

# The Virtual Doppelganger

## Effects of a Virtual Reality Simulator on Perceptions of Schizophrenia

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**Abstract:** Recent scholarship suggests that virtual environments can serve as effective proxies in battling implicit stereotypes. However, existing experimental research has rarely examined the effectiveness of virtual simulations of mental illnesses in inducing empathy to combat stereotypical responses. We report results from a 4-condition, between subjects experiment ( $N = 112$ ), wherein participants were exposed to either a virtual simulation of schizophrenia, a written empathy-set induction of schizophrenia, a combination of both the simulation and written empathy conditions, or a control condition. The results indicated that the virtual simulation + empathy condition induced greater empathy and more positive perceptions toward people suffering from schizophrenia than the control or written empathy-set condition. Interestingly, the simulation-only condition resulted in the greatest desire for social distance whereas not significantly differing on empathy and attitude measures from either the written empathy or simulation + empathy conditions. We discuss the implications of the findings and recommend directions for future research.

**Key Words:** Virtual reality, schizophrenia, simulation, empathy, social distance, technology.

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*Imagine the following scenario: John is in the mall when he is asked to participate in a survey assessing Americans' perceptions of people who suffer from schizophrenia. Like most people, John's worldview is informed by inadequate knowledge and he has no hesitation in (incorrectly) branding people who suffer from schizophrenia as possessing “split or multiple personalities.” He further states that such people are likely to be dangerous with violent streaks, and that he would feel uncomfortable in the presence of such sufferers at his workplace or living in his neighborhood. Finally, when pressed for what are the root causes of schizophrenia, he attributes them to “emotional and spiritual problems.”*

*Now, consider this second scenario: Imagine that John is given the opportunity to experience a day (or even a part of a day) in the life as a schizophrenia patient on a visit to a pharmacy to obtain a prescription medication refill. Now, John finds himself experiencing unfathomable delusions—he sees other consumers in the pharmacy distancing themselves from him and seemingly scurrying for safer ground. When he approaches the pharmacist for the refill, he sees the bottle of medicine turn into poison. All the while, he hears strange and uncontrollable voices in his head, which eventually leads to a feeling of utter helplessness and confusion. Once he is out of this “experience,” John*

*realizes that his schema of people who suffer from schizophrenia was probably inaccurate. If he is asked for his perceptions about people who suffer from schizophrenia now, will his responses be different? Will they reflect greater empathy and more positive attitudes?*

As the aforementioned hypothetical scenario illustrates, ignorance abounds when it comes to the issue of mental health. The statistics are telling—approximately 20% of Americans experience a form of mental illness, with potential ramifications ranging from social ostracism to reduced quality of life (Graves et al., 2005). Such stigmatization is likely to be even greater among those who suffer from severe mental health illnesses, such as schizophrenia (Couture and Penn, 2003). Although research on perceptions of schizophrenia is diverse and extensive (Graves et al., 2005), there is widespread agreement among both scholars and government agencies that public awareness of schizophrenia needs to be raised to combat ignorance and decrease stigmatization. Indeed a landmark, Surgeon General's report identified stigma as the root cause preventing effective treatment of mental disorders (US Department of Health and Human Services, 1999). To reduce stigma, some scholars have suggested that interventions based on perspective-taking—being delegated to the role of the stigmatized other—can yield positive results by reducing the social gap between the self and the stigmatized other (Davis et al., 1996; Yee and Bailenson, 2006). Also, scholars working in the area of empathy research have shown that taking on the perspective of a stigmatized other can reduce perceptions of stigma by increasing sympathy and compassion (Batson, 1991; Batson et al., 1997).

Although these approaches are laudable and have received sustained research attention, traditional empathy manipulations (typically using text or audio-visual instructions) are likely to be effective only in the short term because laboratory subjects rarely, if ever, would be able to truly *experience* a given experimental vignette and incorporate it as part of their “self.” Ideally (and as implied by our second hypothetical scenario mentioned earlier), perceptions of stigma toward people with mental illnesses would be ameliorated when individuals are provided the opportunity to acquire a first-hand experience of a specific mental illness. Fortunately, growing advances in information technology offer a promising solution in terms of creating actual, real life, experiences that account for several of the above-mentioned problems. One particularly useful methodological technique that has assumed prominence is that of virtual reality (VR) or virtual environments (VEs).

