



Virtual reality and embodied experience induce similar levels of empathy change: Experimental evidence

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ABSTRACT

The theory of psychological proximity implies that individuals should empathize with others more the closer their own experience is to that of the target group. Recent technological developments, namely virtual reality (VR), may help expand our ability to empathize with others by increasing perceived closeness. While some researchers find that virtual reality can elicit empathy, others find mixed results. Building on this previous research, we ask: is virtual reality more effective at eliciting empathy than other empathy-inducing activities, specifically an 'embodied' experience? An embodied experience attempts to recreate the experience of the target group to bring the participant closer to the lived experience of the target. To do this, we use an experimental design to compare different activities hypothesized to increase empathy towards a psychically distant group: 1). a virtual reality experience (being virtually present with a woman who must carry water from a distant source to provide for her family), and 2). an embodied experience (carrying water jugs for 10 min). Our main findings indicate that both treatments were effective at eliciting attitude change for both water issues and for gendered water issues. VR was not appreciably better at eliciting empathy or donations compared to an embodied experience.

1. Introduction

It is cognitively challenging work to set aside one's own perspective and lifetime of experience in order to imagine life as another. Thus, achieving a state of empathy, in which an individual is aware of, sensitive to, and/or even vicariously experiencing the thoughts and feelings of another, requires active engagement with a laborious process, and is therefore not a natural, frequent occurrence for cognitively miserly human beings (Fiske & Taylor, 2013). What if there were a technological shortcut to empathy? Virtual reality (VR) systems may be capable of making the experiences of others readily available and the experience less like cognitive and emotional work and more like the passive consumption of television.

The promise of VR as the "ultimate empathy machine" (Milk, 2015) has received much academic attention in recent years (Barbot & Kaufman, 2020; Bevan et al., 2019, pp. 1–12; Bujic et al., 2020; Hassan, 2020; Herrera et al., 2018; Shin, 2018; Schutte and Stilinovic 2017; van Loon et al., 2018). Much of the extant literature supports VR experiences as empathy elicitors, but we contend that much of the results are limited in scope. Specifically, these studies compare VR to traditional media

sources such as print and television. In this study, we instead compare the use of VR to an embodied experience. An embodied experience is simply action taken with one's own body. It contrasts with VR in that it is unmediated by a device or other intervening technology.

We extend the theory of psychological proximity to include VR and embodied experience. The idea of psychological proximity posits that individuals feel closer to, and thus more able to empathize with, groups or individuals they feel like they have more in common with based on similarities in their experiences (Lee et al., 2018; Liviatan et al., 2008; Van Boven et al., 2010). These similarities may be based on spatial proximity to the target group or individual (we both live in Boston; we are both from Sweden) or emotional/cognitive proximity (we are both Christians; we are both lesbians). We hypothesize that VR is closer to an embodied experience (performing an action or being physically put in the context of another's experience) in closing the psychological proximity between the individual and the target group/person than traditional media such as print or television. Using this framework, we test the "ultimate empathy machine" (VR) against a simple embodied experience (carrying water) in eliciting empathy. Our participants were students at an American university, and the target group for their empathy was

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women in other countries who must walk long distances to gather water. We employ a 2×2 experimental research design to contrast the effects of modality on empathy. Some subjects were exposed to a VR experience while others were given an embodied experience. We measured empathy through an empathy survey and real-money donations.

One proponent of VR as an empathy generator is Jeremy Bailenson, the director of Stanford University's Virtual Human Interaction Lab. He has put forth the idea that "we are entering an era that is unprecedented in human history, where you can transform the self and experience anything" (Alsever, 2015). Bailenson and colleagues have simulated everything from walking in a homeless person's shoes as they struggle to meet their daily needs (Asher et al., 2018) to taking a math test as an opposite-gender avatar (Chang et al., 2019). The frequent claim is that VR is uniquely effective in eliciting empathy in its users. However, there is room to doubt that these interventions lead to meaningful change in behavior, such as donations or social action.

However, Bailenson's (2018) previous works argue that VR is not a magic tool for empathy, and the content one displays is crucial for there to be changes in empathy. In fact, he argues that real or embodied experiences should be used to create empathy, and VR should only be used when they meet the DICE criteria—the real experiences should be replaced by VR when they are "Dangerous, Impossible, Counterproductive, or Expensive." Following Bailenson's (2018) reasoning, any VR that represents an experience that can also be modified to create an embodied experience in a lab will not be more effective at inducing empathy.

Nonetheless, there seems to be growing support for and interest in the idea that VR can elicit empathy in its users. For example, the production company Within (formerly VRSE) produced a VR experience with the non-profit Charity: Water with the purpose of more effective fundraising. The organizations claim their VR experience increased giving by donors by over \$2.4 million (Swant, 2016). Both in academia and in popular culture, it seems like VR is gaining traction as a uniquely positioned empathy eliciting technology (Alsever, 2015; Asher et al., 2018; Barbot & Kaufman, 2020; Swant, 2016).

