Immersive Intergroup Contact: Using Virtual Reality to Enhance Empathy and Reduce Stigma Towards Schizophrenia

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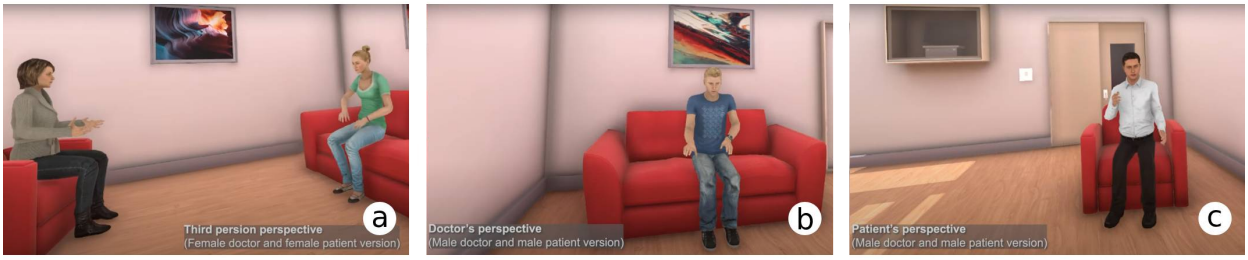

Fig. 1: **Different Perspectives of Experiment**. (a) Third-Person's Condition, where the participant observes the clinical consultation as an external viewer; (b) Doctor's Perspective Condition, where the participant embodies the psychiatrist's viewpoint; (c) Patient's Perspective Condition, from the schizophrenia Patient's viewpoint. All avatars are gender-matched to the participant.

Abstract—Stigma towards individuals with schizophrenia reduces quality of life, creating a barrier to accessing education and employment opportunities. Schizophrenia is one of the most stigmatized mental health conditions, and stigma is prevalent particularly among healthcare professionals. In this study, we investigated whether Virtual Reality (VR) can be incorporated into interventions to reduce stigma. In particular, we compared the effectiveness of three VR conditions based on intergroup contact theory in reducing stigma in form of implicit and explicit attitudes, and behavioral intentions. Through an immersive virtual consultation in a clinical setting, participants (N=60) experienced one of three different conditions: the Doctor's perspective (embodiment in a majority group member during contact), the Patient's perspective (embodiment in a minority group member) and a Third-person perspective (vicarious contact). Results demonstrated an increase of stigma on certain explicit measures (perceived recovery and social restriction) but also an increase of empathy (perspective-taking, empathic concern) across all conditions regardless of perspective. More importantly, participants' viewpoint influenced the desire for social distance differently depending on the perspective: the Third-person observation significantly increased the desire for social distance, Doctor embodiment marginally decreased it, while Patient embodiment showed no significant change. No change was found in the Implicit Association Test. These findings suggest that VR intergroup contact can effectively reduce certain dimensions of stigma toward schizophrenia, but the type of perspective experienced significantly impacts outcomes.

Index Terms—Virtual Reality, Schizophrenia, Attitude Change, Empathy, Stigmatization

1 Introduction

Schizophrenia is a serious and chronic mental illness characterised by delusions, hallucinations, negative symptoms, and cognitive impairments, which often lead to lifelong impairment and disability [53]. Public attitudes toward people with schizophrenia are predominantly negative and are also one of the main obstacles to successful treatment [19, 38]. This stigma creates significant barriers for patients, especially in education and employment opportunities, often leading to social distancing and exclusion [19, 38].

In recent years, Virtual Reality (VR) has been used as a means for us to experience scenarios from various perspectives with a high level of immersion [21]. Studies have shown that the VR experiences can lead to significant attitude changes [33, 44, 50]. For instance, research by Fernanda et al. [21] demonstrated that first-person perspective taking

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through VR had a more lasting impact on participants' attitudes toward the homeless compared to narrative-based methods.

As demonstrated by previous research in social psychology, successful strategies to reduce stigma include promoting positive intergroup contact and enhancing empathy [47, 48]. In this context, VR offers a powerful method for investigating the role intergroup contact in stigma reduction in a controlled yet naturalistic setting [15, 37].

