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The Relationships between Users and Daylighting Design in the 20th Century Architectural Practice

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Abstract: Architecture is considered a crossing field between arts and sciences that is supported by multiple, various and complex issues. Considering that architecture is a man’s creation for men, this research explores human factors in architecture. It specifically focuses on the relationships between users and natural lights (both sunlight and daylight) within houses and public buildings designed during the 20th century modernist era by renowned architects. The investigative approach relies mainly on a literature review as well as in site observations and some interviews for the case studies in France. Six contemporary architects’ work composed the study corpus. The results highlight first that:

- i. users did not perceive natural light as architects intended it,
- ii. users’ sensations could not replace the essential requirements contributing to satisfaction with a comfortable daylit space,
- iii. after the first effect, dissatisfaction occurred and often generated transformations disfiguring the striking effects designed by the architects.

Introduction: Lighting an architectural space is an essential act enabling users to carry activities. Generally, a given standardized light level could satisfy this need. But, in terms of suitability, the issue becomes more complex and may lead to a distress followed by a deep transformation of the architectural space. This complexity along with the variety of the related parameters have generated substantive interest in daylighting across various scientific fields, such as psychology, ergonomics, architecture, energy, economics etc. For instance, the user has become the centre of interest of several research studies on daylighting. These investigations relied on the user’s self-expression of the perceived daylighting inside his living spaces [1,2]. In order to investigate such issues, this research work attempts, first, to explore the relationships between the users and daylighting in the context of the architectural production as a know-how professional field. A critical review is undertaken for six among the 20th century’s most famous modern architects known for their architectural design that strongly valued natural lighting. The review will focus on the relationships to the user’s perception, choices and behaviour. The architectural productions under review (houses and public buildings) are principally examined through a literature review. For some of them, in situ observations as well as interviews with the current buildings’ managers were undertaken.

Walter Gropius and Mies van der Rohe

In search of transparency

Walter Gropius and Mies van der Rohe largely used daylight and transparency as their main design concept, including their buildings in the United States. For Gropius, access to light and air reduces the needs of habitable space. He rejected the idea of the window as a hole in a wall and advocated the curtain wall. Unfortunately, in the Fagus Factory, built between 1911 and 1913 in Alfeld, the office workers use heavy curtains for glare control concealing the transparency so appreciated by the architects.

