

The Oculus Rift Film Experience: A Case Study on Understanding Films in a Head Mounted Display

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Abstract. The purpose of this research was to determine the level of narrative comprehension in films when watched in a virtual reality headset (Oculus Rift). A 360-degree live-action film was created and was shown to participants after which the level of comprehension of various literary aspects as well as the feeling of distraction and enjoyment were measured using questionnaires and interviews. Revealing how increased freedom to view a movie in virtual reality has an effect on storyline understanding, provided a framework to start a discussion on whether and how to utilize virtual reality as a means for storytelling through films.

Keywords: Oculus rift · Virtual reality · Film · Storytelling · Narrative comprehension

1 Introduction

Films provide a brief escape from reality. They provide distraction, add action, love and fear and in doing so change a person's mood [1]. Films absorb viewers in a storyline in which case viewers might forget time and place. In recent years advanced virtual reality technologies have been developed that might enhance a film experience, shifting feelings from absorption to immersion. Immersion can be described as the "psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli" [2]. Virtual reality (from here on abbreviated as VR) devices, which made use of head-mounted displays, were created as early as the nineteen fifties. A device created by Sutherland and Sproull in 1968, which made use of a stereoscopic display and a mechanical tracking system, is considered as one of the first head-mounted VR devices [3]. However recent progresses related to display improvements, positional tracking possibilities, new interaction options, audio improvements (such as built-in interactive 3D audio) and viewer comfort (lower weight, better ergonomics) increased the attention for using VR as a means to experience a film. A successful example of a head-mounted VR device is the Oculus Rift (OR). The OR was initially created for 3D gaming in 2012 and the company behind OR achieved global success, which is

demonstrated in the \$10 million deal acquired via crowdfunding campaigns and the \$2 billion acquisition deal with Facebook in March 2014. The success is related to being the first to introduce a relative low cost and technologically advanced head-mounted (large field of view) display that created true feelings of immersion without feeling nauseous [4].

Since the introduction of VR and the OR there are ‘believers’ that are looking for possibilities to use VR for films, wanting to utilize the expected advantages of an increased experience. There are however also ‘challengers’ that prefer possibilities in ‘traditional media’, such as cinema, that provide more control over the narrative. Heilig, who created the famous VR device ‘Sensorama’ in 1962, already described in his paper “The cinema of the future” (1955) how film critics were sceptical about new 3D and other VR related developments, as it could have a negative effect on story perception [5]. The same discussion continues today, see for instance online articles by Conditt (2016) and Franklenn-Wallis (2016), leading to the question whether the freedom to look around in a 360-degree virtual world increases a film experience or decreases the experience due to a lack of control and comprehension of how a story unfolds [6, 7].

Despite criticism and scepticism, the OR has gained popularity as a medium for film since the Sundance Film Festival in 2012 [8]. Films for the OR might have started small but quickly received a lot of attention. An important development was the establishment of the new Oculus company called ‘Story Studio’. The main goal of this company is to build truly immersive cinematic experiences and is lead among others by a former Pixar director [4]. The growing interest in VR films is also demonstrated in new investments, such as the \$66 million investment in VR start-up Jaunt by among others The Walt Disney Company. Other examples that reveal a rising attention for VR as a medium for film, relate to an increase in available content (see for instance new VR films shown at the 2016 Sundance film Festival) and available channels that release new VR channels (such as YouTube) or are present in VR environments (such as Netflix and Hulu).

Many small independent companies and enthusiasts came up with an idea for an OR film. More often tips and tricks are shared on how to create a VR movie [9, 10]. However a mere three years ago ‘pioneers’ had no guidelines concerning how to make a film that could engage as well as immerse viewers in VR without losing grip of the story and needed to learn by doing [11]. In the Netherlands the Creative Lab at the NHTV University of Applied Sciences, created one of the first short films for the Oculus Rift called ‘Dyskinetic’. The film allowed the viewer to experience being a helpless coma patient while your family is discussing whether or not they should end your life [12]. The Media Lab Amsterdam, together with the company WeMakeVr, created a live-action movie, which was one of the first interactive films in the Netherlands [13]. Both films were well received. However as the OR (DK1) was only accessible for developers, audience reach was low. The first OR for consumers, with many improvements, however has recently been released (March 28th) which will open doors to a larger audience and will stimulate the creation of more VR films [8].

