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Onboarding for Immersive VR: Accessibility, user experience and guidelines

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Abstract. Virtual Reality (VR) is a rapidly evolving form of technology that constructs an entirely digital world, within which we can interact with three-dimensional content. This technology has the potential to enable us to rethink learning and teaching, creating new, fully immersive worlds tailored to our individual preferences. User experience of VR as facilitated by onboarding processes has been studied with regards to wider issues of accessibility such as cybersickness, perceptual differences, sensory sensitivity and neurodiversity. However, the focus has been on the efficacy of interventions rather than onboarding processes and VR user experience more generally. We will focus on supplementing existing research and suggesting guidelines for the design and implementation of onboarding processes, with an emphasis on individual user experience and population heterogeneity. With the rapid growth of VR and immersive learning applications in recent years, as well as the importance of remote learning in a post-COVID environment, personalisable and accessible applications of VR are crucial.

Keywords: Virtual Reality, Onboarding, Accessibility.

1 Introduction

Previous definitions of Virtual Reality (VR) in research have been imprecise [6], [19], [20] and are difficult to identify, as both the technology and relevant research encompass a variety of applications. VR can be defined as "*an artificial environment experienced through a variety of senses, which is created by a computer and accessed via a display… with input devices (e.g., controllers)"* [19]. As VR technology is refined, more sophisticated hardware such as Head-Mounted Displays (HMDs) allow for more realistic interactions between users and VR [3], [10], [17]. The potential for immersive learning practices utilizing advanced VR technology is being recognized in recent literature, and it has been shown to increase user enjoyment of learning and develop skills related to visual and spatial learning, knowledge retention and psychomotor skills [1], [2], [10], [25], [28]. It may also surpass practical limits in learning, affording access to geographically

inaccessible areas such as inside the human body, and outer space [4], [10], [15].

However, alongside precise definitions of VR from which research might benefit in the creation of tailored and specific implementations, applications of VR in immersive teaching have been slow to develop. This may be due to a lack of guidelines surrounding practical implementation of educational VR, particularly in multi-user settings [3], which highlights the need for such research. Furthermore, the practical implications of employing VR in education must be considered. Potential limitations to utilizing the technology include cybersickness, excessive cognitive load, hardware limitations, stress and sensory issues

1.1 Accessibility

It is apparent from the literature that the experience of VR is highly personal and influenced by individual differences [9], [10]. Therefore, to effectively examine VR within the context of learning, the emphasis must be on individual user experience. Part of this consideration must be centred on accessibility, so that VR is studied and designed with a diverse population of individuals and their differences in mind. As Mott et al. [16] have correctly pointed out, VR, like any other technology, is designed with *implicit assumptions of use*. That is: an implicit assumption of the capabilities of the user. Often, minority groups might not meet these assumptions, and so run into issues of accessibility. VR is no different, and developing accessibility in VR involves intersectional, multimodal approaches to VR design and implementation, and inclusive design for cognitive, sensory and physical disabilities and differences.

Several key barriers are found to limit accessibility of VR for a diverse population with limited mobility, physical disabilities, vision impairment, hearing impairment, sensory sensitivity, proprioception issues and intellectual disabilities [5], [11], [24], [28]. Some research exists evaluating guidelines to overcome accessibility issues in VR, such as the use of zooming, inverted colours and auto-reading for people with limited mobility and low vision [7], [23] with varying degrees of success.

However, it is still valuable to focus on the barriers to accessibility of mainstream VR technology, and on solutions that could be introduced.

1.2 Onboarding & Guidelines

There is a lack of research surrounding individual user experience and guidelines for onboarding processes to use VR as a therapeutic and educational tool, particularly with regards to diversity of learning experience and population heterogeneity. More focus has previously been on the efficacy of interventions rather than user experience [20]. Focusing on onboarding more generally will allow us to streamline these processes, catering to a more diverse population with an emphasis on individual user experience. Some have already attempted to address the importance of onboarding processes in user experience and accessibility of VR. Škola et al. [21] have studied user experience of VR as facilitated

via onboarding processes. Their study acknowledges that accustomization to VR technology (headsets, controllers and Virtual Environment (VE)) is crucial in improving user experience and learning effects, thus exploring the benefits of effective onboarding practice. Their study also found that levels of engagement, presence and immersion improved overall user experience, lessened events of VR sickness and reduced the cognitive load of the task.

Janßen et al. [9] also highlight the importance of onboarding processes to the subjective experience of VR. They acknowledge that uncertainty regarding the experience influences how willing people are to take part, and how much they enjoy the experience. They equally emphasise how individual differences, such as age and gender, influence the effectiveness of educational VR. Harth et al. [8] also illustrate the impact prior knowledge and individual differences have on the level of immersion experienced by users in VR.

Thus, it becomes imperative to introduce onboarding guidelines in immersive VR learning, as a continuation of research such as that of Škola et al. [21] and Meyer et al. [14], who found that 'pre-training' in VR reduced cognitive load of learning tasks and increased learning efficiency.

2 Conclusion

Given that Virtual Reality is a relatively new research field, the formulation of guidelines around VR use has not yet been completed, especially for specific implementations of VR such as immersive learning. As a result, to maintain the rapid growth of reliable and valid research, it is important to lay out and explore guidelines with respect to the accessibility of immersive learning. Using a person-oriented approach, accounts of subjective user experience, such as perceived barriers to the access of VR, can be examined. With the current COVID-19 pandemic, technologies borne of social isolation and distancing are now used by many. Guidelines for the use of VR in socialising, connection and learning may therefore become more important than ever [16], [18].

Upon reviewing existing literature, we will present our work on how we addressed the gaps concerning appropriate guidelines around the implementation of VR learning practices. In our presentation we will present the set up and proof of concept work on the onboarding procedures for VR. In considering accessibility, neurodiversity, and the importance of multi-user labs, we will suggest an appropriate framework, in the form of onboarding processes, designed to address such questions of accessibility.

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