Increasingly, VR techniques have been heralded in healthcare and medicine (e.g., Parsons and Mitchell, 2002; Riva, 2002; Tichon et al., 2004), with some scholars proclaiming their value in aiding better comprehension of diseases such as schizophrenia (Tichon and Banks, 2003; Tichon et al., 2004). Although work by Tichon and colleagues suggests that VR systems may improve empathy and understanding of schizophrenia, the majority of findings in healthcare research using VR tools have been restricted to feasibility studies and pilot projects, and rarely been examined under the rubric of methodologically rigorous, controlled studies (Riva, 2002).

In this study, we examined whether a VR simulation of schizophrenia reduces perceptions of stigma and increases feelings of empa-

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thy toward people suffering from schizophrenia. We compare the VR simulation with traditional, written empathy-set instructions (used in prior stigma research) as well as a control condition. Specifically, we report results ( $N = 112$ ) from a 4-condition, between-subjects experiment (VR simulation condition, written empathy condition, VR simulation + empathy condition, control condition).

Although there have been numerous explications of VR and VEs (Blascovich et al., 2002), we find 2 definitions to be especially instructive. Blascovich et al. (2002, p. 105) conceptualize VEs as “synthetic sensory information that leads to perceptions of environments and their contents as if they were not synthetic.” In a related vein, the commonly adopted definition by scholars in medicine and health communication describes VR as “a collection of technologies that allow people to interact efficiently with 3D computerized databases in real time using their natural senses and skills” (McCloy and Stone, 2001, p. 913).

Central to the understanding of VR is the concept of “presence” or “telepresence.” Fundamentally, presence refers to an individual’s perception that a mediated experience is real, and is thought to be a function of the degree of vividness (sensory richness) provided by the technology (Lee, 2004; Steuer, 1992). Such perceptions of vividness and feelings of presence can lead to affective responses. For example, Riva et al. (2007) recently postulated that VR is an affective medium. That is, interaction with a VE programmed to display a specific type of emotion appears to result in those emotions being experienced by the perceiver. In their study, Riva et al. showed that study participants’ interaction with “anxious” and “relaxing” VEs inculcated subsequent feelings of anxiety and relaxation in participants. The authors suggested that VEs can be programmed to produce specific emotions in users.

Although our discussion thus far implies the usefulness of VEs in inducing presence and the ability to experience emotional responses, we believe that the specific responses exhibited by a person experiencing a virtual simulation of schizophrenia lies in our understanding of the self. Although the published data on the self are exhaustive, Baumeister’s (1998) classic thesis suggests that one of the most important features of selfhood relates to the experience of reflexive consciousness. According to Baumeister, this experience involves an essential human tendency to be aware of things and events that surround us, and to be able to consciously reflect on those experiences to form a representation or deeper understanding of oneself. Reflexive consciousness appears to be a product of both self-awareness and “other” awareness. From our perspective, VEs constitute the “other.” Hence, in an interaction with a VE, awareness of the self should be intensified by being able to perceive the specific simulation as well. Such increased self-awareness can lead individuals to compare themselves against some predefined standard (Duvall and Wicklund, 1972). For instance, if a healthy individual is able to experience a virtual simulation of schizophrenia, he or she may be able to assess the experience from the sensory perspective of someone who actually suffers from schizophrenia, rather than relying on lay or pre-existing beliefs about schizophrenia. Thus, increased self-awareness can result in enhanced self-knowledge. Under such conditions, it is likely that individuals will be motivated to invoke an appraisal motive (Chen and Chaiken, 1999) and attempt to be accurate in their assessment. In the context of a virtual simulation of schizophrenia, we expect that participants who experience the simulation would then be made aware of their ignorance of the illness. Such ignorance is likely to result in feelings of guilt or shame, with a possibly lessened tendency to offer stereotypical responses and a corresponding greater likelihood of instead attempting to convey more accurate, thoughtful responses.

