



Circus Noel: A Case Study into Interaction and Interface Design for Cinematic VR

Mirjam Vosmeer^(✉) and Alyea Sandovar^(✉)

Play and Civic Media, Amsterdam University of Applied Sciences,
Amsterdam, Netherlands

m.s.vosmeer@hva.nl, alyea@tinthue.com

Abstract. In this paper, we present the case study *Circus Noel*, a VR tight rope walking act with which the use of movement in cinematic VR was explored. We use the notion of spatial presence as discussed by Ryan, and its potential to induce an ‘illusion of non-mediation’. Seven users were interviewed about their experience. The results of this case study provide insight into the way a user’s body may be represented in cinematic VR by two moving feet, without disrupting the sense of presence.

1 Introduction

Cinematic VR – referring to VR that is recorded with a 360° camera as opposed to VR that is generated with software - provides the user with a new way to experience interactive entertainment in a cinematic setting. Users may experience a previously unknown feeling of being surrounded by the movie that they are watching. At times, users may even be able to interact with the setting and the characters of the storyline that they are involved in. However, to enable these interactions, producers are still exploring the possibilities of interface and interaction design for cinematic VR. A key concept that is influenced by the quality of these designs is *spatial presence* (Schubert et al. 2001). While the notion of presence has been discussed extensively long before cinematic VR was developed; the kind of presence that this particular medium offers seems to differ from presence experienced in other media (such as movies, books or video games). The sensation of being surrounded by a movie induces a sense of presence that is more physical than emotional. Ryan (2015) has identified this distinction as a ‘technology-induced experience of being surrounded by data’ on one hand and a ‘narrative experience of being imaginatively captivated by a story world’ on the other. However, the physical aspect and the possibility of gazing 360 degrees creates the expectation in users that they should be able to see their own body, use their hands to touch objects or even walk around in the VR environment.

This paper presents a VR project, *Circus Noel* (2017) in which the possibility of movement in cinematic VR was explored. We will discuss the results of a small explorative study. Through the study, we have aimed to collect some further insights into the ways that walking can be integrated in the interface design of a cinematic VR experience.

2 Presence, Movement and Interface Design

The term presence is usually defined as the ‘sense of being there’ (Ryan 2015). It is differentiated from immersion by defining immersion as an objective criterion that refers to the medium itself, in this case a VR movie, while presence is a characteristic of the user experience (Roth 2016). Lombard and Ditton (1997) have described presence as a ‘perceptual illusion of non-mediation’, indicating that in an ideal experience of presence, the user is no longer aware that there is technology involved. In a recent research study, it was also asserted that the two main dimensions of immersion are technical and narrative (Elmezeny et al. 2018), confirming the previously cited descriptions by Ryan (2015). The authors propose that the first category may be influenced by body centered interaction (Slater et al. 1994), while the second is more connected to narrative transportation (Phillips and McQuarrie 2010). The current study is concerned with this technical aspect of immersion, and how body centered interaction may influence the sense of presence, ultimately leading to situation in which the context of technology is indeed temporarily forgotten.

In order to not disrupt the immersive experience that VR offers and thus optimize the ‘illusion of non-mediation’, interface design for VR should be as non-intrusive as possible (Pakkanen et al. 2017). In his paper Gillies (2014) poses this question: *What is Movement Interaction in Virtual Reality for?* He proposes Slater’s (2009) theory of Place Illusion, in which Slater states that the immersive quality of VR depends on the ability of the interactive design to reproduce the same sensorimotor contingencies as the real world. A number of examples exist that show that movement interaction appears to increase the sense of presence in VR (Steinicke et al. 2013). In a study conducted in Usuh et al. 1999 found that walking in a digital environment created a stronger sense of presence than using a joystick. Of course, due to limitations of 1999 technology, the visual aspects of virtual simulations have since improved dramatically. Norman (2010) has stated that in the case of walking in VR, the limitation may be the direction of movement. For instance, the user is only able to walk within the scope of the computers overview.

A recent study by Born and Masuch (2018) closely relates to our current study. Their goal was to understand whether virtual representation (having a body or hands in virtual reality) could increase the experience of presence. Their VR experience requires the user to walk a plank between two islands and conclude that spatial presence was significantly higher for users with full body representation. The authors recommend that in a further study to use a tracking technology that allows a rendering with the same refresh rate as the head movement device. Thus, the body movement would be just as smooth as the hand and head movements. In their analysis of VR interaction paradigms, Pakkanen et al. (2017) had their participants compare three ways of interacting within a 360° video including: hand gesturing, head orientation pointing and remote-control use. It was found that the use of hand gestures was significantly more problematic than the other two types of interaction. This result possibly reflects that hand gestures which are ‘new’ to the users, are therefore more difficult to learn and to remember than the use of a remote control or head pointing.

It is the point of our study to explore how smooth movement in cinematic VR can be embedded in the interface and interaction design for this particular medium and thus increase spatial presence, ultimately leading to an ‘illusion of non-mediation’ (Lombard and Ditton 1997).

