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PRESENTER ABSTRACTS

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Towards User Personalized Environments: An Artistic Exploration Using an EEG-Based Brain-Computer Interface

MIRJANA PRPA
mprpa@sfu.ca
Simon Fraser University, Vancouver, BC, Canada

SVETOZAR MIUCIN[1], BERNHARD E.RIECKE[2],
[1]svetozar_miucin@sfu.ca, [2] ber1 @sfu.ca
Simon Fraser University, Vancouver, BC, Canada

This study in progress consists of virtual-reality-based artistic installation controlled by an EEG headset and evaluates the potential of BCI (brain computer interfaces) devices for use in generative virtual environments, as well as the users' perception of their own influence on these environments. The goal of this study in progress is to explore the design of a 3D computer-simulated virtual environment that directly responds to users' current emotional and cognitive state, and to test to what degree users are aware of their influence on the system. Combining artistic and scientific approaches in this work, we have found that users were able to perceive a differences in the model (the virtual environment projected in physical space) caused by the changes in their inner states. Even though users were not able to precisely describe their feelings, they were able to detect changes in their emotional states and to relate those changes to the changes in our model. We evaluate the possible uses of emotional state tracking in virtual and built environments .

1. EXTENDED ABSTRACT

With the development of low-cost brain – computer interface (BCI) devices, a number of authors suggested (Zander et al.,2011) that BCI devices should be considered as a state tracking tool rather than merely a task processing device (e.g. moving a cube on a screen). Studies conducted so far were focusing mostly on technical aspects (such as accuracy, response time and reliability) of BCI devices when used as game input, on practical implications for people with disabilities, or for real time processing tasks. This study focuses on qualitative aspect of BCI devices in tracking users inner states in creating an immersive ambient art installation.,

As a first prototype and testing platform we designed a virtual environment in Unity3D in form of an art installation. This installation incorporates an EEG-based BCI, and it is placed in a dark room with a video projection displaying a flock of birds. Simulation parameters (number of birds, flying speed and motion type, as well as ambient soundscape) either directly corresponded to the user's current state assessed in real-time by an Emotiv Epoc EEG headset (experimental condition), or were randomly generated (as a control condition).

Participants were drafted from the visitors in the exhibition. A total of 13 participants completed the experiment (8 female). No age limit was established, but mainly the participants were within 18 - 50 years old range with different knowledge backgrounds. Participants were simply asked to "explore the system". The experiment consisted of two conditions: experimental condition (controlled by Emotiv EPOC) and control condition (randomly generated input data); it was executed in two stages. In the first stage the participants were exposed to the model and asked to fill in the affect grid prior to and after the session. The second stage of the experiment consisted of an audio-recorded interview and a questionnaire. Questions were oriented towards finding answers about degree of immersion, system responsiveness, degree of users' influence on the system, as well as towards finding overall impression of the system. Despite lack of any detailed explanation of how the system works, post-experimental interview and questionnaire data confirmed our hypothesis that participants are typically aware of the amount of control they do or do not have over the environment, which directly affected their degree of immersion in the environment. This corroborates the potential of designing BCI-supported interactive environments. The overall impression of the system was positive, and participants reported pleasant feelings and stressed the meditative quality of our system.

Insights gained will help to guide the development towards our long-term goal of creating a truly interactive system that not only reads a user's states but creates a feedback loop between the user's state and the perceived environment that allows us to shift the user's emotional state in the direction that the user desires (e.g., more relaxed or more engaged states). To this end, we will research common principles of expanding environment from virtual to physical, built, spaces and investigate which aspects of a physical or virtual environment are most likely to steer the emotional state in the desired direction.

The long-term goal includes research on how to create, reshape, and adapt surrounding environments

(virtual and real) to make them responsive to the users' presence in that space (e.g., movement, thoughts, feelings, and expressions). We hope to implement our findings into built environments in order to create personalized, state driven architecture that will enable users to interact and explore their inner states, individually and collectively

2. REFERENCES

Zander, T.O., Kothe, C., 2011 J. Neural Eng. 8 025005 doi:10.1088/1741-2560/8/2/025005

3. AUTHOR BIOS

Mirjana Prpa is an architect, a virtual reality utopian and a graduate student - researcher at iSpace lab for Virtual Reality at School of Interactive Arts and Technology, Vancouver, Canada. She received a Master Degree in architecture from the University of Novi Sad, Serbia, and has worked mainly on ephemeral designs for performance art projects including projects for theaters and open public spaces. Her current research is in user personalized spaces that are created based on user's emotional states and traits which are resonating with the environment , both virtual and physical.

Svetozar Miucin is a PhD student in the School of Computing Science at Simon Fraser University. Aside from his main research path, which is currently oriented to improving memory behaviour of complex software systems, he is interested in the places where computing science meets areas like interactive arts, neuroscience and social studies.\

Bernhard E.Riecke: As an assistant professor at the School of Interactive Arts & Technology at SFU and associate member of the SFU cognitive Science Program, Riecke is one of the leading experts on self-motion illusion and how it can be implemented and utilized in immersive Virtual Reality to enable more natural embodied spatial perception, cognition, and behavior. This fundamental knowledge is employed to guide the design of novel, more effective human-computer interfaces and interaction paradigms that enable similarly effective processes in computer-mediated environments (such as virtual reality, immersive gaming, and multimedia). Riecke's scholarship is exemplified by more than 70 peer reviewed papers and book chapters, including four best paper awards (ACM & IEEE conferences) and four invited speaker appearances at international conferences and workshops.