vision in front of the worker in his office.

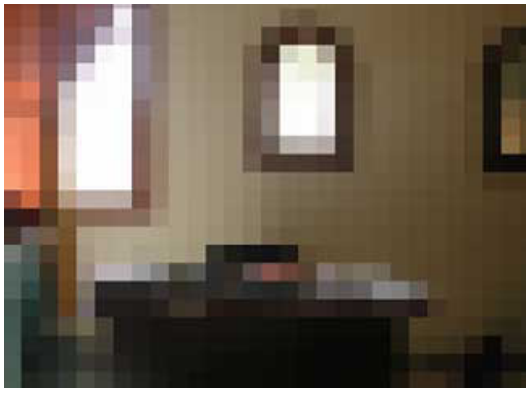

Figure 8: the same picture converted to an assembling of pixels.

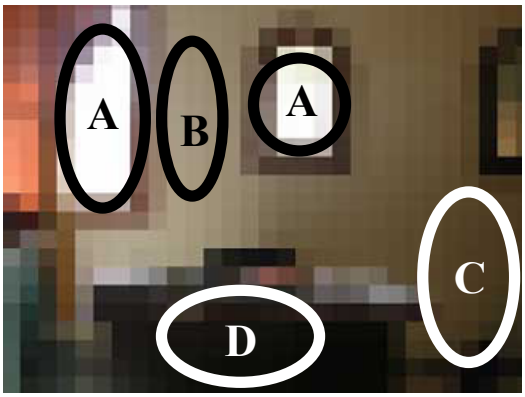

Figure 9: the delimitation of the contrasting zones upon the picture.

One could say that the luminous conditions will change from a day to another and during the day itself. Firstly, it must be noticed that under clear sunny skies the outdoor luminous conditions are stable during the same season in particular for the period of the hottest one (more than a month). That is to say that the indoor luminous ambience could be similar for a long time during this later. By contrast, it is during the same day, and due to the changing direction of sunlight, that the luminance distribution differs from a time to another. But, as it was explained above, the occupant acts on himself to correct this distribution if it causes any discomfort by means of various devices.

4. THE IMPACT OF CULTURE ON THE POE FOR DAYLIGHT:

Daylighting is one of the window's functions and it could be affected by anyone of the others. The variance of the accomplishment of functions such as the view out and privacy provided and / or controlled by the window is in general culturally depending. The context here investigated (Arab Islamic) presents some particularities that make it different from where standard POE for daylight was established and previous adaptations were carried out. Thus, a review of preceding studies investigating this context was necessary. In fact, it was revealed, for example, that while view out is important for occidentals it was less for Algerians [Ouahrani, 1993]. It shows also that privacy needs are differently perceived and vary in importance from each culture to the other [Tabet Aoul and Sharples, 1989; Belakehal et al, 2001].

Then, several questions related to privacy and view out were added to the questionnaire. Also, observations were made about these parameters. They consist on the position of the desks (or preferred place) related to windows and to colleagues (or family members). The pilot study shows that women have special desks (Figure 10) and that the interpersonal relation between the occupants of the same space (office or living room) is a major criterion when occupying it.

Figure 10: the furniture for women is special (left picture). When it is not provided as it is recommended, a thick opaque and large paper is applied on the face of the desk to protect the legs of the worker woman (Right picture) and the desk takes sometimes a particular places.

Another aspect which is related to social and cultural parameters is the language in which the questionnaire must be written and addressed to the occupant of the considered building. Not all people are familiar with questionnaires even workers in offices. The pilot study reveals that several words permitting the characterization pf the luminous conditions were unknown in their academic expression (i.e.: glary). Thus, a second pilot study was conducted especially to define more local terms that could replace the academic ones. Also, the second pilot study confirms that for this kind of society, where the questionnaire is not a common way of communication, it is more

accurately to be in a direct contact with the occupant than addressing him indirectly the questionnaire.

5. CONCLUSION:

Several methods were drawn up to qualitatively evaluate daylighting in buildings. The Post-Occupancy Evaluation (POE) for daylight is considered, nowadays, as the world wide used method. It includes generally the occupant's subjective responses and a number of objective observations. However, the research works carried out by using this method shows that its adaptation to the considered context and the studied case are essential.

The POE method was used to assess the daylighting quality in two kinds of South Algerian contemporary buildings: offices and flats within multifamily housing projects. For a better accuracy and reliability, an adaptation of the POE for daylight method was required because of the particularity of the climatic (hot arid region with clear sunny sky) and cultural (an Arab Islamic) contexts. This adaptation consists on the measurement's methods of the physical parameters characterizing the indoor and outdoor luminous conditions (monitoring procedures) and also on the parameters related to daylighting and occupant's behaviour and preferences.

These changes could not be as standard for any other qualitative evaluation of daylighting inside buildings even it defines the most of the problem. For any further study, a pilot study is needed to verify its adequacy to the new context of investigation.

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