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Re-interpretation of traditional architecture for visual comfort

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ABSTRACT

In the history of stone traditional architecture there are constructive solutions which, with the same climatic conditions and materials used, produce a different final result. This result, which apparently is only a formal and figurative one, actually involves different physical–technical implications that inevitably determine, for these solutions, a different system of actions/reactions due to the change of stress of the physical environment they interact with. Starting from a constructive approach, linked to the Mediterranean culture and, in particular, to a specific declination represented by architecture from the Islamic architectural culture, the aim of the research work is to estimate how the logical–formal and physical operation of the walls of the traditional architecture, interacting with the outdoors, can be used and re-interpreted in order to assure a condition of visual comfort into internal spaces. Therefore, the attempt is that of a re-interpretation in a contemporary key, i.e. the possibility to use these solutions with the purpose of pointing out a methodological procedure which, even if referring to particular special configurations and specific visual duty in its experimental application, can be used in all types of environments; a methodology which contemplates and appraises all of the dynamics and problems linked to the sight and comfort of the average user.

1. Introduction

In the field of architecture, the relationship with natural light, now as much a physiological necessity as a symbolic one, is almost always at the origin of compositional choices that determine different formal solutions, unconscious and fortuitous, conscious and researched. In particular, in the culture of Mediterranean architecture, the building act is translated and identified in the idea of a strong façade, continuous, closed, opaque, in which the relationship with the external environment is translated in cutting out a hole in the vertical wall by subtraction of material in order to receive light.

On the other hand, in Islamic architecture, this behaviour is equivalent to a real dematerialization of entire walls that become highly porous and transparent, therefore establishing a more direct relationship with the external environment (Fig. 1).

The purpose of this research is quite a challenge: even if we know that every type of architecture must be considered as a result of a background of traditions, history, culture, weather, and necessities, how much can these planning choices become reality, considered valid and proposable, in order to be adapted not only to various climates and cultural contexts but also to most contemporary activities? How true is it that some choices apparently only formal and figurative, especially found in the Islamic building experience, do not hide some functional logic that, on the contrary, determines their indispensable aspect and identity?

The belief to attribute to the light and its potentiality the characteristic of priority and universality, compared to all of the other environmental variables, a founding variable is singled out in the luminous radiance in a choice procedure, in order to limit the state of complicity of an architectural project.

Schematizing the empty on abstract wall/type, in which it is possible to find the opposite attitudes of the Mediterranean and the Islamic architecture, the central theme of the research will concern the logic and laws of the propagation of natural light in the internal space and, particularly, the situations or conditions in which light becomes the cause of visual comfort or discomfort.

Starting from the point that, in order to evaluate the visual comfort/discomfort, we have to consider: (i) the subject/observer of the space; (ii) his actions; (iii) his visual duties. In the experimental action, we will consider a subject who develops a common activity of study/work at a desk with a PC.

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2. Definition of the analysis instruments

The first step in the research was the definition of the experimental model to be utilized, which is a room with a square base of 16 m^2 and 3 m high, where all of the walls are matt except the one oriented to the south. In this last wall, an empty percentage of 10% of the total area has been realized; the distribution of the empty space gives the two cases in this research.

In the first case of Fig. 2, the empty space is concentrated in only one square hole placed in the middle of the wall (a single empty space), typical of Mediterranean architecture. In the second case, 10% of the empty space is distributed on the whole area of the wall, typical of the Islamic wall (distributed empty space). For the re-interpretation of these two systems in a contemporary key, the second case has been divided into two systems that we will check are equivalent during the research: case 2a, in which the percentage of empty space is distributed over the whole wall by micro-holes (Fig. 2, case 2); case 2b, in which the whole south wall is substituted by a glass surface with a 0.1 transmission coefficient.