In addition to our understanding of the self, the conceptual rationale underlying perspective-taking is also applicable to the current study. The perspective-taking method has been used in studies on stereotyping and prejudice, as well as stigma research. The basic idea behind this approach is premised on the fact that humans are sometimes guilty of a fundamental attribution error in several social interaction situations (Ross, 1977). That is, people have a marked tendency to attribute outcomes and behaviors to external situational factors when assessing themselves (e.g., “I didn’t get the job because I was suffering from a high fever and couldn’t concentrate”), and to internal dispositional factors when assessing others (e.g., “He didn’t get the job because he is stupid and incompetent”). Researchers have suggested that prejudiced and stigmatized responses can be reduced by asking individuals to adopt the perspective of a certain person or role. Assuming such a perspective results in a closer overlap between the self and the other, with situational factors overriding dispositional factors in subsequent judgments (Galinsky and Moskowitz, 2000).

Along similar lines, stigma researchers have typically used an empathy-set instruction, wherein participants are asked to imagine themselves in the role of a person suffering from a stigmatizing illness or disease (e.g., AIDS). These studies have generally shown that when participants adopt such a perspective, they tend to display greater empathy and understanding toward a typical patient, and tend to offer less stigmatizing responses (Batson, 1991; Batson et al., 1997). Although perspective-taking manipulations in previous research have generally been induced through written instructions, Yee and Bailenson (2006) posited the superiority of VEs in implementing perspective-taking scenarios because individuals can actually be placed in the body of another person rather than merely asking them to imagine the perspective of another person. In the context of the present investigation, an individual who experiences a simulation of schizophrenia should tend to be more empathic and less prejudiced because he or she will be able to observe the experience from the perspective of a person who is afflicted with schizophrenia.

In summary, direct experience of a virtual simulation of schizophrenia should invoke a strong association with the self, and lead to greater empathy and reduced perceptions of prejudice and social distance toward people who suffer from schizophrenia. Operationally, such participants should evince less negative attitudes toward people who suffer from schizophrenia. Particularly, a VE simulation of schizophrenia should be more effective in eliciting empathic responses than a written empathy-set instruction, which, in turn should be more effective than a control condition. In our study, we also include a fourth experimental condition, namely a combination of the VE simulation and the written empathy-set condition, because the preceding discussion suggests that a VE simulation can be rendered even more effective when combined with traditionally used perspective-taking manipulations.

## METHODS

All participants ( $N = 112$ ) in a 4-condition (empathy condition, VE simulation condition, empathy + VE simulation condition, control) between-subjects experiment were randomly assigned to 1 of 4 experimental conditions. Manipulations were accomplished by varying the tasks participants completed (an empathy thought-listing exercise, a VR simulation, both, or neither) before they filled out a paper-and-pencil questionnaire including the study’s dependent and control measures. Participants were equally distributed across the 4 conditions (26 per condition).

## Participants

A total of 112 participants (68 women, 44 men, mean age = 22.25 years) were recruited from a psychology research participant

pool as well as from the university community. Students from the research pool participated in the experiment for extra credit, whereas other participants were paid \$20 for participation. There were no significant differences between these 2 groups on any of the dependent measures. Individuals who had been hospitalized for mental illness were not eligible to participate in the study. All participants signed an informed consent form before their participation in the experiment.

