



Virtually Empathetic?: Examining the Effects of Virtual Reality Storytelling on Empathy

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Abstract. Virtual reality is gaining attention as a new storytelling tool due to its ability to transport users into alternative realities. The current study investigated whether VR storytelling was a viable intervention for inducing a state of empathy. A short documentary about a prison inmate's solitary confinement experiences, *After Solitary*, was shown to two groups of participants. One group watched the documentary on a commercial VR headset (Oculus Rift) and the other group on a desktop computer via a YouTube 360° video. Results indicated the two groups did not differ in their state empathy levels and in their sense of presence levels. This suggests that watching the documentary in VR was not substantially different from watching it on YouTube with respect to the extent to which an individual empathizes with the emotional experience of another person.

Keywords: VR · Empathy · 360° video · Affective empathy · Cognitive empathy · State empathy · Trait empathy · Immersion · Presence · Inmate rehabilitation

1 Introduction

Over the past few years, we have witnessed the rapid proliferation of commercially available virtual reality (VR) headsets. According to International Data Corporation [1], the market size of VR and augmented reality (AR) technology was 6.1 billion US dollars in 2016. The VR/AR market is also expected to increase to 143.3 billion US dollars by 2020. Similarly, augmented, virtual and mixed reality headset sales have dramatically increased worldwide and are estimated to increase for a few more years [2].

Accordingly, this new form of media has been gaining increasing attention as not just a tool of entertainment, but as a research instrument, too. VR has been utilized in various domains and its applications have been widely used. For instance, it has been used to provide psychotherapy for patients with eating disorders to help them overcome body image distortions [3], to reduce social anxiety symptoms [4], and to induce positive mood changes [5]. Unlike traditional media, when users are in virtual environments (VE), they often experience a sense of being in that environment, or presence [6]. Users often experience the feeling of entering into the virtual environment, and getting “physically situated in another.” [7] This, often hard to distinguish from the concept of immersion, which is a measures “the extent to which the computer displays are capable of delivering an ... illusion of reality to the sense of a human participant.” [6]. Although

a clear definition and distinction between immersion and presences are yet to be well-defined, it is generally accepted that immersion are the necessary for experiencing presence [7], and two are closely intertwined with each other.

1.1 Empathy

One of the main reasons why VR is being increasingly used in research studies is that it affords the ability to transport users into an alternative reality that is different from their actual reality. Whether this transportation involves going to Mount Everest, watching the night stars in one's living room using Google Earth, or turning oneself into a three-legged alien, it allows users to go beyond physical boundaries of the present environment and to step into the realm of experiencing an alternative, virtual realities firsthand. Thus, the immersive nature of VR allows for having users put themselves in someone else's shoes and approach situations from their perspectives. This is one reason why VR experiences are a viable tool for inducing empathy – the ability to experience what others are experiencing. It transforms mere low-level sympathy- the ability to understand, as an abstraction, where another person is coming from into true empathy, experiencing second-hand what the other has felt.

Although there is not a single, commonly agreed-on definition of empathy, it can be defined as an individual's ability to understand and share another individual's feelings [8]. As the definition of empathy indicates, empathy is generally conceptualized as a multidimensional construct containing both sides of the coin: understanding another individual's situation or feelings, referred to as cognitive empathy, and feeling for another individual's emotions, referred to as affective empathy. Shen [9] argues that there is also associative empathy, which is concerned with the extent to which an individual identifies with how another individual feels. This third component is considered as a dimension of empathy by other researchers as well [4, 5]. It is argued that associative empathy serves a social function helping an individual establish social relationships with others [12]. Nonetheless, associative empathy has not been research extensively and is harder to define [9].

When empathy is being examined as a phenomenological construct, a distinction between state and trait empathy is usually highlighted. State empathy is when people experience some emotionally empathetic moments in response to another individuals' feelings. State empathy is situational and specific to its subject and involves "automatic and somatic responses" to another person's feelings [13]. State empathy can be distinguished from trait empathy, which refers to an individual's dispositional tendency to feel empathetic toward others' experiences in general [14]. For example, it is generally considered that women are more likely to demonstrate greater levels of trait empathy, when compared to men.