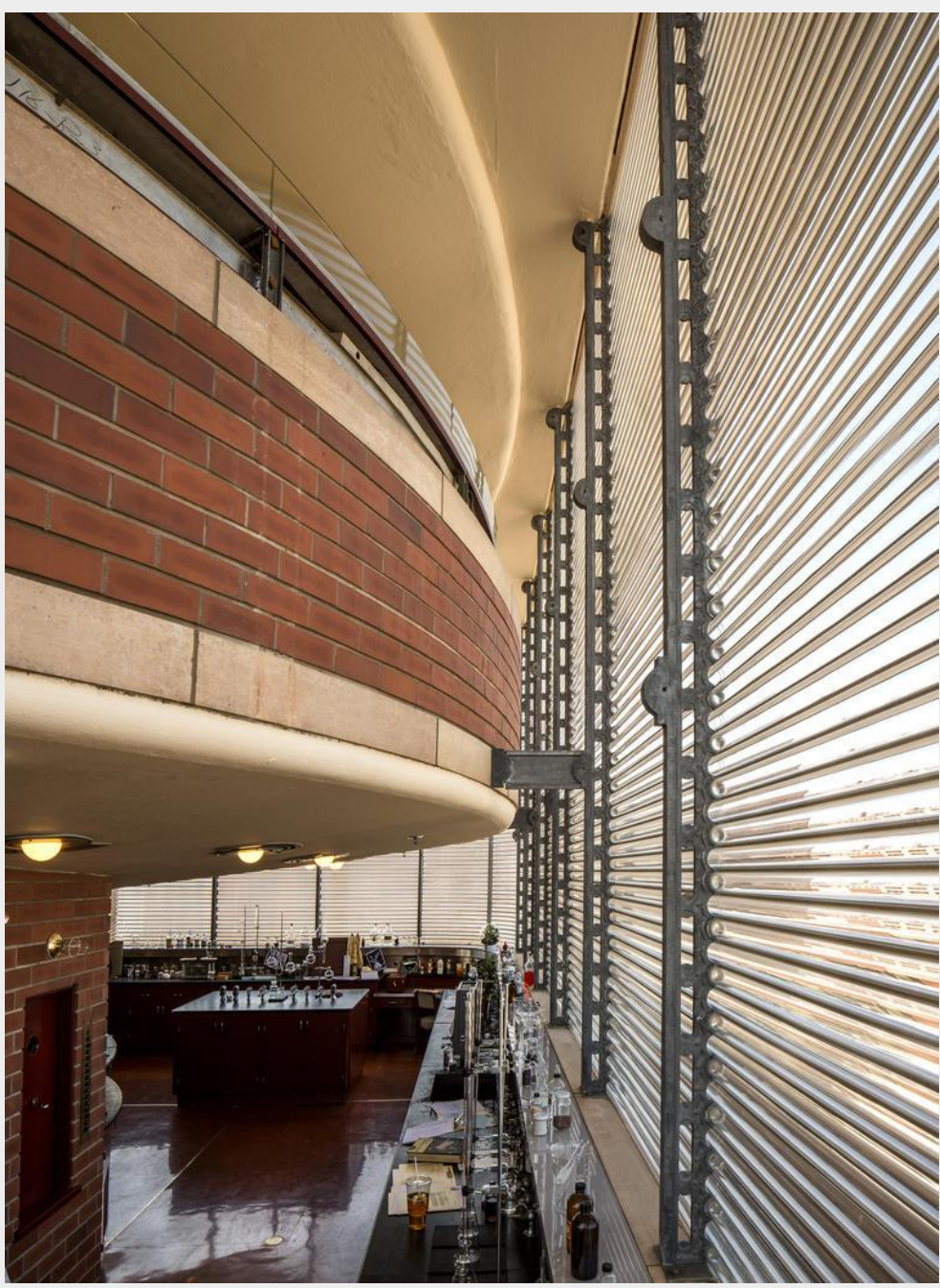
On the other hand, Mies van der Rohe used the window wall indistinguishably between offices and houses. Mies was convinced that the emotion felt by the users of glazed spaces is generated from the multiple and combined reflections of natural light rather than the light-shadow contrast used in classical buildings. For instance, one of the most prominent architectural historians, Paolo Portoghesi, cited the uncontrolled and uncontrollable luminosity of the Mies’ famous Lake Shore Drive Apartments in Chicago.



Frank Lloyd Wright and Alvar Aalto

The importance of context

Wright's contribution to daylighting design is more qualitative than quantitative because he based his design on his own intuition and did not use system calculations. However, this approach also leads to some daylighting problems inside his buildings. Their interiors are often seen as dark spaces. In the Johnson Wax Offices and Laboratories in Racine (Wisconsin), Wright used a translucent glass allows generous daylight penetration but prevents views to the outside whilst



a section of the window area can be opened by the occupants.

Aalto’s interest in daylighting goes beyond intuition and borrows from scientific experimental work. Contrast and various light gradients are evident characters of his interiors. However, because most of his buildings are in overcast sky regions, and were designed in an era of inexpensive energy consumption, a nearly quasi-systematic recourse, at the present time, to the artificial lighting as a more than a complementary source to daylight.

Le Corbusier: A singular case

Being the most prolific writer and speaker of all, it seems that no architect did better than Le Corbusier when he evoked the sensations caused by natural light, narrated its plastic qualities and related its benefits to humans. In order to satisfy users' needs, Le Corbusier referred to his intuitions even if they were purely technical. So, despite his good intentions, his buildings occupants' reactions were chocking and ultimately surprising.