## Stimulus Materials

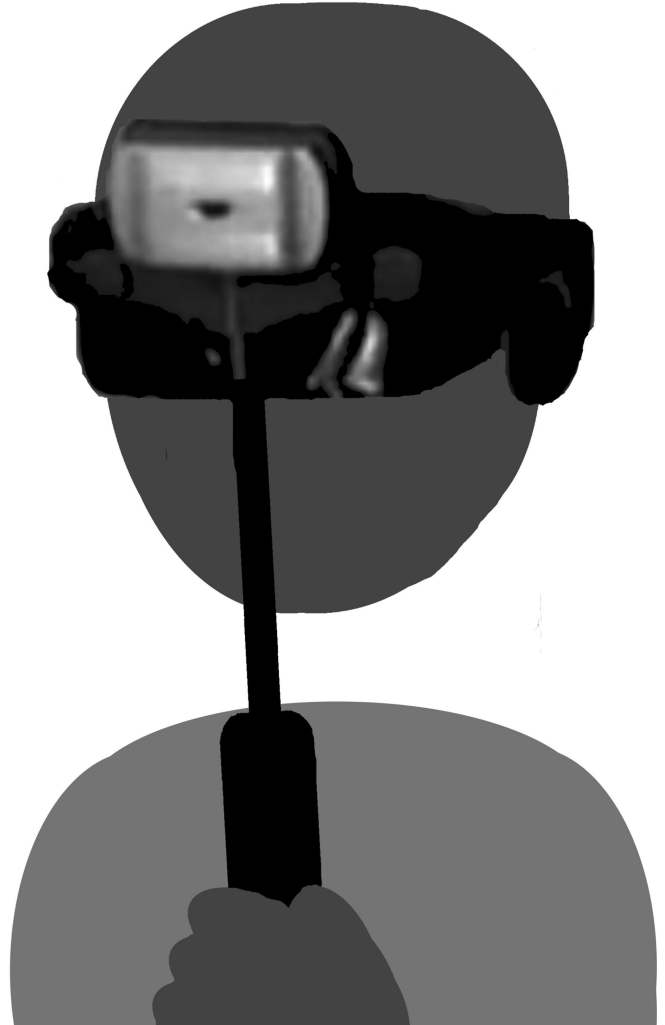
### VE Simulation Condition

For the simulation condition, this experiment used a VR simulation developed by Janssen Pharmaceutica Products, L.P., of Titusville, New Jersey, which is designed to provide the user with an immersive experience simulating the symptoms of schizophrenia. The simulation was designed to aid health professionals in understanding the experience of patients with schizophrenia and was developed on the basis of extensive accounts of persons with schizophrenia, their doctors, and mental health experts (National Public Radio, 2002). The user interface of the simulator consists of a set of virtual-reality goggles and earphones mounted atop a vertically oriented handgrip, which allows the user to see and hear the presentation by holding the device over the face in much the same manner as a hand-held stereoscope (Fig. 1). This interface apparatus, which is attached to a small processing unit and a laptop computer that is used to start and end the simulation, presents simulated 3-dimensional video and stereophonic audio. Motion-tracking sensors in the device also provide an interactive 360-degree field of vision and sound by changing the video and audio point-of-view in response to the user's head turning to "look" left or right (Blascovich et al., 2002, p. 107).

The VR simulator is equipped to take the user through multiple experience scenarios, each of which is interspersed with auditory and visual hallucinations characteristic of schizophrenia. These scenarios include an office visit with a doctor, a bus ride, and a visit to a grocery store pharmacy. The pharmacy visit simulation was used in this experiment. During the pharmacy visit simulation, which lasts about 4 1/2 minutes, the user sees and hears from the point of view of a person with schizophrenia visiting a grocery store pharmacy desk for a prescription refill to replace lost medicine. Although the pharmacist asks questions and makes telephone calls to get the prescription filled, the user experiences a number of simulated visual and auditory hallucinations. For example, disembodied voices warn of dangers ("She's going to get the poison!") and harass the user ("They know your every move!"), images of cruel-faced and mocking people appear in the aisles of the supermarket, wording of posted signs and labels is altered to address the user (the label on the printed prescription bottle briefly reads "POISON," accompanied by a skull and crossbones), and the pharmacist plots against the user ("We should give him the strong stuff") and addresses the user in an incongruently angry or mocking tone while uttering denotatively friendly phrases ("Have a pleasant day"). A multimedia slideshow featuring portions of the VE simulation used in this study are available at: <http://www.npr.org/programs/atc/features/2002/aug/schizophrenia/>.

### Empathy Condition

Participants in the empathy condition were asked to "imagine how a person with schizophrenia feels when she or he goes into a drug store and is hearing voices and seeing things that aren't there," then write down their thoughts on a piece of paper for 1 minute. The



**FIGURE 1.** A schematic diagram illustrating the head-mounted VR simulator.

following verbal instructions were given to participants regarding the thought-listing task:

*Try and really put yourself in that person's place and imagine what it would be like to have these hallucinations and pay attention to what you need to do when in a drug store. Imagine how you would respond if you lost your medication and needed to tell the pharmacist that you needed a refill, all the while you are hearing voices and seeing things that aren't there. Please take a minute and write down what you think that would be like for that person.*

The experimenter then kept time for 1 minute while the participant listed thoughts on a blank piece of paper. After 1 minute elapsed, the experimenter instructed the participant to stop the thought-listing exercise.

For participants who were in the VE simulation + empathy condition, the thought-listing exercise preceded the simulation experience.

In the control condition, participants were merely told that the study examined consumers' perceptions of various health issues. Accordingly, they were asked to fill out the same questionnaire without being exposed to any of the treatment conditions.