Creating a story based immersive film in VR is not an easy-to-reach goal and often confusion arises whether content should be regarded as a film or more as a different kind of experience. A horror film created by The Sid Lee Collective for example did

allow viewers to “experience a 360-degree nightmare”. This film however lacks a storyline and might therefore be perceived not as a ‘film’ but an experience.

Films in the OR seem to provide a different viewing experience compared to traditional film viewing. Using the OR seems to reduce the possibilities a director has to guide the audience. It is the viewer who seems in charge of deciding what to look at, where to look and for how long. For this reason, traditional perceptions of and rules for filmmaking cannot simply be applied when using VR technologies. As VR films are relatively new, little research is available on the subject. Hence the need to study what aspects of a film’s storyline could be understood without enforcing the director’s vision on the viewers by making use of traditional film techniques such as restricting the amount of freedom to look in a virtual reality environment.

The objective of this research is to understand the viewers’ experience of a VR film in terms of immersion and comprehension and in how far these effects are determined by the storytelling techniques adopted. In particular, we focused on the storyline to determine what aspects of a film’s storyline can be comprehended in VR and whether viewers find it pleasurable to watch a film in a head mounted display such as the OR. In doing so we provide new insights to be used to answer the question whether or not it is possible to create a story that can easily be comprehended in virtual reality while generating an immersive experience. Insights that will enable further development ideas on how to create a movie in VR and in doing so stimulate future endeavours in VR filmmaking. In order to study the viewers’ experience and understanding of an OR film, a film had to be created that could serve as a case study. A film called ‘The Prism’ (see Sect. 3.3 for a full description) was created specifically for this research and was one of the first of its kind. This film was a detective themed live-action film shot in 360-degrees. The viewer was part of the story having the actors speaking to them and looking at them for guidance, however as this was not an interactive film the viewer could not interact with the actors. The film can be viewed via YouTube (<https://www.youtube.com/watch?v=oIqXdtkFKDg>).

In the next sections we provide a brief outline concerning the challenges of creating a VR film in connection to film comprehension challenges. Next, we discuss how the research was conducted and provide the research results. Finally, we discuss future research recommendations and avenues for creating films in VR.

2 Oculus Rift Filmmaking

Throughout the years, many proposals have been created on how on screen data is converted into a story world and how viewers perceive this. Scholars have identified the most important elements in a film as being script, setting, technology, performance, conflicts, camera shots, style, plot and narration, which combined can be described as the literary aspects of a film [14]. In traditional filmmaking, directors function as narrators and use various techniques to tell the story on screen. They for example use shot sequences, editing and unify functional diegetic time and space to guide the audience’s attention [15]. The abovementioned techniques however are hard to apply to VR films, as they might break that feeling of immersion [9]. When watching a VR film the viewer needs to feel like being part of the film. By editing the film and changing

shot sequences as in traditional filmmaking, the viewer could be ripped out of the current situation and forced to acclimatize themselves to a new surrounding or a new angle which could be confusing as well as disturbing. In a certain sense, the viewer takes over the role of the director within a VR film, as they are able to look around and can determine what they want to look at, when they want to look at it and how (often) they want to look at it. This means they can direct their own attention, instead of having particular items, feelings or people being focused on for them. This provides the viewer with an extra sense of freedom. However it is still unclear whether this freedom has a positive or negative result on the viewing experience. Without having the certainty of the viewer's attention for objects, actors or emotions, important parts of the film can for instance be missed, resulting in a 'reduced experience'. Style, which represents the director's vision and attitude towards the film, is also limited in a VR film. Directors see the style of a film as a way to add value to it by giving the film their own distinct signature through the use of camera shots and editing. But in VR films this is for a large part absent due to the primacy of the viewer. Technical aspects of filming need to be given considerable attention when making a film for the VR. Not only because of the viewer's freedom but also because a 360-degree view means that there is no place to hide. However, script, plot and narration are aspects from traditional filmmaking that should and can still be taken into account when creating a VR film. The assumption behind this is that viewing a film in VR creates a better experience when storyline, or any of the aforementioned narrative elements, are taken into account and kept intact as much as possible. Therefore, comprehension of the narrative elements and storyline is taken as the key focus of the current study when watching a VR film.

