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PRESENTER ABSTRACTS

ACADEMY OF NEUROSCIENCE FOR ARCHITECTURE

Visual Impairment and Spatial Cognitive Neuroscience

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1. ABSTRACT

Visual experience is necessary for the normal development of spatial cognition (Pasqualotto & Proulx, 2012). Here we will review how visual experience impacts spatial processing and therefore is a relevant consideration for architectural design. First, congenitally blind participants to rely on an egocentric reference frame for spatial cognition tasks, rather than an allocentric reference frame that is favored by late blind and sighted participants (Pasqualotto, Spiller, Jansari, & Proulx, 2013). This suggests that visual experience can influence the neural basis of spatial representations, given the importance of vision for normal multisensory processing (Proulx, Brown, Pasqualotto, & Meijer, 2012). Second, visual experience impacts the development neural regions for multisensory spatial representation (Huang, Chen, Tran, Holstein, & Sereno, 2012). This was revealed when we examined specifically the representation of tactile maps in multisensory areas, such as the putative human ventral intraparietal (VIP) area (Sereno & Huang, 2006). Congenitally blind participants did not have the same representation of the face map as those with visual experience. This finding suggests that visual, rather than tactile, processing dominates activity in this parietal area. Our current work is examining how activity in this area is influenced by transparent barriers. A glass barrier might protect the body from an approaching object, while allowing for full visual perception of the object. Given that this parietal region is involved in defensive movements to protect the head from approaching objects (Stepniewska, Fang, & Kaas, 2005), we are exploring whether the perception of a transparent barrier reduces the activity in this region in response to a looming stimulus. These converging results suggest that the underlying neural and psychological representations of space are influenced by visual experience, or the lack thereof, and design should consider how to best build environments that are congruent with the neural and psychological responses of the inhabitants.

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3. AUTHOR BIOS

Michael J. Proulx is Associate Professor in Psychology and director of the Crossmodal Cognition Lab at the University of Bath. His research focuses on unveiling how our senses interact to represent the world, and he has a particular interest in the impact of blindness on cognition. He is a Fellow of the American Psychological Association and was honored as a torchbearer for

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Alexandra A. de Sousa, Ph.D., is an expert in human brain evolution. Her research answers questions such as: What are big brains for? How is the human brain unique and how did it evolve? Dr. de Sousa has held multiple international research positions and has wide-ranging collaborations, based on which she founded the European Network for Brain Evolution Research. Currently she is part of a VW Stiftung-funded investigation at the intersection of neuroscience and architecture, and here and elsewhere aims to enlighten applied research with an evolutionary perspective.