Impact of Full-Body Haptic Feedback on the Sense of Presence, Affective Experience, and Game Engagement in a VR Game

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EXTENDED ABSTRACT

Virtual reality (VR) has opened new possibilities in the realm of gaming, giving players new opportunities to reconceptualise the understanding around presence and engagement within the game world. Sense of presence (SoP) is a widely assessed aspect of game experience. Through growing VR implementations, SoP gained prominence due to VR's ability to simulate life-like interactive environments and eventually become the crucial aspect for VR effectiveness and quality (De Paolis and De Luca, 2022). However, it is not always straightforward to achieve a strong SoP due

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to the complex nature of human experiences. Largely, SoP depends on a careful interplay of contextual factors, sensory fidelity, technical adaptability (Witmer and Singer, 1998).

One potential way to develop SoP and overall game engagement in VR is to incorporate haptic feedback (Caroux, 2023). The integration of haptic feedback in VR is becoming popular as it enhances VR experiences, and this is particularly effective in narrative-driven games, where haptics can physically convey tension, impact, and the ambiance of the story, enriching the overall experience. For example, the DualSense controllers on the PlayStation 5s have been taking advantage of haptics through the controller using trigger effects and audio driven vibrations (Kuhail et al., 2024).

Although haptic perception is a fundamental aspect of the human experience and is influential in the SoP in VR game environments (Caroux, 2023), it is historically less prioritised compared to visual and audio modalities, and, thus, still remains understudied. The ability of haptics to contribute towards SoP and game engagement has been explored in VR previously. Most of these studies rely on focused haptic devices such as controllers, gloves (Li et al., 2024), vests (Bourachot et al., 2023), and similar devices which lack full-body immersive haptic feedback experience. In contrast, full-body haptic suits, such as the Teslasuit, offer a more holistic haptic experience, and are still in the early stages of adoption in VR gameplay, hence there is the need for further research.

The aim of this study is to understand the effect of full-body haptic feedback, delivered through a haptic suit, on the player's SoP, affective experience, and game engagement in a narrative-based VR game environment.

Methods

We take the VR narrative game *You Are Being Followed (YABF)* (*Uncommon Chocolate, 2021),* to conduct an experimental user study in which participants play with and without full-body haptic feedback that is provided through *Teslasuits.* The game YABF is an ideal choice for this study because its narrative-driven gameplay centers on psychological tension and emotional engagement, while the game’s atmospheric design and reliance on sensory engagement provide a rich context for examining the impact of full-body haptics on SoP, affective experience and game engagement.

We will adopt a mixed-method approach combining pictorial scales, self-report surveys, psychophysiological measures and short qualitative questionnaire, tapping into the following measures of interest:

SoP In this study, SoP meaning a sense of ’being there’ in the virtual place will be measured by using two surveys. First, a pictorial questionnaire (Weibel et al., 2015) will be embedded within the game and will measure the dimensions of attention allocation, spatial situation model, self-location, possible actions, cognitive involvement, and suspension of disbelief. A second survey, Igroup Presence Questionnaire (IPQ) (Schubert et al., 2001), will measure the dimensions of general sense of presence, spatial presence, involvement, and experienced realism.

Affective Engagement: Major affective dimensions of arousal, valence, and dominance will be measured using the widely used self-assessment manikin (SAM) (Bradley and Lang, 1994); in addition, psychophysiological measures will be used to provide insights indirectly, using player heart rate and heart rate variability (Grassini and Laumann, 2020); eye tracking metrics such as fixation duration and saccades (e.g., Duchowski, 2018; Tabbaa et al., 2022), will be used to provide in-depth insights on cognitive dimensions of the user experience.

Game engagement will be used as a generic indicator of game involvement and will be assessed through a post-experiment Game Engagement Questionnaire (GEQ) (Brockmyer et al., 2009). The GEQ taps into 4 dimensions, i.e. Presence, Flow, Absorption, and Dissociation. At the end of the study, a short post-experiment interview will be adopted to get qualitative feedback on players' game engagement.

To manipulate the desired haptic feedback, we used a framework not only for designing and delivering full-body haptic experiences through the Teslasuit (Elor et al., 2021), but also for selecting the scenes from the game allowing the exploration of the haptic feedback. These experiences included emotional resemblance and body function emulation by pulsating heartbeats depending on the in-game character's emotional state, and representation of environmental stimuli through wind, rain and changes in terrain.

In a within-subject study with approximately 50 participants, two conditions, one with (experimental) and one without (control) haptics will be compared to understand the impact of haptic feedback in relation to three measures of interest, reflected in the hypotheses:

H0 (Null): Haptic feedback has no significant impact on SoP, Affect, or PX.

H1: Haptic feedback increases SoP.

H2: Haptic feedback enhances affective experience

H3: Haptic feedback improves game engagement

Data will be analysed using a mixed-method approach, with – quantitative and qualitative data analysis. Quantitative analysis will include statistical comparisons (e.g., t-tests, ANOVA) between conditions to evaluate differences in SoP, Affect, and PX. Qualitative analysis will be conducted in the form of thematic analysis (Braun and Clarke, 2012) which includes coding of interview responses to identify patterns and insights into user perceptions and experiences.

Potential Implications

This study contributes to the understanding of full-body haptic technologies on the player experience in VR games. Findings will contribute to the growing body of knowledge informing the design of immersive VR environments and explore the potential of full-body haptics to enhance player engagement and experience.

Results are expected to offer developers actionable insights for creating more engaging and immersive VR game experiences. Furthermore, by diversifying sensory input, practitioners can enhance overall human experiences, and also improve accessibility, through the provision of alternative sensory interactions for players with visual or auditory impairments, thus contributing to the broader narrative of social inclusion in gaming.

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