3 Method

We were interested in the viewer's understanding of a film when watched in the Oculus Rift (OR). The focus was on the literary aspects of a film, in particular the aspects of characterization, plot and mood. Our hypothesis was that the viewers would be able to recognize and understand the literary aspects of a VR film, despite the lack of story control due to more freedom and possibilities in how to view the film content. The study took place in April 2015 at two different locations. A survey was conducted at the Go Short International Short Film Festival in Nijmegen (Fig. 1). A qualitative research by means of face-to-face interviews was conducted at the NHTV University of Applied



Fig. 1. Participants viewing the film at the Go Short International Film Festival

Sciences in Breda. The literary aspects were examined in the survey as well as the interviews. Whereas the survey identified what literary aspects were understood, the interviews gave an indication to why these aspects were (not) understood. In both locations participants viewed the film while sitting at a table, which mirrored the seating situation in the film (see Sect. 3.3). An Oculus Rift Development Kit 2 was placed on their head with a Sennheiser HD202 over-ear headphone. The film played on a Micro-Star International (MSI®) Gaming Series laptop that ran on Windows 8.

At the Go Short Film Festival, participants were given a multiple-choice questionnaire after they watched the film. The interviews were conducted a week later with a different group of participants. Interviews were conducted a few minutes after viewing the movie.

3.1 Participants

The Oculus Rift is not advised for children under the age of 13 or for any adults who suffer with heart conditions or epilepsy [8]. Sixty-three participants were recruited via convenience sampling and all matched the target group of the film and had never seen the movie before. Thirty-three participants were female, with two thirds of the sample being between the ages of 18–30 years old. All participants were inexperienced VR users. Almost 70 % of the participants had never used a VR device before. Participants that already used a VR device had only experienced this once with an older version of the OR. This high number of inexperienced users was expected because of the newness of the product; no consumer edition of the OR was available and the Development Kit 2 had just been released (in July 2014).

Nine semi-structured interviews were conducted with a separate group of participants between 18–30 years old (five males and four females). After the ninth interview it became apparent that conducting more interviews would not provide the research with any new information and therefore the amount of interviews was considered sufficient. Seven participants had no experience with VR. The remaining participant used the OR a few times before this study was conducted.

3.2 Measurements

A questionnaire was used to understand the participants' comprehension of the storyline. The questionnaire mainly consisted out of five-point Likert scale questions with a few nominal questions to allow participants to choose the answer 'other' and to answer freely. Frequency of distribution was used to determine the overall level of agreement for the descriptive statistics. Themes and patterns were sought throughout the interviews to bring more meaning to the information as well as to explain and support the quantitative data. In order to understand plot comprehension, characterization and mood as specific narrative elements in an OR film, we adopted methods used for traditional film analysis.

Story Comprehension. Several studies have been conducted that measured the comprehension of film narratives and images all having a different focus. Bordwell

discussed measurements of narration in fiction film [16], Turtola focused on the literary, theatrical and cinematic approaches within drama comprehension [17] and Branigan discussed narrative comprehension and film in general [14]. A widely accepted way to measure the level of plot comprehension in films is the three-R scale [18]. The three R's are used as a direct method to access memory, as they measure Recognition, Recall and recognition, with the latter sometimes being replaced by Recounting [19]. Recognition is the quicker and simpler way to access information in the memory, as you can compare information provided now with information you learnt in the past, but all three are important [20]. The three R's combined determine the level of comprehension the viewers had of that particular film [21]. The questions addressing recognition of the storyline are multiple-choice questions in which the participant can read more options and determine which answer they recognize to be correct for the film they watched. For recall and recognition, open questions were used to allow participants to recreate the story in their mind on their own with the information they remember (not recognize). This type of questions allowed participants to recall the main storyline of the film and reconstruct all surrounding parts to make up the whole story. By having the participants recognize, recall and reconstruct the storyline after watching the film in the OR, comprehension of the storyline could be assessed.