While some researchers find that virtual reality can elicit empathy (Asher et al., 2018; Herrera et al., 2018; Markowitz et al., 2018; van Loon et al., 2018), others have found mixed results (Formosa et al., 2017; Keating, 2017) or urge us to consider when VR is necessary or more useful than a real or embodied experience (Bailenson, 2018). Building on this previous research, we ask: is virtual reality more effective at eliciting empathy than other empathy-inducing activities, specifically an 'embodied' experience? An embodied experience attempts to recreate the experience of the target group to bring the participant closer to the lived experience of the target (Shin, 2018; Freedberg & Gallese, 2007). This experience may be closer to VR in eliciting empathy than traditional media such as print or television since they are closer together on a psychological proximity scale.

The theory of psychological proximity implies that participants should empathize with others more the closer their own experience is to that of the target group (Mittelman & Dow, 2018; Lemley & Volokh, 2017; Swift, 1999; Ryu, 2017; Gerry, 2017). Put differently, individuals may feel closer to a target group depending on what experiences—ranging from engaging in person with the target group to reading an article about the target group—they have (Mittelman & Dow, 2018). Following this logic, having a VR experience should bring a participant much closer to the experience of the target group than reading a news article about the group because of how immersive the VR experience can be. Indeed, there is much empirical evidence to support the claim that VR is more effective than print or television at eliciting empathy (Alsever, 2015; Keating, 2017). However, there are far fewer studies that compare VR to embodied experiences (Shin, 2018). We aim to empirically test the effectiveness of VR in eliciting empathy when compared to an experience closer on the psychological proximity scale. In this experiment, we compare participants who have a VR experience to a group carrying out an embodied experience. We ask which experience will be better at eliciting empathy towards a psychically distant group (women who must

carry water from distant sources to provide for their families) measured multiple ways: through an empathy survey and through donation behaviors. This study asks whether the Water: Charity VR experience that claims to have increased donations by \$2.4 million elicits more empathy and donations in our participants than the embodied action of carrying water jugs for 10 min. The goal of the present study is to situate VR in the construal level theory and psychological proximity and to determine if VR is more effective than a simple embodied experience in eliciting empathy. We hypothesize that both the VR and embodied experience will increase empathy towards the target group, but VR will be more effective than the embodied experience. We hope that this research will add to the conversation concerning VR, empathy, and social action.

In this article, we first review recent empirical research on virtual reality and empathy. Then we elaborate on the theory of psychological proximity and where VR is hypothesized to fit in on a scale of relatability. Following this we explain in detail the research design, report our findings and conclude with directions for future research.

2. Literature review

VR experiences are argued to have unique potential to increase empathy since they can be used to replace the user's normal sensory environment with new perspectives (Milk, 2015). Several previous studies investigate the possibility of a causal link between exposure to a virtual reality experience and increased empathy (Asher et al., 2018; Bailenson, 2018; Markowitz et al., 2018; Herrera et al., 2018; van Loon et al., 2018). Many studies find support for a positive effect of VR exposure. For instance, Formosa et al. (2017) found that exposing subjects to virtually reconstructed schizophrenic symptoms increased their self-reported empathy scores from pretest to posttest. Rosenberg et al. (2013) found that participants could be made more likely to perform a prosocial behavior as a result of a VR manipulation. Specifically, subjects who experienced flying like a superhero in VR were more likely to demonstrate "helping behavior" (i.e. picking up the researcher's dropped pens) than those who experienced flying in a helicopter in VR. Many others have confirmed these findings, showing that VR is effective at increasing empathy (Asher et al., 2018; Bailenson, 2018; Schutte & Stilinović, 2017). These studies suggest a link between VR experiences and increased empathy, supporting the argument that VR may be the 'ultimate empathy machine.'

However, there have been mixed results in the remaining empirical assessments of the impact of virtual reality on empathy (Herrera et al., 2018; Markowitz et al., 2018; van Loon et al., 2018). Markowitz et al. (2018) demonstrated gains in factual knowledge regarding ocean acidification from pre-test to post-test after a VR intervention in which subjects experience an underwater virtual world where climate change increases ocean acidity. However, the evidence regarding how and if subjects change their attitudes toward climate change was inconclusive, and there was no measure for behavior change. Similarly, van Loon et al. (2018) find that virtual reality perspective-taking experiences increased participants likelihood to take their partner's perspective.

Few studies have done comparisons between VR and other modalities. For example, Bujic et al. (2020) find that participants score higher on the Human Rights Questionnaire after an immersive journalism VR experience than participants who received traditional journalism experiences. This is inconsistent with Bailenson's (2018) suggestions that any VR that represents an experience that can be recreated in a lab using an embodied experience will not increase empathy. In contrast, Herrera et al. (2018) using three modes of presentation (print, desktop computer, and VR immersive experience), find that there was no difference from pre-test to post-test in self-reported empathy conditions, which is consistent with Bailenson's (2018) predictions. However, more in line with Bujic et al. (2020), they also find that participants who experienced virtual reality conditions were more likely to sign a petition supporting affordable housing for the homeless than those who had the less immersive treatment. These effects were moderated by how immersed

participants felt in the treatment and did not impact behavior in subsequent economic games. This finding is somewhat inconsistent with Bailenson's (2018) suggestions because the VR increased empathetic behavior more than those who had the less immersive experience.

