REEMA KADRI

MSc DIGITAL DESIGN AND INTERACTIVE BUILT ENVIRONMENTS

INITIAL THESIS PROPOSAL

TITLE:

NEUROSCIENCE IN ARCHITECTURE; *AN EXPERIMENTAL APPROACH TO PSYCHOPHYSICAL ANALYSIS THROUGH AFFECTIVE DESIGN AND INTERACTIVE BUILT ENVIRONMENTS*

BACKGROUND:

Relatively little research has been done in regards to designing for human well-being based on quantified or parameterized qualitative data of the human mind. John P. Eberhard's "Architecture and the Brain; A New Knowledge Base from Neuroscience," and Stefan Wermter, Jim Austin, and David Willshaw's "Emergent Neural Computational Architectures Based on Neuroscience: Towards Neuroscience-Inspired Computing," pioneer this approach - but generally speaking, we - as architects and designers, continue to rely on intuition, personal experience, and (what John P. Eberhard claims to be) "*merely an empathetic guess*." [1]

PROBLEM STATEMENT

Technological advancements in brain activity mapping, motion sensing, and interactive built environment can potentially revolutionize the approach to design of built environments, and advocate for a new understanding of the optimization of space.

With rapid developments in technology and the consequent sociological paradigm shift taking place, it is urgent the architect rethinks design approach. Active technology is developing, and architecture generally remains static and impassive. While interactive built environments and digital approaches to design are gaining popularity, it is dangerous for the designer to become a 'slave' to technology, and shift to what could potentially be a revolutionary phenomenon in the architecture world - without first establishing a reliable and accurate foundation of understanding of human needs - both psychologically and physiologically.

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[1] [http://www.biourbanism.org/applying-neuroscience-to-architecture/]

In a world where users seek spatial parameters beyond the physical, and are arguably losing touch with consciousness of their physical and mental well-being, parallel to rapid technological developments, a new approach to designing for humans is an strong area of interest of mine. Designers generally struggle with understanding human psychological and physiological data, as much of it is perceived qualitative. Neuroscience coupled with digital technology could help quantify this, and as a result break grounds in the architect's approach to design and the optimization or adaptability of spaces in accordance to human needs and well-being.

> *"While we gnaw away at understanding the elements of consciousness, we may produce some clarity that eventually enables us to incorporate human experiences of architectural settings directly into the neural networks of designers. This would be a multifaceted design process, built on a foundation of new knowledge and resulting in a much richer and more satisfactory context for our lives. Designers will be consciously able to understand what is, today, merely an empathetic guess,"*
> **John P. Eberhard [2]**

In order to reach a consensus on designing for human health and well-being, research through experimentation design is essential. To maximize the potentials of understanding the human through space, it is fundamental to introduce sufficient dynamism of space through interactivity - both in ideated space, and that of the virtual.

This paper will explore psychological and physiological effects of space on the human through the design of a space of prototypical nature, incorporating affective design through computation, virtual reality, and interactive built environments.

AIMS AND OBJECTIVES:

The aims and objectives of this design-based research are:

1. To design a prototypical space that would aid neuroscientists, architects, designers, and the like, in understanding the human based on perception
2. To establish guides to designing interactive spaces for human health and well-being

METHODOLOGY:

1. Research of psychology and neuroscience in relation to perception of space through:
   a. Books
   b. Case Studies
   c. With input from my personal observations and experiences
2. Research and analysis of previous studies and experiments

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[2] [http://www.biourbanism.org/applying-neuroscience-to-architecture/]

3. Design prototype of space that would aid in the understanding of the human by exploring:
    a. Affective Design (through Computational Design)
    b. Interactivity of space (virtually and physically)
    c. Ways interactivity could be realized in ideated space
    d. Methods of human-reaction data recording (psychologically and physically)
4. Propose applications and explore implications of this prototype; to explore the ways this could improve the understanding the optimization of space

BIBLIOGRAPHY AND SOURCES:

1. "Architect's Brain: Neuroscience, Creativity, and Architecture," Harry Francis Mallgrave
2. "Architecture as Medicine: — the Importance of Architecture for Treatment Outcomes in Psychiatry," Lena From, Stefan Lundin
3. "Brain Landscape: The Coexistence of Neuroscience and Architecture" - John P. Eberhard
4. "Cognitive Neuroscience of Human Systems: Work and Everyday Life," Chris Forsythe, Huafei Liao, Michael Christopher
5. "Contagious Architecture: Computation, Aesthetics, and Space," Luciana Parisi
6. "Does the Built Environment Influence Physical Activity: Committee on Physical Activity, Health, Transport," Transportation Research Board, Institute of Medicine (of the National Academies)
7. "Emergent Neural Computational Architectures Based on Neuroscience: Towards Neuroscience-Inspired Computing," Stefan Wermter, Jim Austin, David Willshaw
8. International Society of Biourbanism [http://www.biourbanism.org/applying-neuroscience-to-architecture/]
9. ANFA (Academy for Neuroscience for Architecture) [http://www.anfarch.org/]
10. Koninklijke Philips (a.k.a. "Philips" -Electronic Company)
11. Works by "Isabella Pasqualini":
    [http://people.epfl.ch/isabella.pasqualini/publications?lang=en&cvlang=en]
    ""Seeing" and "Feeling" Architecture: How Bodily Self-Consciousness Alters Architectonic Experience and Affects the Perception of Interiors"
    "The Riddle of Style Changes in the Visual Arts After Interference with the Right Brain"

LIST OF PREFERRED SUPERVISORS:

1. Dr. Mark Meagher, Dr. Michael Phiri
2. Dr. Tsung Hsien or Dr. Chengzhi Peng - depending on interest in topic

Note: I still may change my topic, as this is not final. I feel the need to consult you about my areas of interest and what possible topics I may choose. The proposed topic is more

theoretical, but I would like to think about the topic further to accommodate for a design-based research. Some possible topics or areas of interest of mine include (in order of preference):

1. ***Transformable Surface Design; Exploring Generative Design in Fabricable and Interactive Contexts;** (output: prototypes of fabricable and transformable surfaces that could accommodate for interactivity of many natures; e.g. facades, interior partitions, furniture, etc...)*

2. ***Ambient Parametric Design; an Exploration of Generative Design Integrative of Experiential Depth***

3. *Fractals, Fibonacci & The Golden Ratio in Generative Design; Seeking Sense, Depth and 'Order' in Seemingly Chaotic Geometries*

   [For these topics **Mr. Wang would be my preferred supervisor]*

4. *Designing Interactive Environments for Health and Well-being: Smart Healing Spaces (and carry on with a design-based thesis for this; outcome: smart healing space prototype)*