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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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Assessing Visitors' Interaction Using Virtual Reality in Dynamic Daylit Exhibition Spaces

A thesis Presented in Partial Fulfillment of the Requirements for Doctor of philosophy Degree in Architecture Engineering

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Disclaimer

This thesis is submitted as partial fulfillment of PhD degree in Architecture, Faculty of Engineering, Ain Shams University.
The work included in this thesis was carried out by the author during the period from November 2017 to June 2020, and no part of it has been submitted for a degree or qualification at any other scientific entity.
The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

The inherent dynamics of daylight shape our experience and form our perceptions of the space. Daylighting performance assessment is both quantitative regarding their prediction methods and qualitative in terms of its impact on the intrinsic subjectivity of human interactions. Research in this field has interdisciplinary nature as it integrates light physics and psychological dimensions to understand the impact of light quality and quantity on the indoor space, hence on the human perception and their interactive level with the space.

Interactivity is a state of action within a space. It provokes the user's perceptions and behaviors in response to design stimuli. The dynamic changes in these stimuli (design actions) impact the interrelation of design actions and users' responses, so finding this relation is important for making decisions that urges the transfer of intended meanings of the space.

Exhibitions are characterized by a high level of meaning-making. Visual features and lighting measures can manipulate space cognition. So, lighting design act as a cornerstone in the design process of exhibition spaces due to its vital role in meaning-making and visitors experiences. The purpose of an exhibition space is to elaborate and signify the objects it holds and attract visitors to explore them. Thus, grabbing the attention of visitors needs to be understood under various lighting conditions. Focusing on daylighting, the influence of luminance and contrast variations on human visual interaction is recognized in this research.

Visual attention can be analyzed through heatmaps showing areas of interest (AoI) in the space. Head tracking in Virtual Reality (VR) can reveal what is behind subconscious interaction with the environment. It gives a better interpretation of how a person interacts with different messages in the environment. Unbiased behaviors can then be captured to extract objective data to build upon. The benefit of the immersive VR environment is allowing any type of simulated environment where visual stimuli with different scenarios can be repeated and controlled while giving a sense of presence. Finding the underlying relationship between qualitative daylighting aspects that urges visual attention of users and induces their subjective perceptions is not a straightforward process. So, this thesis provides an approach to assess and predict the interaction of visitors of the exhibition space through VR and Machine Learning (ML) algorithms.

Keywords

Daylighting, Visual Interaction, Virtual Reality, Machine Learning