Observe or Participate: The Effect of Point-Of-View on Presence and Enjoyment in 360 Degree Movies for Head Mounted Displays

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Abstract. The current study investigated the relationship between the point-of-view (POV) of a 360-degree film for Head Mounted Displays and the level of presence and enjoyment. We created two conditions with a 360-degree movie, with different POVs (actor and observer). Participants from the actor condition scored significantly higher on Spatial Presence compared to participants from the observer condition. However, the expected differences in enjoyment and other subscales of presence between the two conditions were not found. Finally, we provide a recommendation on what POV (actor or observer) is the most presence and enjoyment enhancing.

Keywords: Virtual Reality · Point-of-Views · Presence · Enjoyment · 360-Degree Movies

1 Introduction

Although Virtual Reality as a concept is old, innovative virtual (VR) and augmented reality (AR) technologies and recent industry developments stimulated an increase in VR and AR usage. Several companies made huge investments that received a lot of media attention such as Facebook's $2 billion acquisition of Oculus Rift and investments of Sony (in Playstation VR), HTC and VALVE (in VIVE), Google (in Cardboard and Magic Leap), Samsung (in VR headset) and Microsoft (in HoloLens). Several companies, among which Oculus' Story Studios and 20th Century Fox, already started producing movies and videos for VR devices, expecting unique immersive experiences. Immersion describes the extent to which media are capable of delivering the simulation of reality to the senses of a human participant [1]. Assessing how the viewer perceives the illusion of reality is usually done by measuring the feeling of presence. Presence is defined as the perception of the viewer related to his/her sense of *being present* in a virtual environment and can be operationalized as subjective (rated by the viewer) and objective (rated by observer) presence [1]. Previous research implies that the feeling of presence can be enhanced by VR technology using 360-degree movies in Head Mounted Displays (HMDs) that enable viewers to be completely surrounded by a movie scene [2].

A new question can be raised concerning how to create immersive experiences using VR technology. Virtual reality technology offers new possibilities for moviemakers compared to traditional media (cinema and television) such as user control via free movement of looking around within movie scenes, interaction possibilities and different points-of-views (POVs). In this study we focus on the effect of different POVs, more precisely between an observer and an actor perspective. In the *observer* POV, traditionally used in cinema and television, the viewer experiences the movie from the perspective of an audience member. Being ignored by the actors, the viewer becomes an observer within the movie. The viewer passively observes the actors' interaction and story within the virtual environment. Although it is a passive behaviour, within VR the viewer has the possibility to freely look around within the movie scenes. An *actor* POV is created when the viewer is transported into the perspective of a movie actor. The viewer experiences the movie from the perspective of a character or actor (camera is placed within the actor position).

1.1 Effects of POVs on Presence and Enjoyment

By using an actor POV, the viewer becomes more a part of the environment [3]. As other actors seem to directly talk and interact with the viewer when using an *actor* POV, the viewer might feel more part of the plot and experience more presence within the movie compared to an observer POV. An observer POV means that the viewer is not a character and therefore not part of the plot, which might make a viewer feel less immersed. Several studies suggested that a decrease in distraction and an increase in the level of presence causes the perception of realism and enjoyment of the VR experience when an actor POV is used [2],[4]. However, the aforementioned studies used simulations instead of movies and actors were allowed to interact with the environment where observers would passively observe. There is also the possibility to use an actor POV without interaction. This passive viewing might be more in line with the need of inactively experiencing an entertainment product such as a movie. As most of the previous research focused on *interactive* virtual environment POV's, the current study is designed to gain insight in which of the two POVs (actor versus observer) will increase the feeling of presence and enjoyment the most within *non-interactive* content for virtual environments.

1.2 Aims and Contribution

The current study aimed to explore the effects of POVs on the feeling of presence and level of enjoyment in VR movies, using HMDs. To our knowledge, the results of the present study provide the first evidence in the literature and industry for (VR) moviemakers with recommendations regarding the most effective POV to be used in virtual reality movies based on experience goals. The following research questions were formulated:

RQ1: To what extend does the viewer perceive subjective presence and enjoyment in a virtual environment using a non-interactive movie setting (a 360 degree movie in a HMD)?