Characterization Comprehension. Whereas the three R's are specifically suited for plot analysis and comprehension, there is no agreed upon scale to distinctively measure how viewers understand characterization in a film. Characterization is described as a way for the writer to reveal the personality of a character. The mnemonic device of STEAL (Table 1) is frequently used to explore characterization in a film as it includes all of the aspects of indirect characterization [22].

Table 1. Mnemonic device of STEAL [22].

Speech	What does the character say? How does the character speak?
Thoughts	What is revealed through the character's private thoughts and feelings?
Effect on others toward the character	What is revealed through the character's effect on other people? How do other characters feel or behave in reaction to the character?
Actions	What does the character do? How does the character behave?
Looks	What does the character look like? How does the character dress?

These aspects of STEAL can be applied to VR film as they rely on the film's storyline and not on the technology showing the film.

Mood Measurements. Finally, to determine the mood of the film, a mood measure grid was used which was inspired by Russell's cognitive structure of affect [23]. Russell's cognitive structure of affect summarizes representations of affect covering the level of pleasure-displeasure and those of arousal-sleep. Different moods from each part of this structure were used to describe the feelings of mood experienced by the participants when watching the OR film.

Interview Topics. The approach used for the mixed method was connecting data, which is when a dataset is analysed and then used to inform the subsequent data collection [24]. Firstly, the quantitative data was analysed, which gave an indication as to which topic needed a higher level of understanding. These topics were then used to create the questions for the qualitative data. Participants were asked to reconstruct the storyline. The interviews allowed the participants to go back and forth through the film’s storyline, recalling the overall storyline in order to be able to answer elaborately [14]. The participants were given neutral questions such as “What can you tell me about the characters in the film?” which were formulated in such way to not influence or persuade the interviewee [25]. By not mentioning a specific character it was up to the participant to recall the characters they saw in the film and reconstruct the story surrounding that character.

Frequency of distribution was used to determine the overall level of agreement for the descriptive statistics. Themes and patterns were sought throughout the interviews to bring more meaning to the information as well as to explain and support the quantitative data.

3.3 Material

The film that was created for the research was called ‘The Prism’ (Fig. 2). The film was created to entertain as well as to make it possible to measure comprehension of specific literary aspects of the film. The film was shot with four Canon 5D cameras, on which fish eye lenses were attached allowing for a full 360-degree coverage. The film lasted 7 min in which the viewer was given numerous cues about why they were sitting in the interrogation room and what information about the crime to investigate was known.



Fig. 2. Screenshot from ‘The Prism’ showing the point-of view of the viewer

The story was about a police interrogation. The viewer (participant) experienced the film from the perspective (viewpoint) of the police officer (the interrogator) in the storyline and was being spoken to by police officer ‘Winters’ and by the interrogatee ‘Emma Garner’. The story was set in an interrogation room with a one-way mirror with the police officer (the viewer) as well as the interrogatee sitting at a table. Information was spread out on the table in front of the police officer to give the viewer more clues about the storyline.

The characters Emma Garner and a second officer were present in the room and were speaking to the viewer as if the viewer was the other interrogator. Additionally, a second officer (Bell), who was sitting behind the one-way mirror and therefore not visible to the viewer, spoke to officer Winters and the viewer via a headpiece and in doing so provided the viewer with more information on the case. The two-sided conversation, headset information and visual clues allowed the viewer to understand the literary aspects.

