Spatial Memory of Building Layout via 2D, 3D and Virtual Reality

Yang Ye[1], Yangming Shi, Ph.D.[2], and Jing Du, Ph.D., M.ASCE[3*]

[1]Ph.D. student, The Informatics, Cobots and Intelligent Construction (ICIC) Lab, Department of Civil and Environmental Engineering, University of Florida; e-mail: ye.yang@ufl.edu;
[2]Assistant Professor, Department of Civil, Construction and Environmental Engineering, University of Alabama; e-mail: shiyangming@ua.edu; Former research associate at ICIC Lab.
[3]Associate Professor, The Informatics, Cobots and Intelligent Construction (ICIC) Lab, Department of Civil and Environmental Engineering, University of Florida; e-mail: eric.du@essie.ufl.edu. Corresponding Author.

ABSTRACT

Spatial memory of building layout is critical to the design, construction and management of built facilities. With the advancement of new visualization technologies, the building layout and spatial configurations can be illustrated by multiple means, for instance, 2D drawings, 3D models, and immersive virtual reality (VR). It is noted that different formats of spatial information can influence the memory retention of space in different ways. Yet the relationship between the spatial information format and spatial memory pattern is less clear. This paper introduces the findings of a human-subject experiment (n=63). Participants were required to review a building design in the form of 2D, 3D and VR, and then to hand sketch the memorized layout. A quantitative comparison was performed to assess the discrepancies between the original design and the memorized layout. The result indicated that 2D drawings, in general, led to the largest discrepancy while emerging methods such as 3D and VR indeed led to a better memory. Besides, it was found that the memory quality of using 2D drawings seemed to diverge, showing an obvious performance polarization. The findings are expected to provide more evidence on the effectiveness of engineering visualization.