## Dependent Measures

### Empathic Feelings for People Suffering From Schizophrenia

The dependent measure of empathic feelings for people suffering from schizophrenia was adapted from Batson et al. (1997), and measured using an index of 12 items asking participants to rate how well a series of adjectives (e.g., “Sympathetic,” “Disgusted,” “Scared,” “Compassionate”) described their emotions toward people suffering from schizophrenia (1 = “Not at all,” 7 = “Extremely”).

### The Social Distance Scale

Seven items pertaining to interactions with an individual who has schizophrenia comprised the Social Distance Scale. These items (e.g., “How would you feel having someone with schizophrenia as a neighbor?”) were rated on a 4-point Likert scale (0 = “Definitely unwilling” to 3 = “Definitely willing”) and were adapted from Penn et al. (1994).

### Attitudes Toward People With Schizophrenia

Participants’ attitudes toward people with schizophrenia were assessed using 7 items (e.g., “For most people with schizophrenia, it is their own fault that they have schizophrenia”) on a 9-point scale anchored between “1” denoting “Strongly disagree,” “Not at all,” or “extremely negative” and “9” denoting “Strongly agree,” “very much,” or “Extremely positive.” These items were adapted from Batson et al.’s (1997) scale used to measure attitudes toward people with AIDS. All of the study’s dependent measures are included in the Appendix.

### Simulation Evaluation

In the 2 virtual simulation conditions, participants’ evaluation of the simulation was accomplished through 5 Likert-type items (e.g., “The simulation is an effective way of increasing awareness of schizophrenia”) on a 1 to 7 scale, with “1” indicating “Strongly disagree” and “7” indicating “Strongly agree.”

### Control Measures

Participants’ pre-existing perceptions toward people with schizophrenia were assessed using 8 Likert-type items (e.g., “The main purpose of mental hospitals should be to protect the public from people with schizophrenia”) on a 1 to 7 scale, with “1” indicating “Strongly disagree” and “7” indicating “Strongly agree.” These measures were adapted from Couture and Penn (2006).

### Procedure

All participants took part in the experiment in individually scheduled sessions in a campus laboratory. On arrival, participants were informed that they would be participating in a study designed to assess their perceptions of various health issues. After participants completed the informed consent form, the experiment protocol continued on the basis of a predetermined random condition assignment. Participants assigned to the VE simulation + empathy condition were first given a blank sheet of paper and a pencil and asked to complete the thought-listing exercise, and were then seated in a swivel chair in front of the virtual-reality simulator. After the experimenter provided a brief explanation of how to use the simulator and what the general content of the pharmacy visit simulation would include, participants held the simulator interface up to their faces and began the simulation by pressing a button on the interface. The experimenter stood by in an observation area, monitoring participants’ behavior. After the VE simulation ended, the experimenter unhooked the virtual-reality interface from participants and provided the paper-and-pencil questionnaire containing the study’s dependent and control measures (see Appendix). For those partici-

pants assigned to either the empathy or VE simulation conditions, the procedure was as described earlier, but with the appropriate portion removed: Participants assigned to the empathy condition completed the questionnaire immediately after the thought-listing task, whereas participants assigned to the VE simulation condition proceeded directly to the simulation experience without participating in the thought-listing task. Participants assigned to the control condition proceeded directly to the questionnaire after completing the consent form.

After completing the questionnaire, participants were debriefed, thanked for their participation, and dismissed.

## Index Construction and Preparation for Data Analysis

The dependent measure of empathic feelings for people suffering from schizophrenia was created by additively summing up the 12 items that comprised this index (Cronbach’s  $\alpha = 0.81$ ). Higher scores indicate more positive perceptions of empathy.

The dependent measure of social distance was created by additively summing up the 7 items that comprised this index (Cronbach’s  $\alpha = 0.78$ ). Higher scores indicate greater perceived social distance.

The third dependent measure of attitudes toward people suffering from schizophrenia was created by summing up the 7 items that measured this concept, with higher scores indicating more positive attitudes (Cronbach’s  $\alpha = 0.75$ ).

Of the 5 questions used to evaluate the VR simulator, 1 (“The simulator should make people more sympathetic toward people who suffer from schizophrenia”) did not load with the other 4 items and was therefore dropped from subsequent analysis. The remaining 4 items were added up to form an index (Cronbach’s  $\alpha = 0.76$ ), with higher scores indicating more positive evaluations of the simulator.

