

Facilitating empathy through virtual reality

Nicola S. Schutte¹ · Emma J. Stilianović¹

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Abstract This research experimentally investigated whether virtual reality experience can prompt greater empathy and whether greater engagement with a virtual reality connects this virtual reality experience to empathy. Randomly assigned participants viewed a documentary featuring a young girl living in a refugee camp either in a virtual reality format or in a control two-dimensional format. Results indicated that the virtual reality experience resulted in greater engagement and a higher level of empathy for the refugee girl compared to the control condition. Greater engagement was a process connecting the virtual reality experience to empathy. Virtual reality has the potential to influence interpersonal emotions such as empathy.

Keywords Empathy · Engagement · Virtual reality

Introduction

Empathy consists of the ability to view the world from another person's perspective combined with an emotional reaction to that perspective, including feelings of concern for others (Davis 1983). The perceptual and behavioral processes associated with empathy facilitate group living and are a foundation for beneficial social interactions (Preston and de Waal 2002). A higher level of empathy results in more prosocial behavior, more socially competent behavior, and better social adjustment (Blanke et al. 2016; Eisenberg and Miller 1987). For example, greater empathy is associated with more helping behavior (Pavey et al. 2012). Greater

empathy is an asset in various professions. For example, medical students with higher levels of empathy show greater clinical competence (Ogle et al. 2013). Further, clients have better outcomes when treated by therapists with greater empathy (Moyers et al. 2016).

The use of virtual reality in improving both intra and interpersonal processes has promise (Riva 2005). Areas of application include treatment of anxiety disorders, such as phobias (Anderson et al. 2013; Bissonette et al. 2011), reduction of experience of pain (Hoffman et al. 2000; Morina et al. 2015; Triberti et al. 2014), understanding eating disorders (Gutiérrez-Maldonado et al. 2015; Riva et al. 2008), recovery from stress (Annerstedt et al. 2013), emotion recognition and social cognition training for individuals with autism (Didehbani et al. 2016; Kandalaf et al. 2013), facilitation of helping behavior (Rosenberg et al. 2013), and induction of positive mood in those experiencing pain (Herrero et al. 2014). Virtual reality experiences can influence later real-life functioning. For example, across studies, virtual reality-based phobia exposure therapy results in reduced behavioral phobia symptoms (Morina et al. 2015).

Engagement with a virtual environment influences the impact of virtual reality experience (Schuemie et al. 2001). Engagement, which can be conceptualized as a sense of involvement or connection (Wiebe et al. 2014), may build on a sense of presence. Presence includes sense of involvement and realness of the experience (Diemer et al. 2015), as well as embodiment, which includes features such as perceptual experience of another (Ahn et al. 2013).

Immersive technologies such as virtual reality have different features Cummings and Bailenson (2015). These features include image quality, sound, field of view, tracking of actions of the user and how rapidly the system updates in response to user actions. Features with the most impact

✉ Nicola S. Schutte
nschutte@une.edu.au

¹ University of New England, Armidale, NSW 2351, Australia

are field of view, tracking and update rate Cummings and Bailenson (2015).

A meta-analysis of studies relating self-reported presence with anxiety in response to virtual reality exposure to treat anxiety found greater presence to be associated with more anxiety (Ling et al. 2014). Presence may be a mediator, or process path, between immersion in a virtual reality experience and anxiety induced by situations presented in a virtual reality format (Price and Anderson 2007; Price et al. 2011).

The majority of applications of virtual reality have been in problem-focused clinical areas, such as in the treatment of anxiety (Diemer et al. 2015; Ling et al. 2014; Riva 2005). A few studies have examined the impact of virtual reality experiences on positive characteristics, such as helping (Rosenberg et al. 2013) social cognition and emotion recognition (Didehbani et al. 2016; Kandalaf et al. 2013). The results of these studies suggest that the use of virtual reality to develop or prompt positive interpersonal characteristics has promise.

Empathy is a multi-component positive characteristic consisting of both cognitive and affective components (Davis 1983). Affective aspects of empathy include experiencing another's feeling and having an appropriate emotional response to another person's situation (Batchelder et al. 2017). Cognitive aspects of empathy include understanding another person's perspective and being able to judge and understand the intentions of others.

Empathy and sense of presence may have common features (Nicovich et al. 2005). These features include thoughts and feelings relating to an imagined experience and projection of the self into an environment or the experience of another person. In a study that included measures of trait empathy ability and sense of presence in reaction to a flight simulator experience with interactivity or no interactivity, Nicovich et al. (2005) found that interactivity led to greater presence.

Nicovich et al. (2005) found that degree of presence was associated with general trait empathy. Ahn et al. (2016) found that immersive visual environments that allowed participants to take the perspective of animals led participants to experience more embodiment with the environment and a greater connection between the self and nature compared to the same experience presented in a two dimensional video format. Ahn, et al. (2013) found that the sensory experience of color blindness offered through virtual reality led participants to experience greater feelings of concern for those with color blindness. A sense of presence or engagement may facilitate feelings of connection with others and understanding of others' perspectives. Even though presence and empathy share common features, they are separate concepts, with presence providing a platform for the experience of empathy (Brinck 2017).

