

Quantitative Evaluation of Subjective Experience in Virtual Reality*

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Abstract

Virtual reality (VR) is a constantly progressing technology that essentially allows us to temporarily override the sensory input coming from actual reality. But with this, the range of controllable factors influencing subjective experience broadens up. We are in need for new ways of connecting users' reactions back to the content that elicited them. I believe that in addition to directly asking users for their opinions, there is great benefit in analyzing their behavior and physiological responses. The foundation of this work is a review of the evaluation of subjective experiences, with a focus on (1) mental load and (2) sense of presence in VR. In addition to common quantitative measures like heart rate and continuous post-ratings, I propose the use of eye tracking (visual interface to VR) and electromyography (haptic interface to VR). First, an experiment was carried out that utilized eye tracking for identifying mental load during VR. The results indicated different response patterns in eye behaviors and subjective ratings of mental load. Next, an experiment was designed that utilizes the same approach for identifying breaks in presence (BIPs). Presence is a particularly difficult subjective experience to evaluate, and with the definition we use, it is specific to VR. BIPs are anomalies in a VR experience that diminish the user's sense of presence. Finally, the "bipper" framework developed for Unity provides a structured approach to designing BIPs and recording quantitative data. These contributions not only make solid ground for the BIP research branch, but provide a framework general enough to be utilized for evaluating other subjective experiences not handled in this work, for example attention or emotions.

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