In addition to these dependent measures, we also created an index of the 8 items comprising participants’ pre-existing perceptions toward people suffering from schizophrenia. This index was also reliable (Cronbach’s  $\alpha = 0.76$ ), with higher scores indicating more negative perceptions.

## RESULTS

The effects of the experimental manipulations were investigated for each dependent variable through a series of one-way analysis of variance (ANOVAs).

### Empathic Feelings for People Suffering From Schizophrenia

A one-way ANOVA on this dependent measure revealed a statistically significant effect,  $F(3,108) = 9.93$ ,  $p < 0.001$ ,  $\omega^2 = 0.21$ , with a post hoc analysis showing that the VE simulation + empathy condition differed significantly from the empathy and control conditions (Table 1). In addition, the post hoc analysis revealed that the VE simulation condition differed significantly from the control condition. The overall pattern of the means suggests that the VE conditions induced greater perceptions of empathy, with the simulation + empathy condition resulting in the highest empathy score.

### Social Distance

A one-way ANOVA on the dependent measure of social distance revealed a statistically significant effect,  $F(3,108) = 4.98$ ,  $p < 0.01$ ,  $\omega^2 = 0.10$ . A post hoc analysis (Table 1) showed that the VE simulation condition differed significantly from the other 3 conditions. The direction of the means implies that perceived social distance was greatest in the VE simulation condition, with the other conditions displaying more or less similar scores.

**TABLE 1.** Summary of Means (With Standard Errors) and *F* Values for Dependent Measures of Empathy, Attitudes, and Social Distance

Measure	Control Condition	Written Empathy Condition	VE Simulation Condition	VE Simulation + Empathy Condition	<i>F</i>
Empathy	3.38 <sup>a</sup> (0.10)	3.66 <sup>a,b</sup> (0.10)	3.94 <sup>b,c</sup> (0.10)	4.14 <sup>c</sup> (0.10)	9.93*
Attitudes	4.64 <sup>a</sup> (0.18)	4.79 <sup>a</sup> (0.18)	5.22 <sup>a,b</sup> (0.18)	5.56 <sup>b</sup> (0.18)	5.29*
Social distance	1.44 <sup>b</sup> (0.08)	1.44 <sup>b</sup> (0.08)	1.80 <sup>a</sup> (0.08)	1.43 <sup>b</sup> (0.08)	4.98*

Higher scores on empathy and attitude measures indicate more positive perceptions. Higher scores on social distance indicate greater (more negative) perceived social distance.  
 Comparisons between means, specified by lowercase superscripts, are horizontal only.  
 Cell means that do not share a letter in their superscripts differ at  $p < 0.05$  according to Tukey-Kramer HSD test.  
 \* $p < 0.01$ .

### Attitudes Toward People With Schizophrenia

A similar one-way ANOVA on this measure again showed a statistically significant effect,  $F(3,108) = 5.29, p < 0.01, \omega^2 = 0.11$ . The post hoc analysis (Table 1) uncovered significant differences between the VE simulation + empathy condition and the empathy and control conditions. Although participants' scores in the VE simulation condition did not differ significantly from any of the other 3 conditions, the direction of the means suggests that the VE conditions enhanced more positive attitudes toward people afflicted with schizophrenia.

The effects of the experimental conditions on the 3 primary dependent measures remained largely unaltered when including participants' prior perceptions of schizophrenia as a covariate.

### Simulator Evaluation

Recall that participants in the 2 VE conditions (i.e., with and without the empathy manipulation) were also asked to rate their perceptions of the simulator. On average, participants scored 6.02 (on a 7-point scale), with a *t* test revealing no significant differences between the 2 VE conditions,  $t(55) = 0.04, p = 0.968$ . These scores indicate that participants, on the basis of their experience, responded quite favorably to the potential deployment of the simulator as an effective tool for educating the general populace about schizophrenia.

## DISCUSSION

The methodological importance of this study is underscored by the fact that it is, to the best of our knowledge, among the first such studies to examine the effects of a virtual simulation on the stigma associated with schizophrenia. In addition, we included well-established measures that have been validated in previous stigma research (albeit in a nonvirtual context) that allowed us to draw meaningful inferences and move beyond the domain of mere pilot studies using descriptive statistics. Equally important, by examining the effects of the VE simulations in comparison with the established norm (i.e., control and empathy conditions), our study showcases the utility of examining new technological devices vis-à-vis traditional empathy manipulations, and hopefully provides a roadmap for future investigations of VE simulations for healthcare scenarios, in general, and mental health contexts, in particular.

