Using Virtual Reality to elicit Empathy: a narrative review

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ABSTRACT

Virtual reality (VR) technology is often characterized as "the ultimate empathy machine" as it enables users to experience how it is to be someone else or be somewhere other than where they are in the real physical world. Here, we conducted a narrative review of studies focused on using VR to elicit empathy. Considering the synthesized literature, we identified three contexts where VR systems have been used as a tool to study empathic behavior, namely: 1) to promote pro-environmental behavior; 2) to promote prosocial behavior toward specific social groups (e.g., refugees); and 3) to medical training to promote empathy and more in-depth knowledge of clinical conditions. Based on the data collected VR seems more effective in evoking empathy than traditional approaches such as films/videos, narratives, and curriculum content. Furthermore, it was possible to identify an increase in participants' empathic responses immediately after exposure to VR and up to some period after the intervention (e.g., two months). However, despite the popularity of VR in the study of empathy, the conclusions that can be drawn regarding VR efficacy to promote/elicit empathic behavior are still obscured by the lack of consensual theoretical constructs, the use of a wide variety of self-reported measures, and the incipient use of physiological measures.

KEYWORDS

virtual reality, empathy, 360° immersive virtual environment

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1 INTRODUCTION

Virtual reality (VR) can be defined as an immersive and interactive computer-generated environment that gives users the feeling of being somewhere else other than where they are in the physical world [2]. Through VR, individuals have the feeling of being in a real environment and, potentially, behave accordingly [12]. Thereby, a considerable number of scientific papers have presented claims that VR can be used to elicit empathic behavior, characterizing VR technology as "the ultimate empathy machine" [3]. Empathy is the ability or tendency to share and understand others' thoughts, emotions, and internal states. Although there is no widely accepted definition of empathy, there is a consensus regarding its multidimensional nature. For instance, one of the most used theoretical models is the one that conceives empathy as encompassing a cognitive component (i.e., the capacity for understanding another person's experience and perspective) and an emotional component (i.e., the ability to share the emotional state of another person) [8]. Furthermore, in the last few years, emotion regulation strategies have shown that empathy with other emotional competencies such as mindfulness, self-compassion, and resilience are predictors of well-being [10]. Recent studies have concluded when empathy declines, distress is a key determinant of it [11]. Furthermore, empathy has been linked to increased well-being, reduced symptoms of burnout, and more meaningful work experiences as in the case of medical workers[14]. This narrative review is a first attempt to map the current state-of-the-art on VR to study empathic behavior since, to the best of our knowledge, there is no review on this topic without focusing on a specific context (e.g., medical training) or populations (e.g., schizophrenia).

2 METHODS

We conducted a narrative review of articles that use VR technology to study human empathic responses. Papers were screened independently by two researchers (EK and FFB), and data extraction was performed by one of the co-authors (EK) and checked/complemented by another co-author (FFB).

2.1 Electronic Databases and Search String

For the database search, we used a convenience pool of databases (i.e., the ones that authors are more familiar with). PubMed/MEDLINE

and EBSCO (Psychology and Behavioral Sciences Collection) electronic databases were searched on the 14th of September using the following search string:

((empathy OR ("cognitive empathy") OR ("emotional empathy")) AND (("Virtual Reality") OR (VR)))

However, we plan to increase the number of databases include in the next step of our work which will be conducting a systematic review of VR to study empathy.

2.2 Filters and Eligibility criteria

Whenever possible, electronic searches were restricted to full-text papers published in peer-reviewed journals between 2012 – 2022 in English. Furthermore, in the EBSCO electronic database, papers were searched using the broader search field, while in PubMed/MEDLINE, the search-string was searched using the title/abstract search field. All papers retrieved were assessed against the following inclusion criteria: 1) aimed to study participants' empathic behavior [even if the authors did not directly mention the term empathy]; 2) while or after being exposed to VR. Book chapters, gray literature, and systematic and narrative reviews were excluded. Furthermore, papers were excluded if they recruited exclusively under-age participants (i.e., < 18 years) or did not present standardized measures of empathy (e.g., feasibility studies).

3 RESULTS

A total of 42 papers were retrieved from database searches and exported to the Rayyan QCRI web application [13]. Papers were assessed against the eligibility criteria as depicted in Fig1.

