8-10-2023

“VR Who We Are”: Using Immersive Environments in Neuroscience Research

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TREO Talk Paper

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Abstract

Extended reality (XR) technologies have recently gained relevance in the field of medical neuroscience (Bohil et al. 2011). XR environments such as Virtual Reality were initially introduced enhance ecological validity and experimental control in brain research. Further investigation revealed their potential for providing multi-modal stimuli and compatibility with traditional brain neuroscience tools, including functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG). Researchers were motivated to explore immersive environments and reported positive effects on subjects during rehabilitation, diagnosis, and experimentation (Riva et al. 2019). These initial findings have spurred interdisciplinary research in the fields of neuroscience, computer science, human-computer interaction, and information systems.

Our research aims to address the research gap induced through this synergy of disciplines, by developing immersive environments as prototype applications to investigate the following research questions: **How can immersive environments enhance the rehabilitation and diagnosis of neuropsychological disorders?** and **how can immersive environments facilitate multi-modal stimuli and interactions for neuroscience experimentation?** These questions arise from the lack of comprehensive frameworks in the literature for developing such systems. Through this article, we aim to communicate this negation gap and promote future research efforts aimed at answering these questions. The primary target audience for this research includes researchers in the aforementioned fields, medical practitioners, and system developers. The research framework consists of three major components:

1. Development of optimized immersive applications through a combination of literature review and repeated experimentation in a specific context. These prototypes serve as a foundation for exploring different constructs, features, and constraints. The development process can greatly benefit from information system methods, such as design science research.

2. Validation and refinement of research methods, including the use of metrics and scales. These methods involve integrating functional magnetic resonance imaging (fMRI), electroencephalogram (EEG), clinical diagnosis, and rehabilitation practices. Additionally, the exploration of usable attributes of XR hardware, such as eye tracking, is essential.

3. Construction of theories that are relevant to stakeholders and can be tested and refined through continuous experimentation. These theories encompass the effects of utilizing the developed immersive environments, ultimately providing valuable insights into the field of neuroscience research. This requires a multidisciplinary approach.

References

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