To summarize the results, the direction of means on the measures of empathy and attitudes toward people suffering from schizophrenia suggests that participants' scores showed a monotonic increase from the control to the empathy to the VE simulation to the VE simulation + empathy conditions, with post hoc analyses offering additional insights. On both empathy and attitude measures, observed scores in the VE simulation + empathy condition were significantly different from scores obtained in the control and empathy conditions. These findings are generally consistent with our predictions. However, participants' scores on the social distance

measure revealed an unexpected pattern; although there were no statistically significant differences between the control, empathy, and VE simulation + empathy conditions, the VE simulation condition elicited the highest scores on this measure. Moreover, these scores differed significantly from scores in the other conditions. Finally, participants in the 2 VE conditions appeared to express their endorsement for the simulator as a useful educational device (mean score of more than 6 on a 7-point scale).

To dissect the results further, we begin by offering a caveat. Although study participants exposed to the VE simulations clearly expressed their approval of the simulation in combating stereotypical perceptions of schizophrenia, such ratings need to be examined in concert with participants' scores on the deeper psychological measures of empathy, attitudes, and social distance. Given that exposure to only the VE simulation did not noticeably enhance empathic and attitudinal judgments relative to the control and empathy conditions, participants' ratings of the potential effectiveness of the simulator need to be interpreted cautiously. Perhaps more disturbingly, participants in the VE simulation-only condition displayed the highest scores on the social distance scale, which were significantly different from the scores of participants in all the other 3 conditions. This finding reinforces our warning that mere exposure to a virtual simulation of schizophrenia by itself may not only be ineffective, but actually prove to be inimical despite participants' optimism about the simulator's promise as an educational tool.

Fortunately, the findings observed in the VE simulation + empathy condition provide room for optimism. To reiterate, across the various measures, participants in this condition reported highest scores on empathy and attitudes as well as the lowest scores (more positive) on perceived social distance. Presumably, when these participants were asked to report their perceived social distance, they could use the information from the empathy manipulation to regulate the responses that may have stemmed as a result of exposure to the virtual simulation.

Although the results are clearly intriguing, uncovering the theoretical mechanisms for the specific findings presents an exciting challenge and opportunity to not only researchers interested in examining the effects of new technological innovations in mental health, but also to scholars in social cognition, particularly in the domain of stereotyping and persuasion. Research in a broad variety of domains indicates that simulations alone are often not sufficient to maximize learning and skill development. In many instances, VR is most effective as a learning tool when accompanied by complementary resources presented in other formats such as lecture presentations, written instructions, or physical models (Antonietti et al., 2001; Godat et al., 2007; Pan et al., 2006; Parkes et al., 2009). The results reported here further suggest that simulations without the context of such supplemental resources may lead to outcomes that are not only inferior, but are even counterproductive to learning

goals. For designers of new technologies and mental health experts, our findings clearly suggest the need to examine the potential of VR techniques in concert with more traditional deployments of perspective taking, rather than in isolation. On the basis of the results reported here, scholars, practitioners, and policy makers need to examine creative ways of providing consumers with adequate knowledge about stigma-related issues before exposure to a virtual simulation.

Finally, we acknowledge the limitations of the present investigation and suggest some additional directions for future research. The usual external validity objections prevalent in all experimental research prevent us from generalizing these findings. Future research may include more diverse samples for study as well as different types of virtual simulations of schizophrenia. For instance, the particular simulation that we used in this study may be limited because it portrays the schizophrenia world as potentially scary and shows symptoms such as visual hallucinations (even though the simulation was created in consultation with mental health experts, including patients). The deployment of diverse simulations of mental health would help to increase the scope of such virtual simulations. Also, the amount of detail provided in the empathy condition compared with the VE condition may not have been equivalent. In addition, future research may also examine inclusion of other dependent measures that may help shed further conceptual light in unraveling the relationship between exposure to virtual simulations and effects. For instance, although self-reported empathy measures are meaningful, they may not be isomorphic with “real” feelings of empathy and may not translate into behavioral manifestations.