Further research suggests that it may not be the VR experience itself that elicits empathy, but users' perceptions and expectations of VR (Shin & Biocca, 2018; Shin et al., 2013). Users' perceptions of VR as a medium that encourages empathy induces users' affective affordances while in a VR experience, encouraging users to be more empathetic because they perceived VR as a tool for embodied cognition (Shin, 2017). Furthermore, Shin et al. (2013) use expectation-confirmation theory to show that the cognitive perception of users using VR significantly impacts the cognitive experience they get from a VR experience, suggesting that users' expectations that VR will elicit empathy actually can increase their experience of empathy from the VR experience. This line of research suggests that users' perception of VR is the driver of the relationship between VR and empathy, not the VR experience itself. Furthermore, a recent meta-analysis of more than 43 studies (122 effect sizes) finds that VR increases the emotional empathy of its users, but not their cognitive empathy (Herrera & Konrath, 2019). Thus, while VR may be good at inducing emotional responses, it may not actually allow others to understand the thoughts and feelings of others—which is an especially crucial component when there is social, cultural, or physical distance between parties.

In sum, there seems to be growing support for and interest in the idea that virtual reality can elicit empathy in its users, though the extent of its effectiveness is questionable, as well as its unique ability to elicit empathy especially when feasible alternatives are possible. Due to these mixed results, it is important for more research to be performed on the measurable impact virtual reality experiences have on eliciting empathy and promoting pro-social behavior (such as donating to charity, helping others, or picking up dropped pens). Based on the previous research, there is some reason to believe that a virtual reality intervention might be used to increase empathy toward a marginalized group and that changes in attitudes and intended actions would follow. Further, since much of the extant research compares VR experiences with print or video media, it would be useful to compare the effects of a virtual reality intervention to a more embodied experience to sort out how unique VR may be in eliciting empathy and where it may fall on the psychological proximity scale of relatability, thus beginning to test some of Bailenson's (2018) suggestions on the utility and uniqueness of VR. Therefore, the present experiment directly contrasts the effects of VR and an embodied experience on both self-reported empathy and real-money charitable donations.

3. Theory

Emerging from the VR empathy literature, though never explicitly theorized, is where virtual reality fits on a continuum of empathy-eliciting procedures (Mittelman & Dow, 2018; Lemley & Volokh, 2017; Swift, 1999; Ryu, 2017; Gerry, 2017). We aim to expand this research by making explicit the unstated theory behind claims of VR as the ultimate empathy machine. We situate the VR literature in the established literature of psychological proximity and construal level theory. Namely, given an individual whose empathy we are concerned with and a target group/individual whose lived experience is the target of that empathy, the "closer" a new experience for the individual is to the target's life, the greater the expected change in empathy. This occurs because experiences that the individual perceives as closer in physical or emotional/cognitive proximity take lower levels of construal, in other words less abstraction, to imagine and relate to (Liberman & Trope, 2003; Trope & Liberman, 2010).

Psychological proximity, through the context of construal level theory, assumes that an individual will feel closer, and therefore will have more empathy, for target groups/individuals that they feel are more relatable to themselves (Lee et al., 2018; Liviatan et al., 2008; Van Boven

et al., 2010). Relatability in psychological proximity can take several forms. Two important forms psychological proximity takes are spatial distance (how proximal is the target) and emotional/cognitive distance (how like me is the target). Other forms of psychological proximity exist but are not being tested in the current experiment (temporal distance and hypothetical distance) (Lee et al., 2018). VR's promise is to make spatial distance irrelevant and to collapse emotional/cognitive distance to zero by simulating another's experience as your own. The amount of empathy a person has towards a subject decreases as either their spatial distance or their emotional/cognitive distance from the target increases. At two extremes, there exist one's own experience with no spatial or emotional/cognitive proximity possible and presumably the maximum possible empathy. And at the other, alien experience in both the literal and figurative sense—something so extremely different from one's own life as to be impossible to understand. To put it plainly, the spatial distance component of psychological proximity suggests that it is easier for a person from Wichita, Kansas to relate to other Kansans than to someone from New York City. It would be even more difficult to relate to someone from Mumbai or Nigeria. An individual's physical proximity to the target will have a direct impact on their empathy for the target. Emotional/cognitive distance has a similar diminishing effect on empathy, except instead of physical distance, the distance someone *feels* from the target socially and emotionally is what matters. For example, people are more likely to empathize with someone from their own family, race, religion, sexuality, shared hobby, or their own country than someone from some other outside group. The less familiar a person is with the target socially, the lower their empathy will be.

