Navigating urban spaces demands attention: Evidence from physiological indices of arousal and visual attention

Abstract:

Previous research has demonstrated a profound influence of the configuration of urban and interior spaces on aggregate human movement rates within those spaces. In particular, the space syntax analysis has shown that people prefer paths which are highly connected and highly integrated into the overall spatial system of paths within an environment. The consistency of this finding has led some authors to propose that navigation through both novel and familiar urban spaces is achieved exclusively by effortless processing of exosomatic stimuli -- driven by an understanding that the structure of an environment was intentionally designed to subserve efficient movement. Here, we present an investigation of the sufficiency of this claim by having participants navigate through two virtual environments which differed in the configuration of the included buildings, quantified by intelligibility analysis. To assess whether attentiveness or arousal is necessary for successful navigation, blink-rate, length of the average blink, heart-rate, galvanic skin response, and finger pulse volume was monitored, with each measure traditionally showing a higher response when more effortful processing is necessary. Further, questionnaires were used to assess the trait-level of attentiveness. When navigating through the less structured, unintelligible, environment participants were found to follow longer paths and take more time to complete the task. Accordingly, blink-rate and heart rate were found to be higher in the unintelligible environment throughout the navigation task. These measures were also found to be correlated with the questionnaires measuring mindfulness. However, correlation analysis also revealed that mindfulness was related to the distance traveled and time needed to complete the navigation task. This pattern of results clearly indicates that if exosomatic variables, such as connectivity and integration, are driving performance, then reduction in the systematicity or intelligibility of a built environment will place significant demands on a navigator's spatial cognitive abilities, shaping their navigation qualitatively and quantitatively. These results not only further our understanding of how people navigate through the built environment, but also have implications for the predictions derived from architectural models based on the structure of space, such as space syntax, currently used in architectural practice.

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Biographical Sketches:

Kevin R. Barton is a graduate student at the University of Waterloo in the Cognitive Neuroscience division. He is interested in understanding how humans and animals navigate effectively and ineffectively through novel and familiar environments. He has approached this topic using a variety of techniques, including architectural measures, primarily that of Space Syntax, behavioural, psychophysiological, and animal models to help address this question.

Dr. Colin Ellard is a research psychologist and director of the Research Laboratory for Virtual Environments at the University of Waterloo. His main interest is in using the methods of experimental psychology, simulation, and psychophysiological methods to explore the relationship between design and experience with a particular focus on the emotional response to built space.