Research on the impact of virtual reality immersion on empathy experienced for another individual would increase

information regarding the utility of virtual reality in the realm of interpersonal functioning. The aim of the present pilot research was to examine the impact of virtual reality on engagement and empathy for another person featured in the virtual reality experience. The hypotheses was that presentation of material in a virtual reality format would result in both greater engagement and empathy and that engagement would be a process connecting the impact of presentation of material in a virtual reality format on empathy.

Method

Participants and procedure

After institutional review board approval, 24 university students from Australia provided informed consent and participated in the study. The 14 women and 10 men had a mean age of 19.92 ($SD = 3.46$). Participants were randomly assigned to either a virtual reality presentation condition or a control condition presenting the same material as the virtual reality condition in a two-dimensional format. All participants completed measures of engagement and empathy after the presentation of the material.

A power analysis for a two-group comparison, with power set at 0.8, p set at 0.05, and estimated effect size set at 0.5, indicated that 21 participants would be required to have adequate power. The estimated effect size was based on the effect sizes found in other virtual reality research, such as the meta-analytic effect size across studies on the effect of virtual reality on symptoms associated with psychological disorders Morina et al. (2015) and meta-analytic effect sizes for the impact of immersive technologies on engagement (Cummings and Bailenson 2015).

Material and measures

The eight-minute long United Nations documentary 'Clouds over Sidra' provides a tour of a refugee camp with Sidra, a young girl from Syria, as a guide. Sidra shows her family, her makeshift classroom, as well as other parts of the camp, and talks about her life in the camp and hopes for the future. The virtual reality presentation of the documentary offers 360-degree immersion in the settings featured in the documentary and directed sound corresponding to the view.

Participants in the virtual reality condition wore a virtual reality headset (Samsung) which provided interactive panoramic 360 head-tracking virtual reality with corresponding directed sound to experience the documentary. This virtual reality presentation represents a number of the most important immersive features identified by Cummings and Bailenson (2015), including a wide field of view (360), tracking of user actions and rapid update rate. Participants

in the control condition wore the same type of headset and through the headset viewed and heard the documentary in a two-dimensional format similar to what one would experience on television or film. The two-dimensional format was created by cropping the center frame of a panoramic (non-360) version of the 360 documentary, retaining one-third of the original field of view. Corresponding audio to this field of view remained unchanged. In both conditions participants sat on chairs they could swivel as they wished in the same laboratory room. Thus, all aspects of the presentation aside from the virtual reality features matched as closely as possible across the two conditions.

Seven items adopted from Wiebe et al. (2014) assessed engagement, with each item rated on a 5-point scale on which a high score indicated strong agreement. Representative items include “I was absorbed” and “I lost myself in this experience.” Internal consistency of the scale in the present study was 0.92 as assessed by Chronbach’s alpha. Please see all engagement items in Table 1.

Eight items measuring perspective taking and empathic concern based on Davis (1983) assessed empathy, with each item rated on a 5-point scale on which a high score indicated strong agreement. The modified state-level items referred to the central figure, Sidra, featured in the material. Representative items include “I imagined myself to be in Sidra’s (the 12 year-old girl’s) situation” and “I felt touched by Sidra’s situation.” Internal consistency of the scale was 0.93 as assessed by Chronbach’s alpha. Please see all empathy items in Table 1. Chronbach’s alpha for the 4-item state

perspective taking subscale was 0.86. Chronbach’s alpha for the 4-item empathic concern scale was 0.93.

Results

Men and women did not differ significantly in engagement or empathy, nor was age significantly related to engagement or empathy. The mean engagement score for the entire sample was 27.08 (SD=6.78) and the mean empathy score was 32.13 (SD=7.11). Higher levels of engagement were associated with greater overall experience of empathy, $r(23)=0.84, p=.001$, with the empathic perspective taking subscale, $r(23)=0.86, p=.001$, and with the empathic concern subscale, $r(23)=0.73, p=.001$.

The participants in the virtual reality condition experienced significantly greater engagement than the participants in the control condition, $t(22)=2.21, p=.04$, partial eta squared=0.18 (Table 2). The participants in the virtual reality condition also experienced significantly greater empathy for Sidra, the refugee girl featured in the documentary, than the participants in the control condition, partial eta squared=0.22. Both empathic perspective taking and empathic concern were greater among participants in the virtual reality condition, with $t(22)=2.36, p=.03$, partial eta squared=0.20. and $t(22)=2.34, p=.03$, partial eta squared=0.20 respectively. The effect sizes for all of these comparisons between participants in the virtual reality condition and the control condition are large (Cohen 1992).