Ultimately, we hope that our study is both a novel and rigorous attempt to uncover psychological responses to virtual simulations of schizophrenia as well as providing a tentative roadmap for future user-centered information research approaching the intersection of new information technologies and health issues, particularly mental health. The questions that await examination are many, the challenges formidable, and the societal benefits potentially rewarding. We invite other scholars to join us on this odyssey, and further explore the many nuances of the exciting world of immersive VEs. In conclusion, to revisit the hypothetical scenarios that we introduced at the beginning of this article:

*Merely experiencing a simulation of schizophrenia is unlikely to result in effective results. However, if such personal experience is buttressed by inducing him to ruminate carefully on what a typical patient might undergo, John is likely to be far more empathic and understanding toward people who suffer from schizophrenia.*

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APPENDIX

Dependent Measures

1. Empathic feelings for people suffering from schizophrenia

Please rate below how you feel when you think about people with schizophrenia (i.e., people who hear voices and have odd beliefs, which are called delusions).

1 2 3 4 5 6 7  
Not at all Extremely

1. Sympathetic \_\_\_\_\_
2. Disgusted \_\_\_\_\_
3. Scared \_\_\_\_\_
4. Compassionate \_\_\_\_\_
5. Angry \_\_\_\_\_
6. Soft-hearted \_\_\_\_\_
7. Warm \_\_\_\_\_
8. Afraid \_\_\_\_\_
9. Tender \_\_\_\_\_
10. Confused \_\_\_\_\_
11. Moved \_\_\_\_\_
12. Anxious \_\_\_\_\_

2. The social distance scale

Please rate the statements below on the following scale:

0=definitely willing; 1=probably willing;  
2=probably unwilling; 3=definitely unwilling;

- 1) How would you feel about renting a room in your home to someone with schizophrenia? \_\_\_\_\_
- 2) How about as a worker on the same job as someone with schizophrenia? \_\_\_\_\_
- 3) How would you feel having someone with schizophrenia as a neighbor? \_\_\_\_\_
- 4) How about as the caretaker of your children for a couple of hours? \_\_\_\_\_
- 5) How about having your children marry someone with schizophrenia? \_\_\_\_\_
- 6) How would you feel about introducing an individual with schizophrenia to a young woman/man you are friendly with? \_\_\_\_\_
- 7) How would you feel about recommending someone with schizophrenia for a job working for a friend of yours? \_\_\_\_\_

3. Attitudes toward people with schizophrenia

Please rate each item below using the appropriate scale. Circle the number that best represents your opinion about each statement.

1. For most people with schizophrenia, it is their own fault that they have schizophrenia

1 2 3 4 5 6 7 8 9  
Strongly Disagree Strongly Agree

2. Most people with schizophrenia could have avoided contracting the disease

1 2 3 4 5 6 7 8 9  
Strongly Disagree Strongly Agree

3. How much personally do you care about the plight of people with schizophrenia?

1 2 3 4 5 6 7 8 9  
Not at All Very Much

4. Our society does not do enough to help people with schizophrenia

1 2 3 4 5 6 7 8 9  
Strongly Disagree Strongly Agree

5. Compared with other social problems we face today (e.g., crime, education, drugs, homelessness, environmental protection, energy conservation), how would you rate the importance of helping people with schizophrenia?

1 2 3 4 5 6 7 8 9  
Not at all Important Very Important

6. Our society should do more to protect the welfare of people with schizophrenia

1 2 3 4 5 6 7 8 9  
Strongly Disagree Strongly Agree

7. In general, what are your feelings toward people with schizophrenia?

1 2 3 4 5 6 7 8 9  
Extremely Negative Extremely Positive

4. Simulation evaluation

We would like your reactions to simulation, which was used to help promote health awareness. For each statement, please rate the extent to which you agree or disagree with each statement with "1" indicating "Strongly disagree" and "7" indicating "Strongly agree."

1 2 3 4 5 6 7  
Strongly Disagree Strongly Agree

- 1) The simulation was interesting \_\_\_\_\_.
- 2) The simulation was educational \_\_\_\_\_.
- 3) The simulation is an effective way of increasing awareness to schizophrenia \_\_\_\_\_.
- 4) The simulator should not be used for people who want to work with individuals with schizophrenia \_\_\_\_\_.
- 5) The simulator should make people more sympathetic towards people with schizophrenia \_\_\_\_\_.