Due to the immersive nature of virtual environments and situational aspects of empathy, VR technology has been used to prime users to have a change of the heart on certain topics. Specifically, VR was used to help the caretakers of Alzheimer's patients have a better understanding of how it feels to experience dementia [15], to alleviate levels of racial bias by having Caucasian women see themselves in a darker colored skin [16], to induce empathy for those who had experienced war by putting the viewers in a

disaster [17], and to raise awareness on the importance of the preservation of nature by having users grow from a little seed to a full grown tree, just to be cut down by humans [18].

Wijma et al. conducted an experiment in which participants who were primary informal caregivers of an Alzheimer's patient learned more about the disease in a VR environment [15]. In a pre/post-test design, participants watched a 360° simulation video in VR from a first-person perspective putting them in the shoes of a patient suffering from dementia. In one video, participants were immersed in a situation where it was the patient's birthday and everyone was celebrating and having a piece of birthday cake. The patient, however, had no clue why the surrounding people were celebrating and eating the cake. Participants provided self-reports of empathy among other measures. Results indicated positive changes in empathy ratings, demonstrating that the VR intervention helped induce a state of empathy. Participants also reported having a more in-depth understanding of what it is like to experience dementia.

Maister et al. investigated whether inducing ownership over a body avatar of a different race in VR affected implicit racial bias [16]. Participants, composed of Caucasian women, interacted with a body-tracking VR environment in which their virtual body was shown in different skin (dark-skinned, light-skinned, and purple). Results indicated that participants who had a dark-skinned virtual body demonstrated a substantial decrease in implicit racial bias [19], compared to the participants who had a purple virtual body. This study provides further evidence for the notion that VR can lead to state-like changes in an individual's perspective taking ability and thus induce a state of empathy.

The utility of VR as an intervention technology to induce a state of empathy can be empowered and bolstered by the extent to which the VR environment provides an immersive reality and leads to feelings of being psychologically present in the environment. In relation to VR, immersion refers to the objective quality of sensory input, pertaining to the extent to which visual graphics, sounds, haptic feedback, etc. feels real [7]. Presence, on the other hand, refers to the "subjective experience of being in one place or environment, even when one is physically situated in another" [7]. Although Schubert et al. argues that presence and immersion do not have a one-to-one relationship [20], it is commonly considered that sense of presence rises from immersion. Both immersion and presence are key factors in measuring the effectiveness of a VR environment.

Given the potential of VR to enable users to put themselves into others' shoes and the increasing use of VR as a storytelling tool, the current study investigated whether storytelling in VR could induce changes in an individual's empathy level toward a character in a VR environment. Participants watched a documentary, titled *After Solitary* by Frontline, about a former prison inmate's experience in solitary rooms on either a VR headset or a desktop computer. Following the documentary, participants provided self-reported ratings for their empathy level toward the inmate as well as for immersion and presence. The research question guiding the current study and the hypotheses were as follows:

Is VR storytelling a viable intervention for inducing a state of empathy?

- Hypothesis 1: Participants in the VR condition would report greater levels of immersion and presence as measured by self-reported ratings, when compared to those in the desktop condition.
- Hypothesis 2: Participants in the VR condition would report greater levels of state empathy as measured by self-reported ratings, when compared to those in the desktop condition.

2 Method

We used a between-subjects experimental design (VR vs. YouTube 360° video) to eliminate carry over effects from one condition to another. The dependent variables were self-reported sense of presence and state empathy ratings. What follows is a detailed description of the experimental method in terms of participants, materials, and procedure.

2.1 Participants

The sample consisted of 44 students (15 women, 29 men), with an average age of 22.35 ($SD = 3.49$). Participants received extra credit as compensation for their participation. The study was approved by the local human subjects committee.