We theorize that different types of media and experiences, including VR, can elicit different levels of empathy based on where they fall in this relatability space. In Fig. 1, we propose locations for different types of experiences and media in this space. Fig. 1 charts the possible spatial and emotional/cognitive distance from the target group of various common experiences. Following extant literature, we place sharing the same experience as the target as the lowest spatial and cognitive distance and reading print media about the target as the highest distance. We propose that both print media and film media about a target will result in a participant being further socially/emotionally than they would be if they had a VR experience. Correspondingly, previous literature comparing print media to VR experiences has found that VR often elicits more empathy. In this research, we aim to affix embodied action (engaging in an activity, wearing the clothing, or eating the food of a target group for example) to a space relative to VR. The box found in Fig. 1 highlights our research question concerning whether an embodied action or a VR experience will result in greater psychological distance and less empathy.

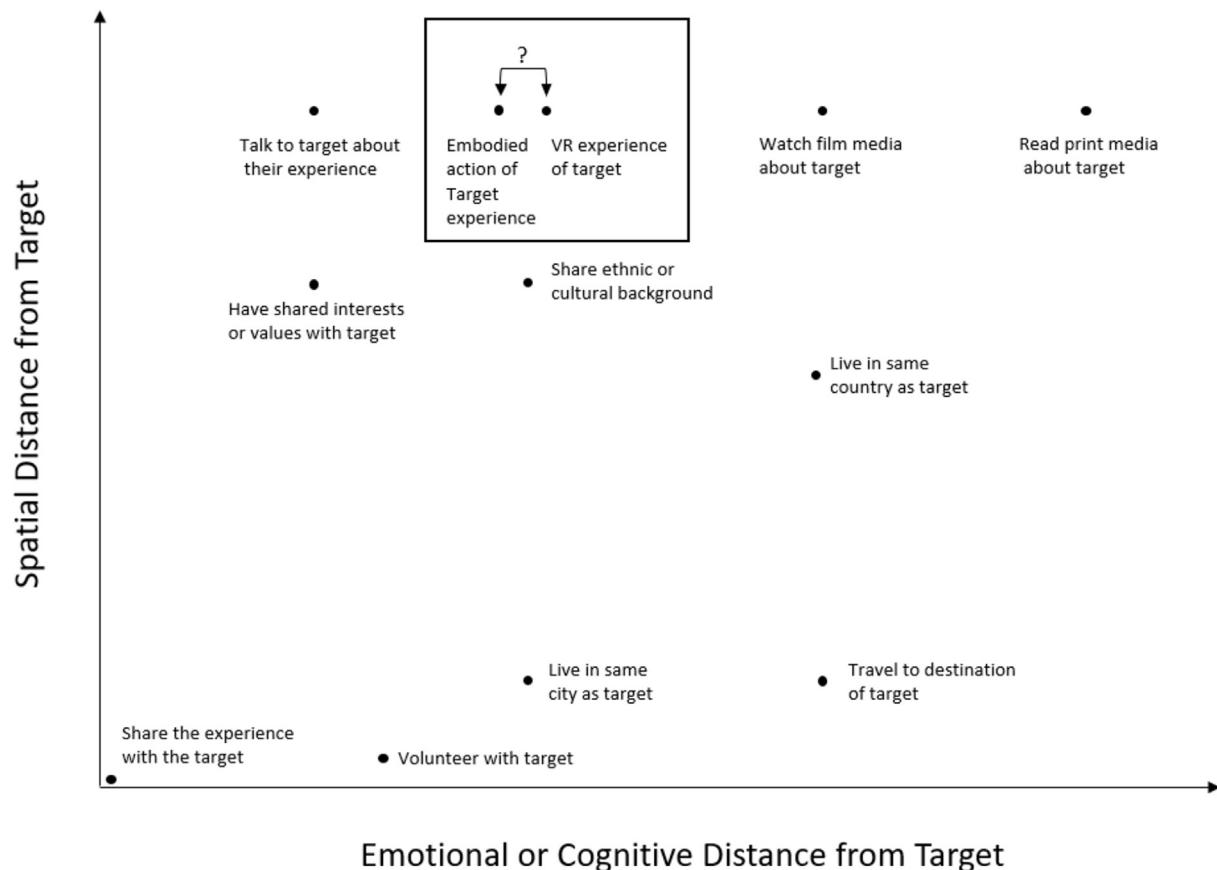
4. Water access

As of 2018, over 750 million people lacked access to a basic drinking water source globally (World Health Organization, 2017). Water is vital to human survival; inadequate and contaminated supplies lead to over half a million deaths per year (Hargrove, 2019). Approximately 10% of global disease is caused by inadequate water supplies, sanitation, and hygiene (Black & King, 2009). Water collection often falls to women and girls, leading to unearned income, missed school, and physical harm through assault and theft during water transit (World Health Organization, 2017). Thus, the burden of water collection reduces the quality of life for women and girls. In sum, alleviating the pressure on women and girls to collect water is linked to improved well-being and life chances (Sommer & Fallon, 2020).

5. Hypotheses

Based on the literature and theory described above, we make the following hypotheses:

Hypothesis 1. Participants that take part in either the VR experience or



Emotional or Cognitive Distance from Target

Fig. 1. Proposed psychological proximity from target group using different experiences.

the embodied activity will have increased directed empathy scores after treatment. (By directed empathy, we mean empathy specifically for the target others.)