3 Case Study: *Circus Noel*

Circus Noel was as a collaborative project between three students, an academic researcher, and two industry partners; a television broadcasting company (AVRO-TROS 2018) and a VR production company (WeMakeVR 2018). It is presented as a virtual tightrope walking act and was developed as a ‘VR companion piece’ to a Dutch national television series for children in December 2017. Although the installation was built with a children’s audience in mind, the VR experience was also successfully presented to adult audiences at Dutch festivals and at demo sessions. The goal of the project was to create a cinematic VR experience that allowed the user to physically walk through a VR scene. The installation differs from previous studies, in that our goal was to develop a smooth walking simulation with filmed footage. The experience is somewhat similar to certain computer-generated VR experiences, such as *The Walk* by Sony (2016) or *Richies’s Plank Experience*, by Toast (2016). The *Circus Noel* VR experience was filmed in an real-life circus with the 360° camera sliding high through the air along a rope. In the VR experience, users can imagine themselves as a tightrope walker who is performing a circus act while fellow circus performers watch and cheer as the mission is accomplished. Producing a VR walking experience filmed with a 360° camera, however, was a technical and conceptual challenge not often undertaken. While it falls beyond the scope of this paper to go into the technical details that made smooth movement in cinematic VR possible, it can be stated that the developers succeeded in creating the right viewing position of the moving user on the rope within 360-degree filmed footage. This includes the right position, to the correct time, and the circus performance in ‘sync’ with the current position of the user on the rope. To give the user a realistic sense of movement a physical installation was build that features a thin bar on the floor, between two platforms. Users wear a HTC Vive headset and HTC Vive trackers that are attached to both ankles.

In the introduction scene, a circus assistant hands the user a pair of shoes, after which the viewer is transported onto a platform high in the circus tent. Looking down, the user can see the circus ring, in which other circus performers are present, and a rope that stretches towards the other side of the tent. The two shoes that were handed over before are seen below, and as the movements of her feet are monitored by the trackers, she can now imagine herself walking high in the air on the rope; while in reality she is walking on a thin bar, just a few centimeters above the ground. The circus setting within the VR experience mimics a real-life experience, but the tightrope as it is shown beneath the user, the two platforms that she walks between and her ‘own’ feet are 3D rendered. To accomplish the blending of the two realities, the filmed material was projected within a sphere using Unity, after which the rope, platform and shoes were added.

4 Study Design and Methodology

A total of 7 adults between the ages of 20 and 39 were interviewed about their experience in this exploratory study. We opted for an open-ended qualitative reflexive approach in which the goal was to understand how to improve the immersive experience of ‘walking in VR’ with filmed footage. Our aim was to gather information on whether the user experience had felt real, how walking in VR felt to the user, and whether the visualization of just two feet was enough to create an immersive experience for users. We wished to understand whether having the two feet (with no body), felt to users like the entire body was involved in the movement.

5 Results and Discussion

To start from the perspective of entertainment, walking in cinematic VR appears to offer an enjoyable and exciting interactive entertainment experience. When users were asked to describe their experience with Circus Noel, their responses mostly seem to reflect Ryan’s (2015) concept of ‘technology-induced experience being surrounded by data’. For example, comments reflect the embodied experience: “I really felt like I was up there.” Another comment described the feelings the experience induced: “I thought it was scary and exciting. When I was walking the bar, I felt like I would fall down because it seemed really high.” In many cases, from the phrases that the users used to describe their rope-walking adventure, it can be deduced that they indeed experienced an ‘illusion of non-mediation’. For instance, if someone is referring to ‘my feet’, or is expressing a fear of falling, or is indeed feeling difficulty to keep their balance, this indicates that they are no longer quite aware of the medium itself. When users were asked about their point of view and level of identification with their ‘avatar feet’, they responded that indeed the movement of their feet in the VR experience and their real feet did correspond one to one: “I felt that I really was walking.”

As Born and Masuch (2018) also assert, the interface design that consists of creating movement by moving your feet – which can be seen as ‘natural feet gestures’ - instead of for instance having to use a controller or learn hand movements (Pakkanen et al. 2017); can help to optimize an immersive entertainment experience. In this particular situation, Norman’s (2010) comments on the fact that walking in VR is limited by the scope of the computers overview is overruled – because of the realistic sense of height that the tightrope walking act provides, users hardly ever wish to step off of the rope. In Circus Noel, users do not seem to miss the representation of their whole body. This is an important result to cinematic VR. Though the industry is growing, it will remain challenging for some time to include a satisfactory image of a user’s own body (primarily as a user’s body cannot be filmed beforehand). The introductory scene in which the circus assistant hands over two shoes, that in the next scene symbolize the users own feet, may indeed have helped to create this illusion.

There were several limitations to this study, the most important being the limited number of participants and the rather non-systematic set-up of our investigations. However, we consider this first study an exploratory project, that will lead to a larger research study. We will systematically explore *spatial presence* and the ways it can be

influenced by physical movement. Our next steps are to gather insights from a group of VR experts through a focus group format, in order to discuss theoretic notions of this specific experiment. Subsequently, we will explore the use of questionnaires such as the IPQ (igroup presence questionnaire) to eventually set up a larger experiment and further investigate isolated elements from this experience. Our goal is to eventually determine which elements influence the sense of presence and their role in the creation of an optimal ‘illusion of non-mediation’ within cinematic VR.

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