2.2 Materials

Documentary. As pointed out earlier, the documentary used in this experiment was titled “After Solitary” by Frontline. The documentary is available as both VR documentary and YouTube 360° video [21]. The two versions are identical, except for the medium. Both versions lasted for 10 min. The documentary puts viewers in the shoes of a former prison inmate, Kenny Moore, who had been frequently placed in a solitary room. In the VR documentary, users can interact with the room the inmate was in and experience what prison inmates’ life would be like. In the YouTube version of the same documentary, participants can still explore the room using the computer mouse. YouTube version also supports 360° viewing angle [21].

State Empathy Questionnaire. State empathy was operationalized as the average score on the State Empathy Questionnaire (SEQ), developed by Shen [9]. The SEQ consists of twelve items rated on a 7-point Likert scale. Four items tap into affective empathy, four into cognitive empathy, and four into associative empathy. The combined score in these three categories was used as a measure of state empathy. Higher SEQ scores indicated greater levels of state empathy.

Presence Questionnaire. Sense of presence was operationalized as the average score on the Presence Questionnaire, developed by Witmer and Singer [7]. The PQ consists of twenty four items rated on a seven-point Likert scale to evaluate the level of presence experienced by the respondent. Four items were excluded from the original PQ. The

adapted version consisted of twenty items. The average score on all of the items was used as a measure of presence, with a higher score indicating higher degree of presence.

2.3 Procedure

Participants were randomly assigned into one of the two experimental conditions, VR documentary on Oculus Rift VR headset with no controllers or YouTube 360° video on a desktop computer. Before the experiment the participants completed online questionnaires which included an immersive tendency questionnaire (rated on a seven-point Likert scale), trait empathy questionnaire (rated on a five-point Likert scale), and some demographic questions regarding the individual's prior experience with VR, and political views (5-point scale ranging from very conservative to very liberal, with the option of no opinion). After the completion of the online screening questionnaire, participants were to make an appointment for when they could participate in the experiment. The screening questionnaire was used to ensure that the two groups did not significantly differ from one another in these variables.

Upon arrival in the lab, participants were provided informed consent and were encouraged to ask for clarifications. Then participants were assigned into their randomly selected groups. Both groups received the same set of instructions and in both cases participants put on a headphone to listen to the documentary while watching it. Participants watched the video in a private area and were instructed to inform the experimenter upon finishing the video. Once the video was finished, participants completed the post-experiment questionnaires on the same computer, which also took about 10 min. The post-experiment questionnaires consisted of the state empathy scale, some immersive tendency questionnaire items, and presence questionnaire.

3 Results

An independent samples *t* test was used to test two hypotheses regarding the between-group differences in presence ratings (hypothesis 1) and in state empathy levels (hypothesis 2). The alpha level was set to .05. Table 1 provides a summary of statistical analysis.

Table 1. Summary of statistical analysis

	<i>n</i>	<i>M</i> (<i>SE</i>)	<i>t</i>	<i>df</i>	<i>p</i>
Presence			.083	42	.93
VR headset	22	4.99 (.168)			
360° video	22	4.97 (.142)			
State empathy			-.014	42	.99
VR headset	22	5.04 (.162)			
360° video	22	5.05 (.225)			

In relation to hypothesis 1, results showed that there was no significant main effect of method of watching the documentary on presence ratings, $t(42) = .083$, $p > .05$. Participants who watched the documentary via the YouTube 360° video ($M = 4.97$, $SE = .142$)

and participants who watched the documentary on Oculus Rift ($M = 4.99$, $SE = .168$) did not significantly differ from one another in their self-reported presence levels. See Fig. 1.

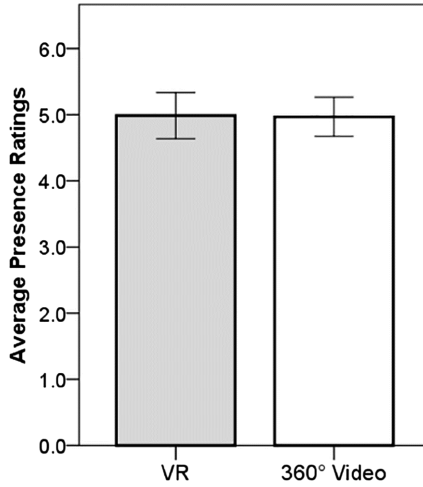


Fig. 1. Bar graph showing average presence ratings as a function of condition.

