A psychological approach to evidence-based architectural design in domestic spaces

Colin Ellard1, Deltcho Valtchanov3, Thomas Seebohm1, Justin Perdue2, Sarah Susanka3, Mark Zanna1
1University of Waterloo, Waterloo, Ontario Canada, 2Stantec Architecture, Toronto, 3Susanka Studios, Raleigh, NC

Introduction
In this experiment, we demonstrate a principled method for assessing the comfort, usability, and affective properties of a series of domestic spaces. We combine high-level visualization with immersive virtual reality, motion tracking and structured interviews to assess the qualities of a variety of styles of domestic spaces. This initial study is meant as a “proof of concept” for future studies in a variety of built settings ranging from institutional and health care environments to the urban scale.

Method
3d visualizations of three existing domestic structures were constructed using 3d Studio Max and V-ray. The structures were Frank Lloyd Wright’s Jacobs House, Sarah Susanka’s Milstein House, and a typical North American suburban house. Participants were provided with immersive experiences of the models using head-mounted displays, infrared motion tracking, and mobile computing. The models were realized at actual size in a gymnasium. Participants explored the spaces until they felt familiar with them, and then they were asked a series of questions about their preferences for particular locations.

Participants were asked about their overall preferences for certain aspects of each of the models. Results suggested that designers’ intentions were, to some extent, manifest in the opinions of participants. For example, the Milstein House, which was designed to enhance both opportunities for socializing and privacy [1], appears to have met both of these objectives.

Using Ajanachara software [2] the spatial properties of the home designs were analyzed to determine such properties as isovist size (area of space observable from a given location), and other higher order properties of spatial shape. Analyses were converted to contour plots to visualize how spatial properties varied between locations in the space. The figure below shows an example of such a contour plot from the Jacobs House.

Conclusions
The findings described here, although very preliminary in nature suggest the viability of a method for assessing the affective properties of architectural spaces using a combination of immersive virtual reality, motion tracking, and traditional structured interview methods of experimental psychology. In future work, we hope to add to these findings by including measurements of physiological reactions during exploration of such spaces, including eye movements, heart rate, skin conductance and EEG.

References

Figure 1. A screenshot of the Milstein House visualization

Figure 2. Spatial analysis of Jacobs House. Colour coding corresponds to size of visible region of space from each location in the space. Light colors indicate large visible regions of space and dark colors indicate small visible regions of space.

Figure 3. Participants were asked: “If this were your house and you were having a party, where would you go to oversee"