Hypothesis 2. Participants in the VR treatment group will experience a *larger increase in empathy than participants in the embodied activity treatment group*. We make this hypothesis in deference to the “VR as ultimate empathy machine” argument. It is the prediction one should make given the assumption that VR drastically decreases psychological proximity.

Hypothesis 3. *Participants in the VR treatment group will donate more to charity than participants in the embodied activity treatment group.* This follows from the above and the additional assumption that greater empathy leads to greater giving.

Method

Design

The current study utilizes an experimental 2 (test timing) \times 2 (stimuli modality) mixed design. Test timing refers to a pretest which precedes the treatment and a posttest which follows. All subjects complete both the pretest and the posttest. Test timing allows all participants to stand in as their own control group. Stimuli modality refers to the treatment participants receive. In the current study, participants were randomly assigned to one of two treatment groups. The first treatment group was given the Charity: Water VR experience and the second treatment group was given an embodied activity.

The Charity: Water VR experience has the participant follow a 13-year-old Ethiopian girl as she collects water and talks about the burden that carrying water has on her life. The experience is 9 min and 4 s and can be found using the following link: <https://youtu.be/nlVlsVfWwS4>. In

the experience, a young Ethiopian girl narrates her experience with water collecting, her responsibility to her family, the dangers of walking a long distance to collect water, the school that she misses out on, and how her life changed after getting a freshwater pump in her village. Charity: Water claims that having their donors experience their VR activity increased their donations by 3 million dollars. Our second treatment, the embodied activity, consists of carrying two one-gallon water jugs through a temperature-controlled building for 10 min. The path that participants walked consisted of hallways and one small open space. The hallways were populated, but not busy. Participants would encounter no more than a few people during their 10 min of carrying the water jugs. The researchers would accompany the participant for the first 2–3 min of water carrying to familiarize them with the path and to provide context for the activity (see [Appendix C](#)). The participants were given several water related facts while they walked, but for the most part were left alone to continue carrying the water jugs. After 10 min, the participants were asked to stop. Scripts for both treatments can be found in [Appendix C](#). These two treatments allow a test for the differential effect of having a VR experience about water carrying as compared to an embodied experience actually carrying water.

The test timing design uses a pretest and posttest format to allow for within group analysis of the effect of the treatment. The pretest and posttests can be found in [Appendix A](#). Pretest and posttest are identical except for all demographic questions are included only in the posttest to avoid any possible priming that these questions may cause. All questions are measured on a five-point Likert scale from “Strongly Disagree” to “Strongly Agree.” Questions are then organized into three categories, water empathy questions (ex. I wish people had better access to water), female or gender related water empathy questions (ex. I worry about what women and girls in other countries go through to get access to water), and water action questions (ex. I always turn off the faucet when I

brush my teeth). Responses from each category are used to create index scores for each participant for both the pretest and the posttest. The difference between pretest and posttest index scores is calculated to generate a change score for each category.

6.2. Participants

Participants were recruited through physical flyers posted in various common areas around a university campus (Appendix B). 100 participants were randomly assigned to one of the two treatments groups taking approximately 20 min per participant. Participants were paid \$10 in cash for participation. All participants were students at the university. Of these participants, 71 identified as female and 28 as male. Participants ranged from 18 to 32 years old with 75% of participants being between 18 and 20.60% of participants were White. All participants were randomly assigned to treatment group.

6.3. Treatment

To empirically test the claims made by Charity: Water that their VR experience was uniquely positioned to elicit more empathy and donations, we use this VR experience as one of our treatment conditions. The VR experience entitled “The Source” was produced by Charity: Water for the purposes of a fundraising and awareness campaign. The experience tells the story of 13-year-old Selam and her struggle to provide water for her family while still attending school. The 8-min experience transports the participant to Ethiopia to show how water is a constant struggle for millions around the world and how a donation can help bring clean and accessible water to families like Selam’s. The designers of “The Source” and other advocates for VR believe that VR is capable of providing a more immersive experience that will elicit greater empathy in viewers than other media (print, video, audio) (Swant, 2016). For comparative purposes we tried to design an experience that we believed may perform equally well to a VR experience using far fewer resources. Therefore, drawing on the psychological proximity literature we designed a water carrying embodied action treatment condition. In this treatment condition participants were asked to carry 2 one-gallon jugs of water for 10 min in an air-conditioned hallway. All participants were given background information and statistics about populations lacking access to water.