RQ2: Does the perceived subjective presence and enjoyment differ when using an actor or observer POV?

2 Method

The experiment took place in 2015 at the NHTV University of Applied Sciences in Breda. All participants were seated in an office chair in order to match the virtual representation of the actor POV in the movie. The turn-able office chair ensured that all participants could easily use head movements and see the movie scenes in 360 degrees. The participants experienced the movie in Unity 5 with the HMD Oculus Rift (DK2) on a Micro-Star International (MSI®) Gaming Series laptop that ran a Windows 8 system, with Sennheiser HD 202 over-ear headphones.

2.1 Design

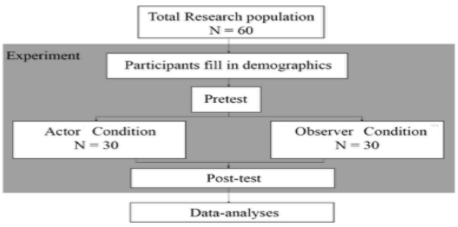
Two POV conditions were created using movies with the same content, yet with different POVs. In the observer POV condition the participant is observing the scene as in traditional movies, whereas in the actor POV condition the participant is observing from the perspective of one of the actors and as such becomes part of the plot (Figure 1). Participants had to fill in the first part of the questionnaire containing background information and mood measurements. Next they were invited to watch the movie after which they filled in the last part of the questionnaire. The total duration of assessment was approximately 30 minutes.

2.2 Participants

Sixty students at NHTV (age 17 to 29 years) were recruited using a convenience sampling method. Participants in the two conditions did not differ on the various background variables such as ethnic background, education, experience with computer games and previous experiences with HMDs. However, more females (67%) participated in the actor condition compared to the observer (37%) condition ($\chi^2(1, N = 60) = 5.41, p < .05$.). The mean age within the

Observer condition was slightly lower: 20 years (SD = 2.21) compared to 22 years (SD = 2.45) ($t(58)= -2.658, p< 0.05$).

Fig.1. Experimental Design and Participant Distribution



2.3 Material

A short virtual reality movie ("The Prism") was created and used in both POV conditions. Much effort was put in creating a good story that did not differ between the two conditions. The movie was focussed around an interrogation scene. A female character (Emma) is being questioned by two police officers. The story is set in an interrogation room of with a one-way mirror. Emma seems to have no clue why she is being questioned and gets all her clues on why she is there from the officers. In the actor condition (Figure 2) the viewer experiences the story from the POV of Emma. In the observer condition (Figure 3) the viewer sees the story from a POV that is positioned to the left of Emma. In this condition the officers and Emma do not acknowledge the viewer.

Fig.2. Actor Condition

Fig.3. Observer Condition

2.4 Measures

SOPI. The Sense Of Presence Inventory [5] was used to measure the level of presence but also included items on background information of the participants. Forty-four items divided across four subscales assessed the level of presence: Spatial Presence (19 items), Engagement (13 items), Naturalness (5 items), and Negative Effects (6 items). Each item was rated on a 5-point Likert scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*).

Enjoyment. Enjoyment is seen as relief from overstimulation (through relaxation) or under stimulation (through arousal). Therefore rather than to simply ask to what extend participants enjoyed a certain experience it is more accurate to let the participants rate their current emotional state and compare it to how they feel after a certain experience. In order to measure the level of enjoyment, a combination between the Positive and Negative Affect Schedule (PANAS) [6] and Pick-A-Mood (PAM) [7] scale was used. The participants had to rate to what extend they were experiencing 4 positive emotions (Excited, Cheerful, Relaxed, Calm) and 4 negative emotions (Tense, Irritated, Sad, Bored) before and after watching the movie. Each item was rated on a 5-point Likert scale, ranging from: 1 *(Very Slightly or Not at All)*, 2 *(A Little)*, 3 *(Moderately)*, 4 *(Quite a Bit)*, 5 *(Extremely)*. In order to measure changes in positive and negative emotions, we compared the results from before and after the movie (subtracting the scores for each of the emotions). We conducted a multivariate analysis of covariance (MANCOVA) to explore differences between two conditions (actor and observer movie) in six dependent variables (Spatial Presence, Engagement, Naturalness, Negative Effects, Change Positive and Negative Aspects) where we included gender and age as covariates.

