ANFA 2014 CONFERENCE

PRESENTER ABSTRACTS

ACADEMY OF NEUROSCIENCE FOR ARCHITECTURE

The Role of Visual Attention in Architectural Design

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Although the visual system can process some aspects of the environment efficiently, such as spatial layout, the visual system is quite limited in its ability to process specific details or relationships between elements in the environment. To help users overcome these limitations, we argue that visual cues are critical for guiding attention toward important elements in the built environment, allowing users to understand more complex design goals. We review three examples of design goals that can benefit from attentional guidance, describing architectural techniques that support these goals and highlighting the cognitive and neural mechanisms associated with each technique.

1. EXTENDED ABSTRACT

In a flash of an instant, people can rapidly categorize their environments, a phenomenon often referred to as rapid gist extraction (Potter, 1975; Oliva & Torralba, 2001). In contrast, it takes time and effort to notice specific details or relationships between elements in the environment (Treisman & Gelade, 1980; Logan, 1994). Although gist extraction is one important component in architectural design, more complex design goals may require this more limited, effortful type of processing. Thus, how a user attends to an architectural space may be critical for understanding the deeper meaning of the design.

We argue that a major role in architectural design is to provide guidance or visual cues to help the user focus on critical elements in a space, and that such guidance is especially important for helping users grasp more complex design goals. Here we review examples of three such design goals, describing how architectural design techniques can guide the user's attention in specific ways and highlighting the cognitive and neural processes associated with each technique. For instance, certain design techniques can help users relate separate regions of a space to one another, highlight the overall spatial structure of a space, or evoke different modes of thinking (i.e., focused versus unfocused attention).

To help users connect separate regions of the built environment, symmetry and repetition are often used to emphasize cohesion among disparate elements. In symmetric designs, the spatial alignment of separate elements may facilitate comparison, allowing the brain to quickly extract similarities and differences among multiple elements (Gentner, 1983; Michal et al., in preparation). Repeating elements (e.g., arches in the Kimball Museum) may evoke cohesion across different spatial regions because attending to an element in one location allows for other neurons to simultaneously respond to that same element in other locations (Treue & Trujillo, 1999). Several visual cues such as symmetry, spatial alignment, and perspective (e.g., the Salk Institute) can be used to define a focal point, which draws attention to one important region by enhancing the visual saliency of that region (Itti & Koch, 2001). In addition to having aesthetic value, focal points can also clarify the overall organization of an architectural space by orienting users to landmarks or principal axes (e.g., the Philbrook Museum; Cheng & Newcombe, 2005; Xu & Franconeri, 2012). Finally, varying the openness or enclosure of a space (e.g., the Kravis Residence) may elicit unfocused/creative or focused thinking by activating bottom-up versus top-down attentional networks in the brain (Berman et al., 2008).

Although these examples highlight an important relationship between visual attention and architectural design, further research is necessary to clarify this relationship. For instance, are there other design techniques in addition to focal points that can help users develop mental maps of built environments? Can visual cues aid in other complex spatial processes, such as transitioning between 2D and 3D representations of built environments? What other design principles other than openness and enclosure can evoke different modes of attention? Additionally, how can architects' use of visual cues inform our understanding of the visual system?

In conclusion, to maximize the architectural experience and fully understand the effect of the environment on attention, we believe it is important for architects and neuroscientists to further explore how attention affects the architectural experience and vice versa.

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Dr. Audrey Lustig Michal is a cognitive neuroscientist with a background in neuroimaging and visual attention. She completed her B.A. in Biological Basis of Behavior at the University of Pennsylvania and her Ph D. in psychology at the University of Illinois. Dr. Michal's current work focuses on the role of attention in understanding spatial relations and relational reasoning more generally. She uses fMRI, eyetracking, and psychophysical techniques to address these issues.

Michael Lustig began his architectural practice in 1976 in Chicago after attending Ohio State University, Cornell University, and the University of Illinois, where his research centered on artificial intelligence applications to architecture and he received a Master of Architecture degree in 1974. He was an Adjunct Assistant Professor at the University of Illinois, Chicago and was editor of the Chicago Architectural Journal. His buildings have been completed throughout the US and Europe and include residences, commercial buildings, and the Philbrook Museum of Art. His projects have been awarded several AIA design awards and have been exhibited at several museums and universities in the U.S. and Europe. He was the American Institute of Architects/Chicago recipient of the Young Architect Award and his work has been published in several books and journals including 150 Years of Chicago Architecture, Progressive Architecture, Abitare, L'Architecture D'Aujourd'hui, and Ottagano.