

fMRI Study of Architecturally-Induced Contemplative States

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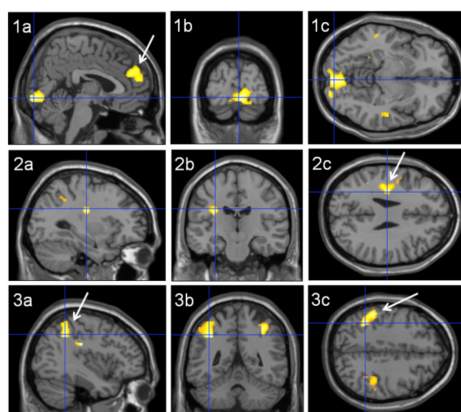
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NOTE: for more info on the authors, see attached sheet

This presentation reports on an interdisciplinary investigation testing whether the perception of environments designed for contemplation elicit brain activations similar to those found under contemplative states. If architecture is shown to be an effective ‘external method’ to facilitate contemplation, then the beneficial effects of internally-driven contemplative practices (e.g., prayer, meditation) shown by recent neuroscience research could be extended to exposure to architectures designed for that purpose. Our long-term goal is to investigate cognitive, emotional, and health effects of contemplative/sacred architecture on the wider population.

In order to test the hypothesis that buildings designed for contemplation elicit neuro-signatures associated with meditative states, we devised a pilot project combining a **functional Magnetic Resonance Imaging** (fMRI) based experiment and current neuroscience literature on the meditative states. We recruited 13 architects and asked them to view images of ordinary buildings (‘Control’ Block) and contemplation-inducing (‘Experimental’ Block) edifices while their brains were being scanned. A building was depicted through 4 images at 20 seconds each (totaling 80 sec) separated from the next set by a 40 sec recovery period (gray plate). Each Block started with a Baseline period in which a gray color plate was presented for 60 sec. There was a short questionnaire after each Block and a 20-minute Exit Interview.

Briefly, we found that: (1) *Brain regions activated in subjects with architecture expertise when viewing contemplative buildings **overlap** with brain regions activated in adept meditators during meditation (with some differences)*; (2) ***Markedly distinct** neural activations occur when subjects experienced ordinary vs. contemplation-inducing buildings*; and (3) *There are **correlations** between subject-reported **anxiety**, **depth of experience** and **brain physiology** attributable to the induced contemplation*. In short, our fMRI study supports the hypothesis that specially designed buildings may induce phenomenologies similar to those under contemplation. Here are some details:



Figures 1-3 depict brain activation patterns for contrasts between control (C) and experimental (E) blocks. ----- CONFIDENTIAL INFORMATION (Do NOT publish) -----

1a-b-c. Whole brain analysis (C>E) showing activation in Medial Frontal Gyrus/BA9 (see arrow, in 1a) and Occipital Lobe (Right Lingual Gyrus/BA18). Increases in Medial Frontal Gyrus indicates greater activity in the brain’s executive function during the control block compared with that during the experimental block.

2a-b-c. Whole brain analysis (E>C) showing activation in Left Precentral Gyrus/BA6 (see arrow, in 2c). There is an unexpected activation of the pre-motor area (Precentral Gyrus), which may suggest motor resonance congruent with the implied movement expressed in the architectural images, and possibly signifying the embodied nature of the induced contemplative states. This pattern may be consistent with brain correlates of contemplation gained through word-based prayer. However, other features (i.e., lateralization and no Frontal Lobe activity) are consistent with meditative states as reported in the neuroscience literature (indicating loss of self-awareness, lack of analytical/critical thinking, etc.).

3a-b-c. Parietal Lobe Region of Interest analysis (E>C) showing activation in inferior parietal lobe (see arrows, in 3a and 3c). This is consistent with, (i) a recent study of cerebral blood flow changes from meditation, and (ii) brain imaging studies of aesthetic judgment that suggested the role of visuo-motor and somato-motor resonance in the viewers of artworks.

We hope that this research effort (1) extends our understanding of alternative means to foster contemplation at an individual and collective scale; (2) opens new avenues of investigation in neuroscience; (3) advances the scientific examination of architecture (sacred and otherwise); and (4) provides an empirical foundation for the effects of centuries’ old architectural traditions on human phenomenology.

Julio Bermudez, Ph.D., Associate AIA, is a tenured Associate Professor at the Catholic University of America School of Architecture and Planning where he directs the Cultural Studies and Sacred Space graduate concentration program. He holds a Architect degree from Catholic University in Argentina (1982), a Master's in Architecture (1990) and a Ph.D. in Education (1994) degrees from the University of Minnesota. Prior to joining CUA, Bermudez was a tenured faculty at the University of Utah, Salt Lake City. Bermudez's research focuses in the study of **architectural phenomenology** and the **relationship between architecture, culture and spirituality**. He has lectured, led symposia, and published articles in these areas nationally and internationally. Current projects include a fMRI study of architecturally induced contemplative states at the Utah Brain Institute, the analysis of results from a massive survey on profound experiences of place, and work on a book on the architectural extraordinary. Bermudez co-founded the *Forum for Architecture, Culture and Spirituality* in 2007, an international group dedicated to the investigation of the interactions between buildings, social customs/beliefs, and spirituality. Prior to this work, Dr. Bermudez pioneered the application of architectural concepts and methods to the interdisciplinary design of data environments. This 10 year long effort attracted over \$4.5M in funding, and generated an extensive number of lectures, performances, workshops, and publications in the U.S. and abroad. This work also produced several patents, commercialization contracts, and spin-off companies. Professor Bermudez has received several national and international recognitions including the 1998 AIA Education Honors Award, the 2004-05 ACSA Creative Achievement Award, the 2005 Premio Trayectoria Creativa Arturo Montagu (conferred by SIGraDI, Latin America), t ada

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David Lipschitz, Ph.D. is a Post-doctoral Research Associate in the Department of Anesthesiology's Pain Research Center at the University of Utah. His areas of specialty are **neuroendocrinology and sensory neuroscience**. He is presently supporting several research projects in these areas. Dr. Lipschitz's record include many peer-reviewed publications, experimental design, research logistics support, etc. He holds a BS in Zoology and Genetics (1983), a M.S. (1988) and a PhD in Zoology (1994) from the University of Witwatersrand in Johannesburg, South Africa.

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