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# Sunlight and daylight in the traditional built environment: case of the hot arid regions.

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## SUNLIGHT AND DAYLIGHT IN THE TRADITIONAL BUILT ENVIRONMENT. CASE OF THE HOT ARID REGIONS.

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### ABSTRACT

In hot arid regions sunlighting is an essential consideration to achieve an architecture environmentally conscious. This paper aims to identify the sunlighting strategies and their resulting typology in some urban spaces, different types of buildings and constructional details, as developed in the traditional hot and arid regions of the Islamic world.

### KEYWORDS

Sunlight, daylight, typology, urban space, architecture, arid regions, Islamic.

### INTRODUCTION

Traditionally, the sun has very often been used passively in town planning and in architecture. Today's technological development offers new materials, techniques and strategies to optimally use the sun's energy. However, traditional concepts and techniques remain an interesting source of understanding and inspiration for urban planners and architects. In the hot arid regions several architectonic elements, illustrating various sunlighting strategies, have been developed. Morphologically, these strategies highlight inspiring elements with prominent environmental and energy savings potential.

The interest on traditional sunlighting and daylighting strategies arises first from its great availability throughout the year. Secondly, there is an ancestral tradition of adaptation to the intense sunlight with spiritual values associated to it. Finally, the performant but costly devices presently developed are often out of reach of the developing countries.

This paper is based on an analytical study and classification of sunlighting strategies and their resulting architectural typology in urban spaces, various buildings and constructional details in the hot arid regions of the Islamic world. This preliminary outcome is part of a broader research including people's reactions and attitudes, of an Islamic culture, towards various daylighting design strategies in different working and living spaces.

## URBAN SPACE

Street design in the traditional Islamic towns varied according to their geographical location, type and function, i.e. residential or commercial. The latter being often totally covered either heavily by perforated vaults (Aleppo), semi-heavily by high parapet walls and double pitched roofs (Damascus), or lightly by thick plank and reed (Kairaouan) (Fig.1). Streets in the residential areas are either partially covered by cantilevered volumes (Baghdad) or totally by additional living spaces (Ghardaia) (Fig.2).

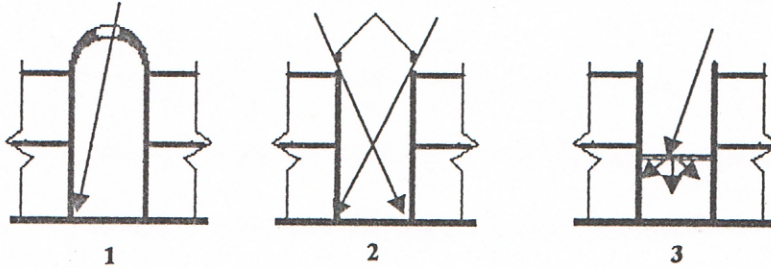


Fig.1. Types of urban roofing in commercial streets: 1) heavily, 2) semi-heavily, and 3) lightly.

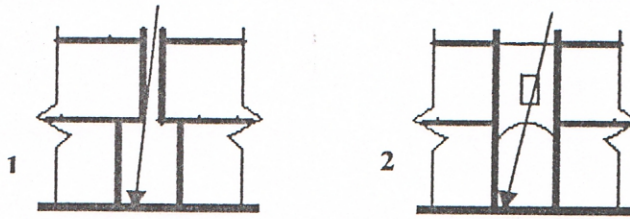


Fig.2. Types of urban roofing in residential streets: 1) partially covered, and 2) totally covered.

This type of urban roofing, by cutting off most of direct sunlight, provides comfortable thermal and luminous environment. Further, this sequential experience of dark and lit spaces possesses an aesthetic appeal often considered the architectural character of Islamic towns. (De Oliveira, 1998).

## PUBLIC BUILDINGS

Mosques, Schools (*madrasa*), Eastern inn (*khans, foundok*), Turkish baths (*hammams*) and Hospitals (*bimaristans*) are the most common public buildings of the traditional Islamic city. The courtyard and domelight are the two most recurring spatial configurations used for daylighting purposes. The courtyard, the principal source of daylighting, gradually infiltrates light inside the prayer hall of most mosques (Afzal Ebrahim, 1988). Screened and deeply recessed upper windows add a diffused natural light in its peripheral zones. Light is then reflected to the ceiling through the double arched naves or through the pierced tympanums.

The cupola, on the other hand, is used to illuminate specific strategic elements spaces like the prayer niche (*mihrab*), each extremity of the entire wall that faces Mecca (*qibla* wall) and the transept area (Hillenbrand, 1985) (Fig.3). This luminous environment creates a restful and pleasant space for the quiet and spiritual activities.

The Turkish bath (*hammam*) illustrates probably best the combined effect of top lighting and creation of an ambience. The cupola is uniquely here garnished by translucent coloured glass oculi (Fig.4) which combined with the water vapour creates a relaxing and exciting atmosphere for a social, symbolic and ritual activity (Vogt-Goknil, 1965).