A mediation analysis using PROCESS model 4, as recommended by Hayes (2013), examined whether greater engagement induced by the virtual reality condition was a path connecting the virtual reality experience to greater empathy. The indirect effect was 4.61 (SE=2.24), with the bias corrected 95% (lower and upper bound) confidence intervals for the indirect effect at 0.62 and 11.90, and a Sobel test of $z=2.05, p=.04$, indicating significant mediation. Thus, the higher level of engagement experienced in the virtual reality condition was a path to the greater empathy experienced in reaction to this condition.

Table 1 Engagement and empathy items

Engagement
I was absorbed
I blocked out things around me
The time just slipped away
I lost track of the world around me
I was so involved that I lost track of time
During this experience I let myself go
I lost myself in this experience
Empathy
I imagined myself to be in Sidra’s (the 12 year-old girl’s) situation. (EP)
I felt as if I were in Sidra’s shoes. (EP)
I felt touched by Sidra’s situation. (EC)
I felt sorry for Sidra. (EC)
I tried to see things from Sidra’s point of view. (EP)
I felt compassion for Sidra. (EC)
I tried to take the perspective of Sidra. (EP)
I felt protective towards Sidra. (EC)

EP items relating to empathic perspective taking, EC items relating to empathic concern

Table 2 Means and standard deviations for the virtual reality and control conditions

Measure	Virtual reality (N=12)		Control (N=12)	
	Mean	SD	Mean	SD
Engagement	29.92	4.91	24.25	7.39
Total empathy	35.42	4.12	28.83	8.07
Empathic perspective taking	17.00	2.69	13.67	4.08
Empathic concern	18.42	2.07	15.17	4.34

Discussion

Virtual reality experience resulted in greater engagement and a higher level of empathy for an individual featured in the virtual reality material compared to a control condition presenting the same material in a non-virtual reality format. Virtual reality experience led to a higher level of two dimensions of empathy, empathic perspective taking and empathic concern. The effect sizes for the impact of virtual reality on both engagement and empathy were large. Greater engagement, or presence, was associated with higher levels of empathy. Engagement was a process path connecting the virtual reality experience with empathy.

The finding that virtual reality leads to greater engagement replicates findings of previous research on the impact of immersive technologies on sense of presence (Cummings and Bailenson 2015). The large effect size for the impact of the virtual reality incorporating key features of immersive technology used in the present study on engagement confirms the importance of features such as wide field of view (360), tracking of user actions and rapid update rate. The finding that engagement connects virtual reality experience to empathy extends findings regarding the role of presence in connecting virtual reality to anxiety (Diemer et al. 2015; Price and Anderson 2007; Price et al. 2011). Taken together, these findings suggest that greater engagement or sense of presence induced by virtual reality may intensify a variety of emotional and cognitive reactions, including empathy.

The connection between increases in engagement and increases in empathy found in the present study are congruent with the notion that engagement is a foundation for the experience of therapist empathy (Colosimo and Pos 2015; Geller and Porges 2014), and extends this idea to engagement being a factor in the experience of empathy for others in non-therapy settings. However, empathy in a therapeutic environment might have other facets related to the purpose and nature of such an environment. Training studies not utilizing virtual reality have found it is possible to increase empathy (Teding van Berkhout and Malouff 2016). Future empathy training studies might utilize virtual reality to create even more effective empathy training protocols tailored to specific purposes. Such training protocols may be especially useful for those entering professions in which empathy is desirable.

Future research might further investigate the use of virtual reality in building empathy for groups of others with whom there is no direct contact as well as direct contact. The virtual reality material featuring life in a refugee camp is an example of presentation of a group of others with whom participants had no direct contact. A similar study might examine the impact of a virtual reality experience featuring others, such as members of other ethnic groups, with whom participants do have contact. Future research might also

investigate the impact of virtual reality on other characteristics such as effective interpersonal communication, emotion expression, and psychological well-being. Such research might include investigation of the role of engagement in the connection between virtual reality and empathy.

The finding that virtual reality can lead to experience of more empathy adds to previous findings regarding the impact of virtual reality in problem-focused areas such as treatment of anxiety (Riva 2005) and pain reduction (Triberti et al. 2014). The finding that virtual reality can lead to greater experience of empathy is congruent with the findings of Didehban et al. (2016) and Kandalaf et al. (2013) relating to the emotional and social skills benefits of virtual-reality based training for individuals with autism. A variety of individuals and populations may benefit from increases in ability to experience empathy.

Future research might address some of the limitations of the present pilot study. Replication with larger samples from diverse populations and various target individuals for whom empathy would provide information regarding the replicability of the findings and under which conditions virtual reality and engagement may facilitate empathy. Exploration of additional emerging features of virtual reality could help identify the most effective virtual reality presentations.

In conclusion, virtual reality has the potential to increase engagement and through engagement increase characteristics such as empathy. Future research might examine the effectiveness of virtual training to increase various positive interpersonal emotions.

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