Interactive Architecture and BCI: Expanding the Relationship Between Space and User

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I. ABSTRACT

The intersection of interactive architecture and neuroscience expands the discipline of architecture by acknowledging a departure from the traditional notions of space and user. In this emerging context, the user is an active participant. As our world becomes increasingly connected and interactive, communication with our spaces and objects becomes progressively mediated through intelligent devices and interfaces. When considering this dynamic human factor, technology increasingly blurs the limits of the body's territory. The emerging field of sensorial spatial design explores how we can alternatively experience and potentially communicate with our environment. This paper explores the roles of Brain Computing Interfaces (BCI) and interactive architecture through an interdisciplinary research collaboration between the fields of Architecture, Neuroscience, and Dance as well as through ongoing experiments in the authors' interactive architecture seminar.

Brain on Dance is an interdisciplinary collaboration between the University of Houston College of Architecture and the Laboratory for Noninvasive Brain-Machine Interface Systems led by Dr. Jose Contreras-Vidal. This collaboration aimed to create a real-time emotionally responsive environment controlled by a performer's brain activity. Our research team developed a series of algorithms and graphic representations that paired the brain's emotive state with physical movement based on Laban's action efforts. These algorithms and graphic representations were translated to commands that controlled the hue, saturation, and intensity of the stage lighting providing a real-time interactive environment based on the dancer's emotive and physical states. The software developed for this research forms a closed –loop system that allows the audience, performer, and environment to all become participants in the performance. (Fig. 1)

In our interactive architecture seminar, students investigate not only the physical occupation of space but also the physiological occupation of space. (Fig. 2) These conceptually complex, often abstract and intangible, dynamic human relationships are introduced to students through very concrete methods of making at 1:1. (Fig. 3) Our students imagine not only the possibilities of interaction and response, but also design the physical mechanics and the procedural logic of the systems that quantify the behavioral data.

By engaging not only the predominant visual sense, but a user's neural activity, behavior, and experience, these explorations transform architecture into a real-time medium. Exploiting a participant's senses and behavior creates a multilayered experience that evokes time, space, memory and feeling. These projects rely on the performance of the participant and in doing so create new social relationships.

Figure 1 - Brain on Dance – Photograph by Lynn Lane Photography

Figure 2 - Interactive Prototypes - Student Work

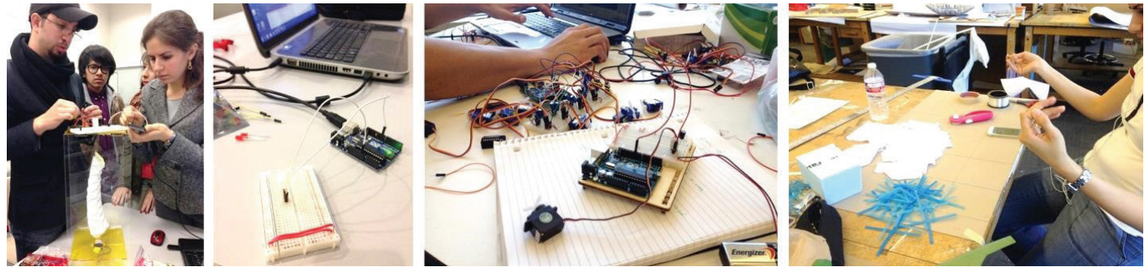

Figure 3 - Interactive Prototypes - Student Work

2. REFERENCES

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