In this work, we explored the effectiveness of *different forms* of VR contact in reducing stigma towards individuals with schizophrenia: *vicarious contact* (observing contact between the majority and minority group member, Third person condition), embodiment in a *majority group member* during intergroup contact (Doctor condition), and embodiment in a *minority group member* (Patient condition) during intergroup contact.

Our overall research question **RQ** is: *Can VR interventions based on different forms of intergroup contact reduce explicit and implicit mental health stigma?*

To address this RQ, we created gender-matched scenarios for participants to observe a consultation regarding schizophrenia care with a patient with schizophrenia from the third-person perspective (**3PP**), the doctor's perspective (**Doctor**), or the patient's perspective (**Patient**), as shown in Figure 1. Our research question focuses on how these different VR perspectives influence individuals' attitudes toward people with schizophrenia. We investigated how each perspective affects specific dimensions of *explicit* stigma, including social distance, stereotyping, separateness, social restriction and perceived recovery, as well as dimensions of empathy, including perspective taking and empathic concern. Additionally, we explored whether these VR experiences can influence *implicit* biases measured through the Implicit Association Test (IAT).

Summary of Contributions: 1.We developed a realistic VR scenario depicting a doctor-patient conversation based on real-world consultations in a psychiatric clinical setting. 2. In order to develop conditions for participants to "experience" the virtual consultation via three different perspectives (3PP, Doctor, Patient), we implemented a novel method for "passive perspective-taking" for the embodiment conditions (Doctor and Patient), so that participants could follow the virtual character's head movements while avoiding simulation sickness. 3. We conducted an experimental study with a total of 60 valid participants, measuring their *explicit* and *implicit* attitudes before and after the experiment. 4. Our intervention is based on psychological theories, drawing upon theories of intergroup contact and embodiment.

2 Related Work

2.1 Stigma Towards Schizophrenia

The stigma associated with schizophrenia is more common compared to other mental illnesses, such as anxiety and depression [22, 54]. It is often linked to the most negative stereotypes, viewed as the least likely to recover, and is frequently misunderstood or feared [54]. Research suggests knowledge about mental health issues does not necessarily correlate with reduced bias or stigma, even among healthcare professionals in mental health institutions [25]. As a result, patients not only face stigma from the general public but sometimes even from their nurses or psychiatrists. For example, a study found that nurses reported greater stigma than the general population, including more negative attitudes, a stronger sense of separation from individuals with mental illness, and lower behavioral intentions, among other factors [5]. Another study found that 78% of surveyed medical and nursing undergraduates (n=344) held concerns about potential violence from people with schizophrenia [31]. Moreover, this stigma extends to their families, a phenomenon known as "family stigma." Some family members may feel ashamed of their association with their relative and may deliberately distance themselves from them [9].

2.2 Stigma Reduction And Intergroup Contact

Intergroup contact theory posits that positive, meaningful interactions with individuals from stigmatized groups can reduce stigma [1, 41]. Vicarious contact, an indirect form of intergroup contact, involves observing an intergroup interaction, such as between a member from an advantaged and a member from a disadvantaged group, and has also shown to reduce stigma [7]. Intergroup contact interventions work best when Allport's (1954) conditions for positive contact are met: equal status between both groups in the contact situation, working towards common goals, involve cooperation, include the support of authorities.

Intergroup contact reduces stigma by enhancing empathy [42]. Empathy refers to people's ability to understand and share the feelings of another person [14]. It includes both affective empathy (empathic concern) and cognitive empathy (perspective taking). Empathic concern refers to the emotional resonance with another person's feelings, while cognitive empathy refers to the intellectual understanding of another's perspective. Perspective taking specifically refers to the cognitive process of imagining oneself in another person's situation [6, 48].

2.3 Perspective Taking And Empathy Development In VR

Given the established role of empathy in stigma reduction, researchers have increasingly explored VR as a new medium for facilitating these processes. VR has emerged as a transformative platform for health professions education, particularly for conditions like schizophrenia that involve complex perceptual experiences difficult to convey through traditional media [26, 53]. Perspective-taking in VR represents a significant technical advancement over traditional empathy development methods. While conventional approaches rely primarily on role-playing or observation, VR enables direct experiential learning through technology [24]. These systems typically employ techniques such as embodiment illusions and multisensory integration to create immersive perspective experiences [27].