In relation to hypothesis 2, results showed that there was no significant main effect of method of watching the documentary on state empathy levels, $t(42) = -.014$, $p > .05$. Participants who watched the documentary via the YouTube 360° video ($M = 5.04$, $SE = .162$) and participants who watched the documentary on Oculus Rift ($M = 5.05$, $SE = .225$) did not significantly differ from one another in their self-reported state empathy levels. See Fig. 2.

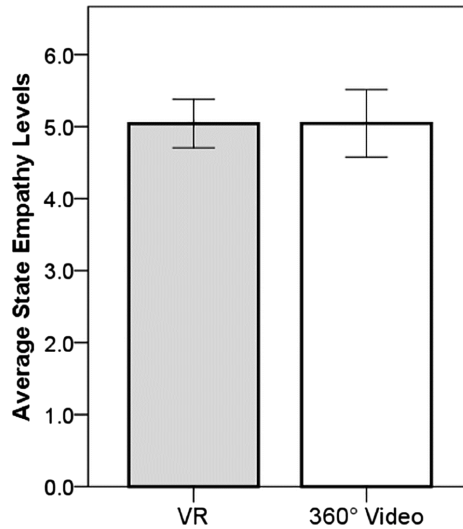


Fig. 2. Bar graph showing average state empathy scores as a function of condition.

4 Discussion

The current study investigated the viability of VR storytelling as an intervention to induce changes in state empathy levels. The results provided no support for the hypothesis that participants in the VR condition would report greater levels of immersion and presence as measured by self-reported ratings, when compared to those in the desktop condition. There was no supporting evidence for the second hypothesis that participants in the VR condition would report greater levels of state empathy as measured by self-reported ratings, when compared to those in the desktop condition. Taken together, these results indicate that the two groups did not differ in their presence and state empathy levels, contrary to prediction. This finding suggests that watching the documentary in VR was not substantially different from watching it on YouTube with respect to the extent to which an individual empathizes with the emotional experience of another person.

The results from the current experiment are contradictory to prior studies providing corroborating evidence for the effectiveness of VR in inducing changes in state empathy [15–17]. That said, the conceptualized mediating effect of sense of presence in a VR environment on state empathy could explain the null findings from the current experiments. Hypothesis 1 was concerned with the differences in sense of presence and was not supported by the data. Thus, the fact that participants did not differ in their sense of presence may explain why they did not differ in their state empathy levels either. This interpretation is in line with prior work on the diegetic effect [21]. Schubert et al. pointed out that sense of presence is not commonly reported in traditional media, except for diegetic effect. It is possible that participants may experience certain emotional changes while interacting with a VR environment, despite being unable to consciously report it

[22]. Hence, it could be argued that participants in the VR condition experienced greater changes in their state empathy at the physiological levels but their perceived sense of presence was similar to that of the YouTube 360° video condition. Since the current study employed no physiological measures, this potential explanation remains as an open question for future research.

One limitation of the current study is related to the content of the documentary that was used in the experiment. As pointed out before, the documentary was about a former prison inmate's experience with solitary confinement. The sensitive nature of the topic and its content may be the reason why the two groups did not differ from one another in state empathy levels. Future studies could address this limitation by employing other documentaries that are less sensitive in nature. Additionally, owing to its complex operational definition, measuring state empathy in VR environments may not be a clear-cut process. Thus, state empathy might be difficult to measure using self-reported measures only, without physiological measures. Future research could attempt to develop physiological measures of state empathy. Also, the current experimental design could be replicated to investigate whether VR storytelling is a viable intervention for inducing changes in other emotions that have an established valid physiological and behavioral measures (e.g., measurement of enjoyment of a comedy show by measuring how much participants laugh or by electrodermal activity).

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