4 Results

The usage of the newest OR version helped to create a positive experience: 94 % of the participants and almost all interviewees did not suffer with any health problems whilst watching the film. For those that had some complaints, this was related to dizziness or eyestrain problems. The film was perceived positively with just under 90 % admitting to enjoying watching a film in the Oculus Rift and over 90 % of both samples agreeing to expecting a future for films in head mounted displays. Over 60 % of the participants felt that being able to look around during a film felt like a distraction, however the interviews made clear that the feeling of distraction was also due to the newness of the product/experience. Many participants mentioned that as this was their first encounter with the Oculus Rift they were more interested in the features of the display than in what was actually being shown. In addition only a weak correlation was found ($r = -0.29$) for the enjoyment of watching the OR between first-time users and users who had used the Oculus Rift before. Both equally enjoyed the experience. The interviews revealed that even for the more experienced users VR still felt new (especially the DK2) and that they never experienced a film in VR before.

Characterization of the interviewee Emma Garner and officer Winters. Descriptive statistics were used in the questionnaire relative to the questions formulated by using the mnemonic device of STEAL. When watching the film in the Oculus Rift the participants frequently mentioned body language and the fact that they were evidently reading the body language of the people in their surroundings. They also mentioned the feeling of empathy towards the characters as the participants felt part of the story with the characters pleading for their help. Finally, the feeling of intimidation bestowed upon by the police officer as he circled around the participants and got in their personal space was also frequently mentioned, a fact that is not possible with regular film.

More than 60 % of the participants correctly acknowledged that the police officer was not experienced nor in charge of the interrogation and more than 80 % correctly read Emma Garner's body language and tone of voice as saying she was insecure and losing control.

Plot. Simple nominal questions were used to confirm whether the participants could recognize and recall factors of the film's storyline. The distribution of responses were analysed showing that for each statement over 65 % of the participants selected the correct answer, therefore confirming they understood the plot of the story. One of the facts mentioned on numerous occasions in the film was the brother and sister

relationship between the interviewee and the suspect. However, surprisingly, 14 % claimed to have no clue about this relationship proving that the Oculus Rift did distract some participants a lot more than others. Readable facts placed on the table in front of the participant were noted by nearly all. However, they could not be read easily, limiting the amount of small details possible for films. The participants of both the questionnaires and interviews confirmed that they received most information from audible clues. Overall the participants comprehended the film's plot correctly. However some of the smaller details were overlooked or overheard. The participants were able to recall and reconstruct the film's plot when asked about what happened. They also experienced no difficulties in describing what happened prior to the beginning of the film moving back and forth through the film's story [14].

Conflict. Most participants understood the conflicts in the film: 81 % of the participants understood that the internal struggle of betrayal and protection was a reoccurring theme. Participants inferred these themes mainly using visible cues 'reading' the interaction between the police officer and the interviewee as well as the internal struggle displayed within the characters.

Setting and Mood. Being fully immersed in the setting helped the participant feel part of the film. The feeling of tenseness was recorded by 70 % of the participant. They mentioned in the interviews that this feeling of tenseness was evoked by the storyline and by the aggression the police officer displayed. Being surrounded in an interrogation environment did contribute to the storyline comprehension but did not seem to increase feelings or mood experiences.

Distracting Elements. Besides the literary aspects there were a few noticeable distracting elements, which were frequently mentioned throughout the interviews. Especially the unexpected immersion and point of view was a reoccurring topic in the interviews. Many participants mentioned they felt being part of the film and yet they also mentioned that they felt slightly confused with the point of view of this film, which differed from a regular film. Participants did not expect and are not used to being part of the story in a film, let alone that the characters acknowledge the presence of the viewer. Or as one participant explained: "It took me a while to understand that I was part of the story". Especially as a character was staring at the participant as if waiting for a response, viewers missed the option to interact as if in a game: "It made me feel kind of stupid". This increased the distraction and therefore decreased story comprehension.

5 Discussion and Conclusion

The research showed that viewers liked the experience of a VR film. Although the key features of a VR device do distract the viewer, the overall story comprehension remains intact. When watching a film in the OR participants felt distracted by the freedom the device provided. Being able to look around during the film, even when a character was looking directly at or talking to them was a different viewing experience and added a new feature to film viewing. As such the research showed that important factors of a storyline are missed and this must be taken into account when creating a story in VR.