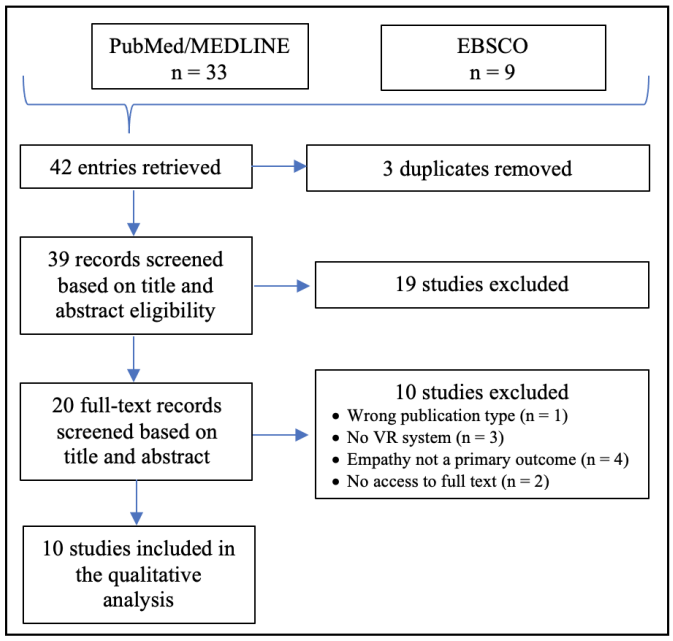

Figure 1: Flow diagram of the studies included

3.1 General characteristics of the studies included

The potential of VR to elicit empathy was analyzed in three different contexts: 1) as a means to promote pro-environmental behaviors, for instance, by increasing donations to protect coral reefs [15]; 2) to promote empathy and more in-depth knowledge of the difficulties faced by patients with dementia in healthcare workers [9] and caregivers [4]; and 3) to promote prosocial behavior by facilitating perspective taking on a peer [1], homeless people [5], refugees [18], victims of sexual harassment [17], or towards people/avatars experiencing pain [16] and pleasure [6][7]. A total of 2061 participants were recruited with sample sizes ranging between 24 [6][18] and 1006 [15] participants, with four studies having recruited more than 100 participants (114 [9], 180 [1], 556 [5], and 1006 [15] participants, respectively). On average, participants were 33.19 +/- 12.75 years [19.91 - 55.1] (mean age), and 56.85% identified themselves as female, with one study only recruiting men [17]. Regarding exposure to VR, sessions took on average 10.18 +/- 5.34 minutes [4.87 - 20] (mean min), with six studies [15][5][7][6][4][18] immersed participants in one session and three immersed participants twice [1][17][16].

3.2 Measures of Empathy and VR features analyzed

With no exceptions, all included papers reported using one [15][9][7][6][4][18] or multi-self-reported questionnaires [1][5][17][16] to measure empathy. Examples of the questionnaires used are the Interpersonal Reactivity Index [5][6], or some of its sub-scales [9][7], the Empathy Scale [17], the Situational Empathy and Perspective Taking Scale [9], the Empathy for Pain Scale [7][6], or adapted items from other empathy scales [4][18]. In addition, three papers also assessed the impact of VR on the feeling of connectedness with others [17][5][1], body transfer [1], attitude towards gender-based violence [17], personal distress, attitudes towards the homeless [5] and social presence [5][16]. Regarding objective measures, four studies used biometric signals, such as galvanic skin response (GSR) [16], and skin conductance reactivity alone (SCR) [7][6] or combined with heart rate (HR) [6]. Also, participants' head position was tracked by a wireless InterSense IS-900 VET system [16] or using an infrared camera (Oculus DK2 IR camera) [5]. Concerning the analysis of which VR/technical components were more effective to elicit empathy, studies compared the impact of 360º immersive virtual environments (IVE) with two-dimensional video/film [15][18], curriculum contents (i.e., workshops [9] or e-courses material [4]), narrative-based perspective taking exercises [5][17] text-based information [15][5]. Other technical features analyzed were the degree of immersion (i.e., 3D versus 2D) [5] and the perspective in which participants experienced the VE (i.e., first-person versus third-person perspective) [7][6]. The majority of the papers immersed participants using head-mounted displays (HMD) [17], some have specified it is Oculus Rift DK2 [5][7][6][4] or HTC Vive [1], but also headsets as Oculus Quest [9], Samsung VR headset [18] or Zeiss VR One Headset [15] were used, and in one study the immersion is achieved by 3D shutter glasses NuVision [16].

3.3 Efficacy of VR to elicit empathy

The impact of VR to elicit empathy seems to be moderated by several factors (e.g., contexts, order of exposure, control condition to which VR is compared, and demographic variables). For instance, two studies reported that 360º IVEs are more effective than (unidirectional) videos/films to promote pro-environmental behavior [15] and empathy toward refugees [18]. In another study, targeting personal distress and empathy toward the homeless [5], no statistical differences were found between 360º IVEs and narrative-based perspective exercises. However, it was possible to identify a long-lasting positive attitude toward the homeless (i.e., two months after the intervention) in the IVEs group but not in the control group [5]. In addition, when analyzing empathy toward victims of sexual harassment, 360º IVEs was as effective as a narrative-based perspective-taking exercise [17]. However, significantly higher scores on empathy were identified when participants were first exposed to the narrative-based perspective-taking exercise after the 360° IVEs rather than before the 360° video [17]. When VR was used as a medical training tool, one study [4] showed that 360º IVEs' are more effective in promoting empathy toward the challenges faced by people with dementia, while in another study, 360º IVEs' impact on medical training and empathy towards patients with dementia were moderated by demographic characteristics, with significant improvements on empathy levels being identified only in older and non-english native speakers participants [9]. Furthermore, higher scores on empathy scales were identified when participants are asked to interact with avatars depicting familiar faces expressed pain compared to unfamiliar avatars [16] or when taking the perspective of an individual they expect later to interact [1]. Finally, in the studies where participants watch/embody people/avatars experiencing pain and pleasure it was found higher feelings of ownership in the first-person perspective compared to the third-person perspective condition [7][6].

4 CONCLUSION

Our review provides an overview of the current state of research concerning the use of VR to study/elicit empathy. As the next step, we plan to upgrade it to a systematic review by surveying more papers and analyzing them more thoroughly. While we find the evidence on the effectiveness of VR in eliciting empathy promising, it is still clouded by the lack of gold-standard instruments to measure empathy. We believe that an important next research step in this domain should be finding how empathy influences physiological attributes and using the sensors as a more objective measure of empathy. Furthermore, VR's impact on empathy seems to be moderated by demographic, methodological and context variables that should be taken into consideration in future studies, too.

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