3 Results

We found difference between the two conditions with regard to Spatial Presence ($F(1) = 2.653$, $p < .001$, $\eta_p^2 = .172$). In line with previous research [1,2], independent T-test revealed that participants in actor condition scored significantly higher on Spatial Presence than participants from observer condition ($t(58) = -3.067$, $p < 0.01$). No other differences between the conditions were found on the other subscales, Engagement ($F(1) = .034$, $p > .001$, $\eta p2 = .003$), Naturalness ($F(1) = .418$, $p > .001$, $\eta p2 = .035$), Negative Effects ($F(1) = 1.693$, $p > .001$, $\eta p2 = .051$), Change Positive Affect ($F(1) = .664$, $p > .001$, $\eta p2 = .027$), and Change Negative Affect ($F(1) = .045$, $p > .001$, $\eta p2 = .002$).

Table 1. Means, Standard Deviations (in Parentheses) per Condition and Effect Sizes of the Differences between the Conditions on Dependent Variables (Results from MANCOVA)

	Actor Condition	Observer Condition	Partial Eta Square (η_p^2)
Spatial Presence	3.37 (.41)	2.99 (.53)	.172***
Engagement	3.71 (.47)	3.68 (.45)	.003
Naturalness	3.57 (.38)	3.81 (.51)	.035
Negative Effects	2.16 (.77)	1.98 (.76)	.051
Changes Positive	-.27 (.77)	-.01 (.48)	.027
Changes Negative	.06 (.55)	.03 (.62)	.002

*** $p < .001$

4 Discussion

The results suggest that virtual reality technology can be used to create immersive experiences regardless of the POVs being used. The actor as well as the observer POV results in positive effects on engagement, presence and naturalness. Although both conditions are suitable to engage viewers, an actor point of view seems to be preferred, as this will increase feelings of spatial presence. An actor POV makes use of the characteristics of a virtual environment that encompasses (or is simulating) a sensitivity and responsiveness to the presence of the viewer (creating an ambient intelligent context). This responsiveness seems to increase the involvement of viewers as active participants in the story. An overwhelming sensory input of a VR environment might activate processes that lead to the perception of being spatially present in the mediated environment [8]. An example of such a sensory input is the experience of being addressed by the characters in a movie and thus being (forced to be) involved in the plot as is suggested by an actor POV.

Additionally, the expected suggestion of interactivity and overwhelming sensory experience may also partly explain the lack of differences between both POV conditions with regard to the remaining variables. On the one hand this has to do with the suggestion of interactivity creating expectancies that cannot be met. As viewers in the actor POV are being looked at and spoken to by actors and as such play a role in the story, viewers might feel inclined to respond and actively participate (as in games). Nevertheless, this is not possible in a non-interactive movie setting, which might have reduced the effect of different POVs on engagement and naturalness. On the other hand, the participants (and viewers in general) have little to no experience with movies in virtual reality and as such the overwhelming sensory virtual reality experience might have been too high in both conditions to find differences (as is partly supported by the relative strong positive effects in both the actor and observer POV conditions). We can also speculate that the participants who use a HMD for the first time are already affected by anticipation and excitement of using a HMD before the experience takes place. Therefore the experience itself has little to no effect on mood and emotions experienced before and after the VR movie experience. Future research should look at effects of POVs on presence and enjoyment for more experienced virtual reality movie viewers. Moreover, the experimental situation might have put viewers in a more active mood, while at home they might have a need for a more passive consumption of movies in virtual environments. Clearly, more experiments are needed to determine the effects of POVs on presence and enjoyment in different contexts and for different types of content.

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