Research shows that VR-based perspective-taking outperforms traditional methods in building empathy, demonstrating a unique ability to foster more positive, longer-lasting attitudes and motivate prosocial behaviors [21]. The effectiveness of this technology addresses a critical need in healthcare education, where concerning attitudes among medical professionals persist, as discussed in Section 2.1.

The effectiveness of VR in mental health education stems from its unique technical capabilities to generate presence—the subjective feeling of being there in the virtual environment [45]. Research demonstrates that higher levels of interactivity correlate with stronger presence sensations, which in turn enhance learning outcomes [4, 11]. These capabilities have proven valuable in psychiatric education, where VR has shown promise for understanding symptoms, training, and treatment support [18, 52]. Recent analyses reveal that mental health education represents a significant segment within empathy-focused VR content, comprising 13.3% of all such applications [28].

2.4 Stigma Reduction Through Immersive Experiences

Research has shown that immersive VR can effectively reduce stigma across multiple domains [49]. This capability is particularly significant for addressing mental health stigma, as people with psychiatric conditions are often perceived by the public as fundamentally different and excluded from group membership [55].

VR offers unique technical approaches to addressing mental health stigma, encompassing knowledge gaps, prejudicial attitudes, and discriminatory behaviors [10]. For schizophrenia specifically, stigma reduction is particularly critical, as approximately 40% of individuals with this condition report significant stigmatization experiences [51].

Experimental studies have demonstrated VR's effectiveness in stigma reduction. Marques et al. [34] conducted a controlled study (n=102) comparing VR simulation of psychotic symptoms with 2D video exposure, finding that VR significantly stronger attitudinal and knowledge changes. Similarly, Mason and Westhead [35] evaluated a serious VR game with 37 participants, documenting medium to large improvements on psychometric scales measuring attitudes toward schizophrenia.

Farmer [15] lays out three levels of virtual interaction that might act to reduce prejudice and humanise stigmatised groups. First, merely being given a sense of precence within a situation relevant to the stigmatised group can act to increase empathy [12]. Another form of this presence level is vicarious contact i.e. passively observing interactions between members of ones own group and the stigmatised group. A

recent study [8] found that viewing cooperative performance between ingroup and outgroup members within VR led to positive attitude of the outgroup, particularly when the ingroup member performed well.

The second level is direct virtual contact. A systematic review indicates that VR-based contact interventions have shown promising results in reducing stigma toward marginalized groups [49]; however, their effectiveness varies depending on the perspective participants adopt. Specifically, embodying majority group members consistently reduces stigma, whereas minority embodiment can either decrease or inadvertently increase stigma. Research on implicit versus explicit stigma measures in VR remains inconclusive, and interventions typically affect one but not both types of stigma measures simultaneously.

The third level of VR intervention identified by Farmer [15] is the use of sensorimotor congruencies to embody a member of the stigmatized group. Multiple studies have shown that inducing ownership of outgroup bodies and identities can lead to significant reductions in negative stereotypes, including a decrease in implicit racial bias and ageism [16, 49]. One recent study showed that giving participants a first-person perspective of a person suffering from depression within Immersive VR reduced stigma and increased neural activity related to empathy [29].

Given the inconsistencies in the current literature, it remains unclear how different forms of VR contact (embodiment in majority and minority group member) affect explicit and implicit stigma.

2.5 Hypotheses For The Current Study

Based on this literature, we aim to investigate which contact perspective has the greatest impact on empathy and attitudes toward people with schizophrenia. We compared three forms of contact: embodiment in a majority group member during intergroup contact (Doctor condition), embodiment in a minority group member (Patient condition) during intergroup contact, and vicarious contact (observing contact between the majority and minority group member, Third Person condition, 3PP). In the context of a virtual consultation between a doctor and patient, the doctor's perspective represents the majority group member , the patient's perspective the minority member (stigmatized group), and the third person vicarious contact between a majority and minority group member. We expect direct intergroup contact (Doctor, Patient) to be more effective than indirect contact (vicarious, 3PP). Our hypotheses are as follows:

- H1: Participants in the Patient condition show greater empathy (empathic concern, perspective-taking), lower implicit bias (IAT), and lower explicit stigma (social distance, stereotyping, separateness, social restriction, perceived recovery) than participants in the Doctor or 3PP conditions.
- H2: Participants in the Doctor condition show greater empathy, lower implicit bias and lower explicit stigma compared to those in the 3PP condition.

