Immersive models for evaluating window design

While recent studies suggest benefits of using immersive virtual reality (VR) technology to obtain user experience during the design process of spaces, it is still unclear whether VR can be used as a reliable tool to evaluate the lighting quality. This study examined 5 daylight control options (electrochromic windows versus blinds with different degrees of daylight transmission and color) and their impacts on users’ satisfaction, visual comfort, and perceived thermal comfort in a physical office as well as its digital twin. The daylight control options were installed in a physical office setting located in Mississippi, U.S. Participants \((N = 56)\) experienced each daylight control option and completed an online survey. Also, measurements for daylight glare probability and desk temperature were conducted at each physical workstation using High Dynamic Range photography and HOBO loggers, respectively. Using Matterport, web-based 3D models of the office with the daylight control options were created. Participants \((N = 61)\) explored the immersive virtual models using Oculus Quest 2 VR goggles on a university campus and responded to a verbal survey. Semi-structured interviews were also conducted after participants’ VR experience. Findings revealed high visual comfort ratings for the electrochromic window with 1% of visible light transmission compared to light and dark shades in both virtual and physical settings. However, results regarding perception of glare severity, perceived temperature, and overall satisfaction with workstations were inconsistent between the VR and physical setting. Findings from this study help the architects and stakeholders identify the optimal window design features in office workstations and understand validity of VR as a tool to assess user experience of lighting quality in spaces.