6.4. Procedure

Participants were scheduled for appointments at 30-min intervals to allow each to proceed through the protocol individually. Participants were greeted and ushered into a room with only the experiment materials and the experimenters (For a full script of the experiment protocol see Appendix C.). The participant was then seated in front of a tablet and asked to read a consent form on the computer and indicate consent. Following consent, participants responded to the pretest (Appendix A). The pretest gauged participants’ feelings on a panel of questions regarding water access issues, the role women and girls play in water collection, and their own water action behaviors. After the pretest, all participants were read an identical paragraph providing background information and statistics concerning the global water access crisis:

“Thank you for completing the pretest, I will now read you a short prompt that will provide you some context for the subject of today’s experiment. Over 663 million people in the world still lack access to basic drinking water facilities. Lack of access to clean drinking water causes water-borne illnesses, poor sanitation, and leads to millions of deaths per year. The burden of water fetching in these conditions almost always falls on women and girls, limiting women’s career options and often keeping girls out of school. In some regions, women and girls wake up before dawn and walk over 6km (or nearly 4 miles) carrying 6 and a half gallons (or 55 pounds)

of water. Making this situation worse is the fact that this water is often unsafe for human consumption.”

At this point, each participant was given the treatment corresponding to their randomly assigned condition. They were given a prompt explaining what they would be asked to do - either participate in the VR experience or the embodied water carrying activity (see Appendix C). Participants in the VR experience condition were then introduced to the VR set (a smartphone within a Google Cardboard device with a pair of over ear headphones) and instructed to let the experimenter know when they completed the experience. During this period, they were free to turn their heads and bodies to look around within the VR experience ‘The Source.’ Participants in the embodied action condition had their task explained to them in another short prompt and were accompanied by the experimenter for the first 2 min of their 10 min walk to familiarize them with the walking route. Embodied action participants were given regular indications of how much time they have remaining before they should stop.

Following the treatment, all participants were then administered the posttest, which was identical to the pretest except that it included several additional demographic questions. Upon completion of the posttest participants were thanked and handed an envelope containing \$10 (in \$1 bills) as payment and told that they could keep the full amount or any portion thereof, however, if they would like to they could donate any portion of their payment to Charity: Water or Save the Children by putting money into two additional clearly marked envelopes and anonymously dropping them into two large boxes marked with the charity names. Participants were ensured that the money would go to the charity, that all donations were anonymous to the experimenters, and that they were free to keep their full payment if they would like. The experimenter then stepped out of the room and waited for the participant to complete the task of sorting dollars into envelopes and placing them in the appropriate boxes. The experiment concluded when the participant emerged from the room. Finally, the experimenter prompted the participant for questions and concerns, addressed these and thanked the participant for their time and effort.

6.5. Dependent variables

Directed Empathy Change Score. This is the cumulative score of each participant’s responses to the water empathy survey questions. Each question is measured on a 5-point Likert Scale. Responses are coded 1 for least empathetic and 5 for most empathetic. The directed empathy change score measures the cumulative change in empathy for all water empathy scores.

Generalized Female Empathy Change Score. The generalized female empathy change score follows the same procedure as above, but for the female or gender related empathy questions. We ask questions concerning female related empathy questions in this section. This allows us to measure a related, albeit less directly, issue to test for more generalized empathy change.

Charity Donation. After completion of the treatment, all participants were paid \$10 in cash (specifically, ten \$1 bills) in an envelope. Participants were then told that they could keep all of their money and leave or donate to Charity: Water or Save the Children with any portion of the money they were given. The donation dependent variable measures the amount of money, in dollars, donated by each participant. Participants were informed that all donation amounts would be anonymous.

7. Results

As discussed above, the pretest and posttest responses are organized into two categories (water empathy and female or gender related empathy). All responses from these categories were converted into indexes. Participants could donate any number of the ten \$1 bills they were given to Charity: Water or the organization Save the Children. We

interpret these donations as reflecting targeted empathy and general empathy respectively, and larger donations corresponding to greater empathy.

Descriptive statistics for all outcomes can be found in [Table 1](#) below.

Testing Hypothesis 1. Hypothesis 1 stated: *Participants that take part in either the VR experience or the embodied activity will have increased directed empathy scores after treatment.* We performed Wilcoxon matched-pairs sign tests (non-parametric *t*-test) on the pretest and posttest indexes. There is a statistically significant change from pretest to posttest for all three categories for both treatment conditions (see [Table 2](#)). These findings indicate that both the VR condition and the embodied action condition were successful at eliciting empathy change. Subjects reported increased empathy on each scale, no matter the treatment (See [Table 3](#) for average change in each category by treatment.).

Testing Hypothesis 2. Hypothesis 2 stated: *Participants in the VR treatment group will experience a larger increase in empathy than participants in the embodied activity treatment group.* We ran both standard analysis of variance (ANOVA) and the nonparametric Brown-Forsythe *F* test due to violations of the outliers and normality assumptions. We report the results of the Brown-Forsythe tests in [Table 3](#). All results are substantively identical to the standard ANOVA. We find that there is not a clear pattern of significant difference in the empathy scores between treatment groups. In each case, the change scores are higher for the Embodied Action group. However, the difference is statistically reliable in only one case (Water Empathy), and only marginally ($p = 0.046$). The marginally significant result is evidence that the experiment has enough statistical power to detect a 2.8% change in the empathy index. More formally, with 2 groups, 50 observations per group and an alpha value of 0.05, an ANOVA has an 80% chance to not miss an effect of size of $f = 0.28$ where f is expressed in standard deviation units. By the well-known recommendations in Cohen (1988), the current design had sufficient power to detect large (greater than 0.8) and medium (greater than 0.5) effects. A small effect might exist and not appear in the current experiment on 100 subjects due to a Type II error. A conservative interpretation of the results would be that both treatments increase empathy, but neither is notably more effective.