3 Experimental Design

3.1 Scenario Design

Our scenario design process began with clinical observation and environmental documentation to ensure authenticity. Ahead of the clinic visit, we reviewed several psychiatric training videos to understand communication patterns between psychiatrists and different patient populations. One of our authors, a psychiatrist, took the team for a visit at the Black Country NHS clinic to observe patient-psychiatrist interactions and document the physical consultation environment.

A confidentiality agreement provided by the clinic was signed by every member of the development team prior to the observation, which followed strict ethical protocols at the clinic for teaching and training purposes. The goal of the visit was for the research team to gain general insights into communication dynamics, behavioral patterns, and clinical atmosphere that would inform our VR scenario design, rather than to record or replicate specific patient cases. To ensure clinical authenticity while rigorously protecting patient confidentiality, the narrative script for the VR experience was not based on any observed individual case. Instead, it was adapted from standardized, anonymized training scenarios similar to those used in professional psychiatric education and examinations (such as the CASC). The virtual environment was modeled after an actual place of safety room within the clinic, which was documented when not in use, allowing us to achieve high environmental fidelity without compromising patient privacy.

3.1.1 Observations from Real-life Consultations for Schizophrenia

Our visit to the psychiatry clinic and observations of real consultations helped us better understand how psychiatrists and patients communicate. We found that body language plays an essential role. The patient usually looks down and avoids eye contact, fidgets and shifts position constantly, revealing their discomfort, and speaks loudly with big movements to interrupt conversations with exaggerated emotions. In contrast, the psychiatrist stays focused on listening and thinking at the same time. They lean forward with a calm and engaging position, and use hand gestures to help explain things. This observation significantly guided our motion capture session with actors in portraying the doctor and patient's movements.

We also gained a better understanding of patients' and doctors' inner states during their conversation and communication. The psychiatrist wants to obtain more information about the patient's mental health, their present risk to themselves or others, and also to ascertain the causes and triggers of their condition. The patient, on the other hand, may be confused about why they are there, may want to leave the hospital, and may view this interaction with a previously unknown doctor with suspicion. For the doctor-patient interaction to be successful, a psychiatrist needs to build rapport with the patient and therefore has to be honest with them and communicate clearly and without judgment to allow the patient to explain their situation and difficulties.

The psychiatrist always makes their questions and instructions simple and straightforward to understand and follow. They try to clarify the details when asked, carefully avoiding any argument with the patient. They show empathy and support to the patients to relieve their fear, worry, and guilt. On the other hand, the patient sometimes has long pauses in the middle of sentences (the doctor explained that the most common behavior of their patients is thinking and being silent when they are suspicious of the doctor and their intentions). Patients with mental illnesses usually need more time to think and process the questions and sometimes intentionally use silence as a method of refusal to engage. Therefore, getting accustomed to the silence and delayed responses of patients is a basic skill for psychiatrists. We used this feature to design the patient behavior in the later stages of production.

3.1.2 The "Place of Safety" Virtual Environment

To ensure the authenticity of the project, we studied the real consultation room and clinical environment. We chose to fully replicate and model the "Place of Safety" for our study (Figure 3 (a)). The Place of Safety is a designated place under the mental health act legislation where patients can be taken to when placed under Section 136 by the Police. Section 136 is a legal power exercised by Police officers to detain someone in a designated safe-place, which can either be a place of safety, a bed in the emergency department, or a cell in a custody suite. In this case, the patient was reviewed at a designated place of safety in a mental health hospital. These rooms are designed to be secure to prevent patients from harming themselves or others. In this room, there are no objects within reach of the patient that can be grabbed, thrown, or smashed. The curtains are securely fixed to the windows without hooks and cannot be removed, all items are firmly attached to the floor or walls, the sockets are locked in various closed boxes, and there are no sharp corners. The doctor sits on a sofa closer to the exit, ensuring unobstructed access to leave the room promptly in case of any danger. The third sofa by the windowsill is designated for use by additional healthcare personnel and supervising observers, which is the position we designed for the third-person perspective. The outdoor space is a balcony surrounded by wire fencing. We also used a 360 camera to record the environment and ambisonic sound to better recreate the environment and build the virtual scenario accordingly. We recorded the real environment outside the hospital and created it as a Skybox texture in the project, so that Users can see the real outdoor environment through the window (see

Figure 3 (b)). The noise adds authenticity to the scene and enhances the level of immersion in the experience.