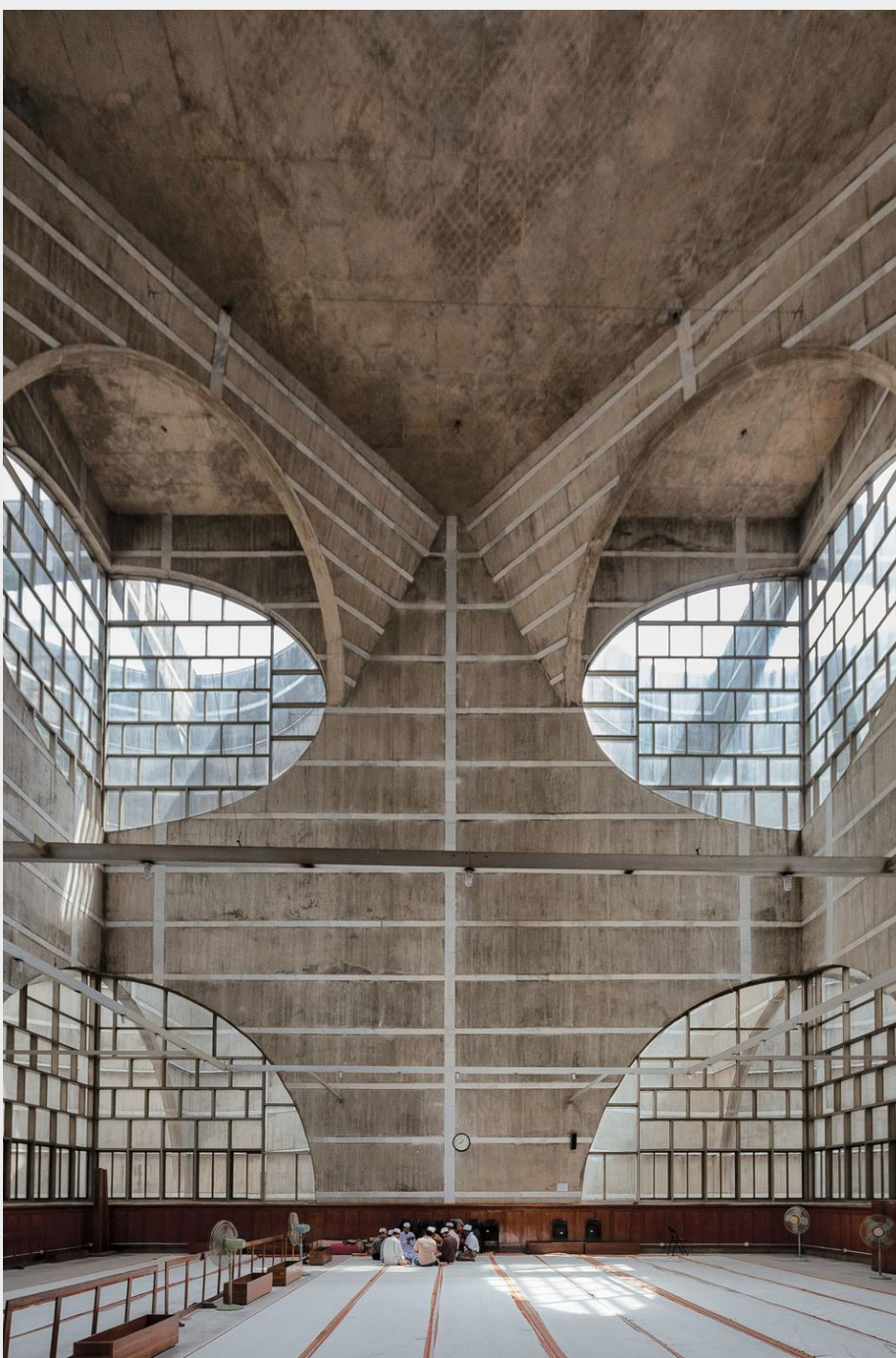
The Frugès Housing District in Pessac, France, is a reference case showing that the universal aesthetics could not be accepted as the Modernists thought. The apartments buildings facades are oriented to the west and east and have subsequently been altered at different stages. The windows areas were mainly reduced in response to the sun excessive exposition.



Louis Kahn and Light

Kahn gives a singular importance to daylight in his buildings as well in his theories. He rejected the principle of a universal lighting and advocated a singular lighting for specific spaces. But unfortunately, the examination of Kahn's buildings reveals some contradictions with his own theory.

The Dacca Assembly Building is almost considered as an illustration of Kahn's daylighting mastery. However, some interiors receive insufficient to inadequate and even glaring daylight. Inside the National Assembly Mosque, the direct sunlight disturb the prayers and require moving from a place to another. Also, the supposedly space-structuring and orientating clear-dim effects are not performing well because they are not the users' habitual references.



Conclusion: In this study, a critical review has been undertaken for the specific buildings known for their daylighting design in order to investigate the relationships between the users and daylighting design. The outcomes indicate that: i) the users did not perceive daylight as it was expected by its prominent Modernist architects, ii) the visual and artistic aspects could not replace the visual comfort related requirements (solar and glare control as well as avoiding overheating and inner gloomy spaces), and iii) that when the first sensation and/or impression effect is outdated, dissatisfaction could occur and generate several transformations disfiguring the striking effects previously designed by the architects.