Testing Hypothesis 3. Hypothesis 3 stated: *Participants in the VR treatment group will donate more to charity than participants in the embodied activity treatment group.* Results for Brown-Forsythe tests of difference are reported in [Table 3](#). We find no significant difference in donation behavior between the treatment conditions. In total, our participants donated 37% of their pay to our two charities. In general, the water carrying condition participants donated more than their VR peers (but not significantly higher) (water: \$2.12 vs. \$1.98; children: \$1.90 vs. \$1.56; total: \$4.02 vs \$3.38). Water carriers donated 40.2% of their pay, while VR participants donated 33.8% of their pay. Also, 1/5 of our participants donated ALL of their pay. The discussion of statistical power above applies to this measure as well. In concrete terms, for Total Donations, the experiment was powered to detect a \$1 difference in donation amounts ($f \times SD = 0.28 \times \$3.58 = \$1.00$). The lack of a statistically

Table 1
Descriptive statistics.

Variables	Description	Mean (Std. Dev)	Range
Donation to Charity: Water	Total donations made to Charity: Water by each participant (targeted empathy)	\$2.05 (2.06)	\$0 - 10
Donation to Save the Children	Total donations made to Save the Children by each participant (general empathy)	\$1.73 (\$1.98)	\$0 - 10
Total Donations	Total donations to any charity by each participant	\$3.70 (3.58)	\$0 - 10
Water Empathy Change Score	Change in water empathy index from pre-test to post-test	.065 (.058)	-.125 - .273
Female Empathy Change Score	Change in female empathy index from pre-test to post-test	.080 (.088)	-.139 - .333

Table 2
Wilcoxon matched pairs sign test for three survey index change scores.

	Water Empathy Score	Female Water Empathy Score
Treatment 1: VR experience	4.88***	4.54***
Treatment 2: Embodied Action	6.06***	5.49***

Notes: a) Reported numbers correspond to Wilcoxon z-score b)*** indicates $p < 0.001$.

Table 3
Brown-Forsythe F test between treatment groups.

	Mean Score VR Group	Mean Score Embodied Action Group	f Statistic
Total Dollars Donated	\$3.38	\$4.02	0.796
Charity: Water Dollars Donated	\$1.98	\$2.12	0.114
Save the Children Donated	\$1.56	\$1.90	0.732
Water Empathy Change Score	5.32%	7.64%	4.096 *
Female Empathy Change Score	7.28%	8.78%	0.718

Notes: a) * indicates $p < 0.05$.

significant difference, and the fact that the mean observed donation amounts are in contradiction to the hypothesis cast doubt on [Hypothesis 3](#).

Demographic factors (self-reported gender, age and race) had no significant impact on either empathy or action change scores or on donation amounts.

8. Discussion and conclusion

In sum, our main findings indicate that both of our treatments were effective at eliciting attitude change for both water issues and for gendered water issues. Another finding that stands out from this study is that the water carrying condition participants donated more than their VR peers, but not significantly higher. Together, the results suggest that VR is not appreciably more effective at eliciting empathy and donations compared to an embodied experience.

Our findings are consistent with previous research that finds VR experiences increase empathy ([Asher et al., 2018](#); [Formosa et al., 2017](#); [Herrera et al., 2018](#); [Markowitz et al., 2018](#); [Milk, 2015](#); [Rosenberg et al., 2013](#); [van Loon et al., 2018](#)). Importantly, we also find that an embodied experience meant to represent the same real experience depicted in the VR also significantly increased reported levels of empathy. This somewhat contradicts [Herrera et al. \(2018\)](#) findings and [Bailenson's \(2018\)](#) suggestions that any VR that represents an experience that can be recreated in a lab using an embodied experience should not increase empathy.

However, when we compared the empathy elicited from the VR experience to the embodied experience of carrying water we found no difference in the treatments. Our findings suggest that even an embodied experience, which theoretically should allow closer psychological proximity than reading an article or watching a film, does not elicit more empathy than a VR experience. Thus, our findings diverge from [Bujic et al. \(2020\)](#), which find an immersive journalism VR experience increases empathy in participants more than those who received traditional journalism experiences, but are more in line with [Bailenson's \(2018\)](#) ideas that there is not something unique about VR in eliciting empathy beyond its representation of the subject. Put differently, if both VR and an embodied experience can represent the subject in a laboratory, VR will not do any better at increasing empathy than the embodied experience.