3.1.3 Script Design

Working together with the psychiatrist, we analyzed the structure of the usual consultation for schizophrenia. The structure usually is: 1. The psychiatrist's introduction VS the patient's resistance and non-cooperation. 2. The psychiatrist builds trust VS the patient's doubt and fear. 3. The psychiatrist inquires about the events VS the patient's emotional disclosure. 4. The psychiatrist clarifies and analyses reasons VS the patient's misunderstanding. 5. The psychiatrist's follow-up suggestions VS the patient's relief as they receive the treatment plan (Figure 2). we developed a dialogue script between a doctor and a patient and adopted this structure. Based on our field observations and

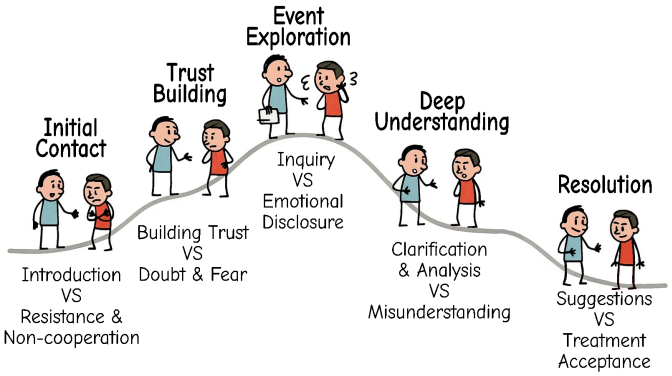

Fig. 2: The structured progression of psychiatrist-patient communication, illustrating key stages from initial contact to treatment plan.

training videos, we adapted our scenario to create a relevant narrative and conversation. Our original reference video showed a patient presenting with symptoms of psychosis experiencing hallucinations and delusions, believing that the government was monitoring him through various means and that everyone around him had been brainwashed. Building upon this premise, we adapted the story to a 16-year-old student preparing for his GCSE exam. The age of 16 was deliberately chosen as it presents unique safeguarding considerations that would not apply to adults, including different consent protocols and mandatory parental involvement in treatment decisions. This way our scenario provides additional challenge and more valuable for psychiatry trainee doctors training. Due to the stress of academic pressure, the 17-year-old consumed pills provided by his friend, leading to a overuse of drugs which triggered severe hallucinations and delusions. In this revised narrative, the patient believes the government constantly monitors him and lives in fear. He initially confides in his mother, who dismisses his concerns as delusional. However, one morning, the patient experiences another intense episode of hallucinations and delusions and, in a state of panic, decides to arm himself with a knife to protect himself and his mother. Alarmed by his behavior, his mother contacts the police for assistance. Consequently, he is brought to the consultation room for evaluation and support. In the scenario, the patient exhibits signs of anxiety, such as refusing to engage with the doctor and scanning the room nervously. Through the psychiatrist's efforts, the patient gradually becomes calmer, eventually opening up about his experiences, fears, and the underlying reasons for his condition. Please see our supplementary material for our script.

3.2 Technical Pipeline

3.2.1 Environment

The 3D environment was designed to replicate a real consultation room as closely as possible (Figure 3). The room includes three consultation sofas, a locked television, and a restroom door. All furniture is either too heavy to move or securely fixed to prevent patients from harming themselves.

To construct the virtual environment, we used Autodesk Maya for 3D modelling. The scenery outside the room window was created using a 360-degree video shot on-site at the clinic, providing an authentic backdrop to enhance immersion.