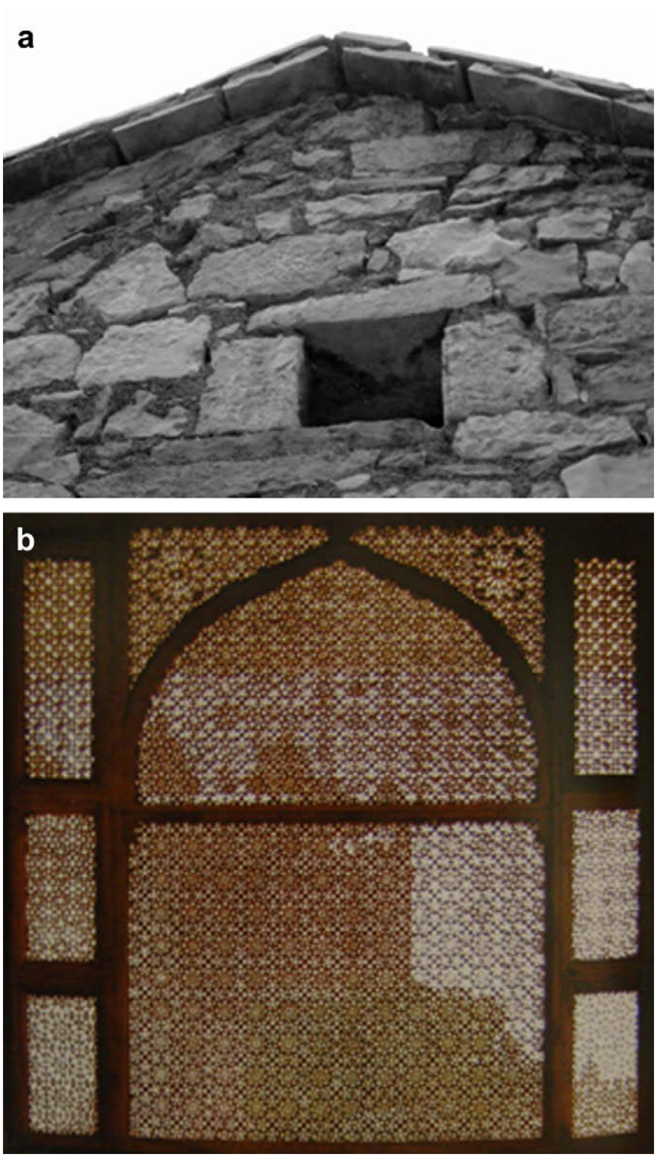

Fig. 1. Comparison between Mediterranean and Islamic walls. Case 1: Mediterranean wall. Case 2: Islamic wall.

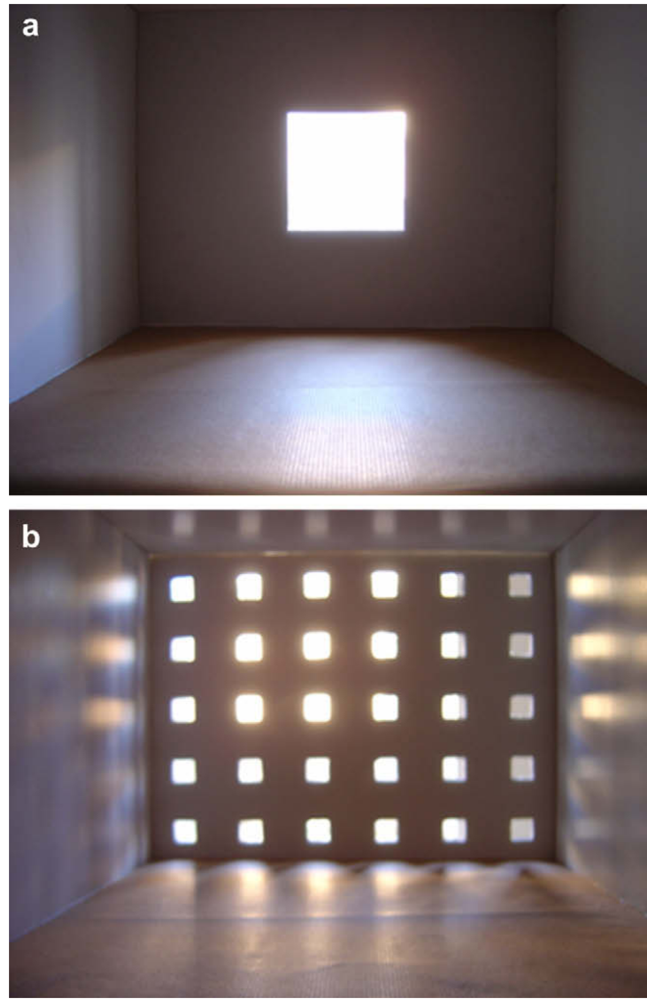

Fig. 2. Different distributions of empty spaces in the wall. Case 1: Single empty space. Case 2: Distributed empty space.

The experimental procedure has been conducted through the realization of a scale model and the use of two programs for the evaluation of the natural illuminance: Rafis (Rough Analysis for Illuminated Spaces) and Relux Professional.

Rafis [1] is a calculation program created by a team of researchers at the Polytechnic University of Catalonia for the evaluation of daylight illuminance. The program enables calculation of the daylight factor (DF) on an ideal writing desk 0.80 m above the floor with the same shape and surface. The sky condition used by the software is determined by the following formula and is expressed as [2]:

$$L_p = L_z \times [1 + 0.2\cos(\beta)] \times [(1 + 2\sin(\alpha))/3] \quad (1)$$

where:

L_p is the luminance of the sky for a height β in the direction of the equator, kcd/m^2
L_z is the luminance at the zenith, kcd/m^2
α is the azimuthal angle measured starting from the geographic south, rad

The input data are: the geometric configuration of the room (base and height dimensions), the coefficient of reflection of the opaque walls and the coefficients of transmission and obstruction of the transparent surfaces. The coefficient of reflection of the floor is the default value used by the software and equal to 20%.