Although the results make clear that it is a challenge for a director to guide viewers' attention in VR, the difficulty to do so is also related to the unexpected point of view and the newness of the medium. The newness factor created a wow feeling that stimulated the viewing behaviour, which might not reflect the viewing behaviour when more VR movies have been seen. The participants were trying to experience all of the features possible in the OR and were less interested in following the actual storyline. It is to be expected that when the device becomes more accessible the newness will wear off and the viewers will pay more attention to the content instead of the technology and environment context. Once viewers become more experienced in viewing films in VR, they might better understand the intention of a director and feel less inclined to test all movement possibilities. That could also result in viewers noticing more and thus following cues given by the director such as what and where to look at in a specific moment. Even so, increased viewing experience is still no guarantee that a viewer will be looking in the direction the director wishes. The challenge remains to produce a story that fits into the VR world created and takes into account the (higher) need for an experience.

However even though the experience was new and exciting and participants wanted to test what was possible, this did not negatively affect the level of comprehension of the film. The majority of the participants had not been in contact with the OR before, but surprisingly they were still able to comprehend the film's storyline even though they had to get used to the technology whilst watching the film. The participants were able to recognize the characterization and conflict within the film; as well as being able to easily recall factors, which supported their level of comprehension of these aspects [19].

There were several limitations in this research mainly due to the lack of previous research. For this reason research conducted on general films had to be used. However due to the large differences in regular films and 360-degree OR films, not all research could simply be adopted. Due to the lack of pre-existing research it was also difficult to find supporting data. The most challenging part of this research however was the creation of a 360-degree film. Without any guidelines and with timing issues and restrictions, some unexpected effects were stimulated, among which the point-of-view used that made viewers want to interact with the characters as if being in a game. However, overall the results provided positive insights into films for the OR and indications on how to achieve better results, which is very insightful for future research. Elements, which were not comprehended as much, were mood and setting. It became apparent in the interviews that these elements were not felt sufficiently as they received insufficient attention from the filmmakers. The room was extremely bare and did not project any feeling to the participants. The participants felt as if they were in the room, however there was nothing in the room to give them a certain feeling or mood, which a more exciting genre could have made better use of.

A genre that relies heavily on mood and that could profit from the OR is horror as the genre tries to provoke the feeling of tenseness and scariness in viewers. Especially the use of darkness could benefit in the horror genre as the OR allows for a viewer to look around and search for what might scare them. The question of what happened next in 'the Prism' arose by numerous participants, fuelling their desire to know more, however this desire was only limited. Reason being that the detective genre and storyline lacked tension and an attractive setting to get the viewers excited.

Frequently mentioned in the interviews as well as in personal conversations was the need for more. Participants wanted to interact with their surroundings, picking up items, moving and speaking to the characters, thus showing a preference towards interactive films over non-interactive films for the OR.

More research should be conducted on comprehension of a storyline within the Oculus Rift. The results from this study provided insights into acquiring more adept results from a more detailed and elaborate survey. Films of different genres should be examined and results compared to this current research to provide more insightful information. The film we studied was perceived as very immersive. However any technical issue, such as small editing errors or little glitches would break this feeling of immersion as it would remind the viewer that it was not a real-life experience. It is therefore of high importance that when creating a film for the OR, it is technically of a high quality to minimize distractions and maximize the feeling of immersion.

This research was not about whether VR is a better means than traditional cinema to create a film. With this research we wanted to see whether a film experience could be created that takes into account possible benefits of a more immersed experience as well as possible drawbacks of a decreased comprehension due to less control. Although hard to conclude based on one research using one movie (genre), that has not been optimally created for VR, the results seem to indicate that it is possible to tell stories in VR by means of a film. As such we tend to join the ambassadors and advocate VR to be used for films. VR devices such as the Oculus Rift offer a lot of potentials for the film industry by creating new viewing experiences.

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