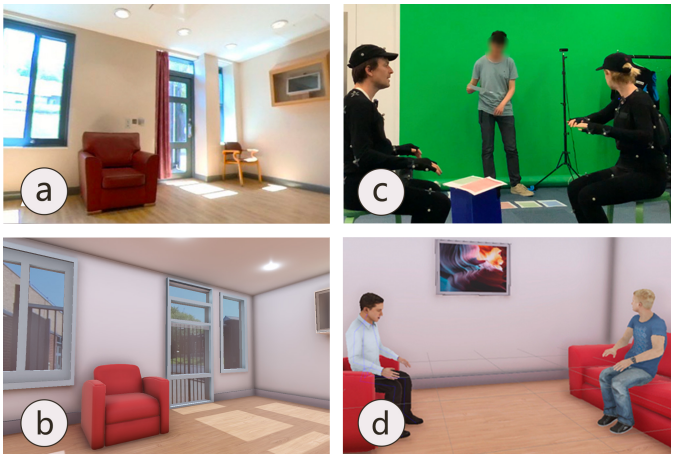

Fig. 3: Technical pipeline of the virtual consultation room development: (a) Reference consultation room in the clinic; (b) 3D modelled environment; (c) Motion capture session with two professional actors; (d) Final implementation in Unity.

3.2.2 Motion Capture

We invited two professional actors, one male and one female, to perform scripted interactions using Optitrack Motive and MotionBuilder software. Due to the motion capture system's specific requirements, reflective objects within the capture area interfered with the cameras, necessitating separating body and facial animations during the recording process. We first captured the audio and body movement using Optitrack, then the actors dubbed their facial expressions using Unity's Live Capture system according to the audio. The virtual characters representing the doctor and patient were selected from the Microsoft Rocketbox library. To recreate the scenario, we selected four avatars in total, as shown in Figure 1: the doctor (one male and one female), and the adolescent patient (one male and one female). We used Audacity to adjust the voice tracks recorded from the actors and created gender and age appropriate voice-tracks for the four virtual characters.

To achieve realistic character animations for the virtual consultation scenes, we implemented a multi-stage processing pipeline. The raw motion capture data were carefully refined in the Motive software to optimize movement quality and natural flow. These processed animations were integrated with character models in Motion Builder, utilizing its rigging capabilities to ensure smooth movement transitions.

3.2.3 Unity Development and Passive Perspective-Taking

The final integration process used Unity 2021.3.18.f1c1 to create a real-time controllable VR viewing experience. The VR environment framework was built using Oculus XR and Open XR, with interaction functionality implemented through XR Interaction Toolkit, supporting basic play and pause controls. For character animation, we used Animator for skeletal control, combined with Avatar Mask to separately manage facial, hand, and body animations. To ensure precise synchronization of animations, voice, and environmental sound effects, we utilized Timeline for timeline arrangement, strictly aligning all content components (various animations, voice files, and environmental audio).

For the 3PP condition, participants will be seated away from the two characters, and observe them from a distance. In this case, the participants can move their head freely at 6 degree-of-freedom (6DoF), like in any VR applications. For the Doctor and Patient conditions, however, as we are trying to create perspective-taking from a pre-animated character, ideally participants should be able to follow the viewpoint of the animated head - something we often see in movies or

TV. In VR, unfortunately, this will not only reduce agency (i.e., you feel your head movement out of your control), but also cause simulation sickness. In 360 movies, for example, even when being in the body of someone else (fixed position), participants can still look around freely, having a 3DoF experience. We first tried adapting the 360 degree movies method by updating participants' camera position (i.e., view point) with the avatar's pre-animated head position, giving participants 3DoF to look around. However, this still led to simulation sickness when the avatar has large, sudden movements - something the patient character does often. We also tried completely detach participants' camera position from the pre-animated avatar head, which then led to proprioception mismatch where participants sees their virtual body moves back and forth, when they are staying still.

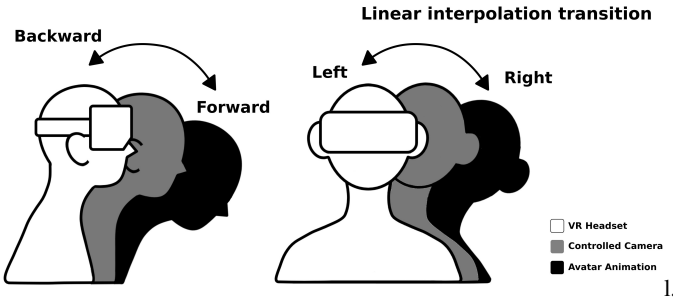

Fig. 4: **Passive-Perspective Taking Design** The black layer shows the pre-recorded head positions from our animated avatar. The white VR Headset layer represents the real head position of participants wearing the VR device. The gray layer, generated in real-time between the two using a LERP function, follows the pre-animated head with a constant speed.