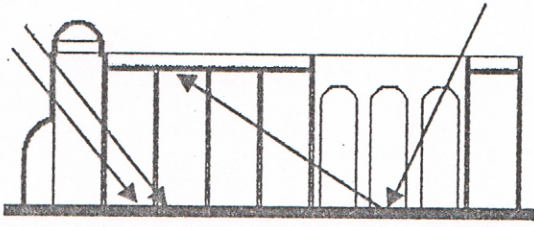


Fig. 3. Courtyard, cupola and double arched naves: means of interior daylighting in mosques.

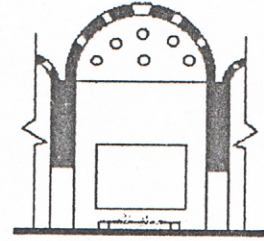


Fig. 4. Use of a cupola with coloured glass oculi in the Turkish bath for daylighting.

## HOUSING

The inward looking courtyard and various configurations of windows are the daylighting channels in traditional housing. Variations are found in different parts of the Islamic world, due to the change in climate. Hence, in the harsh Algerian desert the courtyard is almost totally covered, leaving a small opening at the top to admit sunlight when needed (Ouahrani, 1993). In milder contexts, the open courtyard has surrounding covered arcades acting as sunlight overhangs and protecting alleyways (Bourbia, 1990) (Fig. 5).

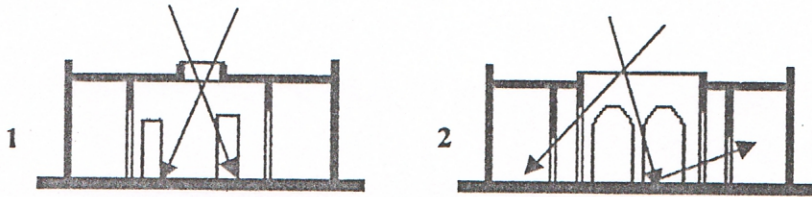


Fig. 5. The courtyard configuration vary due to the change in climate: 1) totally covered and 2) partially with surrounding covered arcades.

Space occupancy is also related to the daily and seasonal brightness of the spaces. The most occupied spaces are oriented south-east to catch the early sunrays. Similarly and within the same space sunlight has been used to emphasis a geometric spatial composition such as the Egyptian living room (*durqua'a*). Here, beside the light provided by peripheral upper windows a skylight is strategically located above the central fountain in the room (Fig. 6) (Noweir and Panerai, 1987). The association of natural light and water creates a pleasant and refreshing atmosphere while providing an interesting inside / outside scene.

Whenever external windows exist, they are of small size and often screened. The Yemenite traditional window has specific features, being divided in various functions, ventilation, natural light admission, provision of view and privacy.

## CONSTRUCTIONAL DETAILS

Some constructional details are often an elaborate development of the ancient ones such as the pierced slabs of stone of the Amoun's in Egypt. The traditional 'moucharaby' a wooden lattice of cylinders joined with spherical joints, screens an unglazed opening. The rounded surfaces reflect and grade the light very softly, while also allowing ventilation, minimising heat penetration and providing visual privacy (Tabet Aoul, 1991).

The *muquarnas* used inside buildings, consist of a more or less complex honeycomb of small niches, diffuse sunlight. They eliminate any kind of plasticity, creating an ornamental and delightful luminous environment (Norberg-Schulz, 1986). Also, the reflected light from the white painted and coloured ceramic walls attenuates the bearing wall heaviness (Burckhardt, 1985).

Split windows, with an increasing section from outside to inside is another architectonic element, which admit daylight and control sunlight (Fig.7).

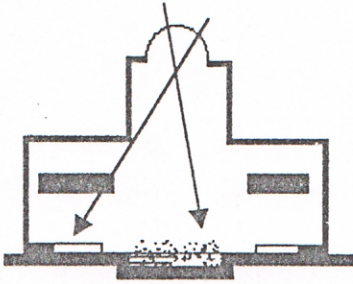


Fig.6. A skylight is used for daylighting in the Egyptian *durqua'a*

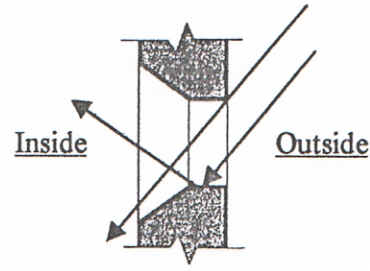


Fig.7. The split window is a specific design adopted to admit and control sunlight

## CONCLUSION

Traditional built environment in hot arid regions reveals the importance given to sunlight among other environmental parameters (heat, cooling, ventilation...). This paper highlights several sunlighting strategies adopted in the traditional built environment of the hot and arid regions.

The salient result is that the solutions often go beyond the sole consideration of amount of light (often quantitatively considered below standards) to encompass the qualitative characteristics with psychological, spiritual and socio-cultural connotations. The variety of architectural design and components in the context considered imply that a daylighting culture exist in the traditional built form. Also, the study showed the power of natural light to structure the space.

It must therefore be emphasised that daylight evaluation cannot be limited to quantitative evaluations, but should consider equally the quality of daylight distribution, perceptual needs of the occupants, cultural background, the type of task and it's frequency and their implication on architectural design.

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