Even if VR is not unique in its ability to elicit empathy, perhaps it may still be better at eliciting behavior - such as donating to a water charity – that might ultimately be more important than the abstract, immaterial *feeling* of empathy. After all, Charity: Water claims that “The Source” helped them raise over \$2.4 million at one fundraiser event. To test the effectiveness of VR or embodied action at eliciting donation behaviors we asked all participants to anonymously donate any portion of their \$10 pay to two charities. First, we asked them if they would like to donate to Charity: Water, the maker of “The Source” to test whether the VR experience or the embodied action were more effective at getting participants to donate. Second, we asked if they would like to donate to an unrelated charity (Save the Children) to determine if the VR experience and the embodied action have spillover undirected empathy effects. We found no evidence VR was especially efficacious either narrowly or generally. Two water jugs produced the same outcome as an elaborate VR production.

Thus, our findings also diverge from [Herrera et al. \(2018\)](#), who find that participants who experienced virtual reality conditions were more likely to sign a petition supporting affordable housing for the homeless than those who had the less immersive treatment, whereas we find that the water carrying condition participants donated more than their VR peers, though not significantly higher. While this result is not significant, future research should consider if this suggests that embodied actions may be stronger in inducing cognitive empathy and VR in emotional empathy, which may explain differences in actionable behaviors post intervention ([Herrera & Konrath, 2019](#)).

Theoretically, being virtually “present” with a woman collecting water and explaining her experience approaches the two important forms of psychological proximity reviewed in the theory section of this article: spatial distance and emotional/cognitive distance. The participant can see the environment of the target and travel with them through the space they occupy, though only virtually. While this experience actually enters the world and allows the participant to essentially “see through the eyes” of the target, the embodied experience, focusing only on emotional/cognitive distance, allows the participant to “walk in the shoes” of the target. Our findings suggest that a VR experience is at the same level as an embodied action of carrying water in terms of psychological proximity, suggesting that the cognitive/emotional component may have greater empathetic outcomes than simulating physical closeness. Put differently, it appears that a VR experience is no better than an embodied experience of carrying water at allowing individuals to perceive themselves as closer to the target, even though VR simulates both physical and emotional/cognitive proximity, while the embodied experience does not address physical closeness at all ([Liberman & Trope, 2003](#); [Trope & Liberman, 2010](#)). Consequently, our findings contribute to theories of psychological proximity, suggesting that focusing on emotional/cognitive distance rather than physical distance may be more effective at increasing relatability.

Practically, our findings suggest that if we want people to relate to others, a VR experience is no better than an embodied experience. For example, if we want people to donate money to important causes like water access, then one does not need an expensive VR production to do so. A few jugs of water and some facts will likely work just fine. Thus, producing expensive productions with novel technological advancements may not provide the extra or added value they are thought to elicit. However, it is also important to think about how these different activities may be experienced in normal life, outside of an experiment. Though popular and new technologies may be interesting or attractive to people, and thus make them more interested in attending a donation event or other venue aimed at helping others, an outrageous activity, like carrying jugs of water, may also help attract participants while also having the added benefit of being cheaper. Additionally, while carrying jugs of water will limit those with various physical limitations, VR is also not accommodating to those prone to motion sickness or those with different

visual capabilities.

What does this say for [Bailenson's \(2018\)](#) DICE criteria for deciding on the necessity of VR? Well, both our tested experiences significantly predicted increases in empathy, just not more for one than the other. Philosophically, does this mean that if we could create an embodied experience in a laboratory that could be compared to a VR experience than the VR would, by definition, not be more effective than the embodied experience because a VR is only going to have a large impact beyond an embodied experience when an embodied experience is not possible in a laboratory? This is more of a logic trap than an assessment of the utility and uniqueness of VR, as it would necessitate there to be no comparison, which then could not be empirically evaluated to determine if the VR was more effective. To avoid these logical fallacies without creating more, let's just consider the point of the comparison in relation to our findings. VR, as an empathy delivery system probably is not a better delivery system than an embodied experience, when possible, so we should think about other delivery systems when possible so we do not use newer technology just for the sake of using it. Advertising an event as having VR may be just as enticing as advertising an event where you have to do something weird like carry jugs of water.

However, the present analysis is not without limitations. First, the VR device used in the present experiment (the Google Cardboard), while being the most accessible of all VR devices, is not the most powerful VR device. The Google Cardboard uses a mobile phone for its screen and has several bugs such as subpar motion tracking and interruptions by texts and calls. At least one of these issues was dealt with by using a cell phone that had no connection to the mobile network. However, future research would benefit by replicating with a more advanced VR unit. The present analysis was limited by funding in this regard.

Future research should continue to explore how virtual reality mediates our ability and propensity to relate to others. Other areas of concern should be incorporated beyond issues of access to water to test the difference between VR and embodied experiences. This presents a challenge of coming up with a comparable embodied action to the area of interest, though can be overcome with some creativity. Moreover, studies should also incorporate a traditional medium in addition to a VR and embodied experience to work out the ordering of traditional mediums, VR experiences, and embodied experiences, as previous research largely supports that VR is more effective at eliciting empathy at traditional mediums of print and film. While more research needs to be done, the mixed results of this study and previous studies indicates the proposition that VR is the ultimate empathy machine seems to be more of an article of faith than a proven fact.

Declaration of competing interest

We have no conflicts of interest to report.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chbr.2020.100038>.

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