As the main cause of simulation sickness was caused by the instantaneous displacement of the Avatar's head animation (stop-and-go), resulting in discontinuous camera movement, we adopted linear interpolation (LERP) to blend the camera position with the avatar's pre-animated position. Or in other words, the virtual camera position is constantly moving from participants physical position towards the position of the pre-animated head. This allows users to freely adjust their viewing direction (3DoF) while following the avatar's head movement (Figure 4), while avoiding any sudden change of velocity. We chose to use Cinemachine to control camera behavior, first setting the follow target as the Avatar's head object. The Body uses the Transposer method, in "lock to target with world up" mode. Rotation control disables automatic aiming (Aim nothing), enabling 3DoF control so that the users can look around freely. Smooth parameter adjustment of damping parameters were used to make camera movement show an easing effect (X=13.3, Y=13.6, Z=14.6; camera takes roughly 13-14 seconds to reach target position). Test results show that this solution greatly reduces dizziness, making long-time viewing possible.

3.3 Participants

This study involved 60 participants (39 females, 21 males, age mean $\pm$ SE: 28.85 $\pm$ 1.05, range 19 $-$ 58 years; with one participant declining to provide age information) recruited from Goldsmiths, University of London, and the University of Greenwich. Participants were randomly assigned to one of three perspective conditions (Doctor, Patient and Third-person). Ethical approval was granted by the Goldsmiths, University of London Computing Ethics Committee.

Participants were required to meet the following eligibility criteria: a minimum age of 18 years, at least three years of residence in an English-speaking country to ensure comprehension of the VR narrative, and no history of motion sickness. During screening, potential participants received detailed information about the study's duration and procedures. Those who met the eligibility criteria and expressed interest provided informed consent. All participants were advised of their right to withdraw from the study at any time. Upon completing their sessions, participants were debriefed on the research objectives and received a £15 Amazon voucher as compensation for their participation. To minimise extraneous variables, we matched the gender of the avatars to that of the gender identity specified by participants. All our participant identified either as female or male.

Participants were informed during recruitment that the study pertained to schizophrenia. In the pre-questionnaire, participants rated their existing knowledge of schizophrenia on a 5-point scale (1 = Never heard to 5 = Advanced knowledge). The mean $\pm$ SD self-reported knowledge score for the sample was 2.92 $\pm$ 0.78. The distribution of responses showed that the majority of participants rated their knowledge as a 3 (n=27) or 4 (n=16), with fewer selecting a 2 (n=15) or 1 (n=2). No participant reported having advanced knowledge (n=0). Although prior knowledge was not a controlled factor for participant selection, our recruitment with a notable representation of psychology students naturally resulted in a sample where most reported at least a basic level of knowledge. A one-way ANOVA was conducted which found no statistically significant difference between different conditions ($F(2,57) = 2.03$, $p = .141$).

4 Measurements

4.1 Explicit Stigma towards Schizophrenia

Stigma was measured in form of behavioral intentions and explicit attitudes, adapting [2]. Behavioral intentions were measured with the social distance scale, attitudes were measured on four scales: stereotyping, separateness, social restriction, and perceived recovery.

4.1.1 Behavioral Intentions

Behavioral intentions were measured with the social distance scale on six items. The **social distance subscale** assessed participants' willingness to interact with people with schizophrenia in various social contexts. To better suit our participant demographic (i.e., young adults), some items were modified, such as "Would you be willing to allow a child of yours to marry a person with schizophrenia?" changed to "Would you be willing to marry a person with schizophrenia?". The social distance scale demonstrated excellent internal consistency (pre-test α = .904, post-test α = .916). Items were recoded, and mean scores were calculated across items which were scored on a scale from 1 ("strongly disagree") to 4 ("strongly agree"), with higher scores indicating higher desire for social distance (greater stigma).

4.1.2 Explicit Attitudes

Explicit attitudes were measured on four scales, each on a 4-point Likert scale from 1 ("strongly disagree") to 4 ("strongly agree"): stereotyping, separateness, social restriction, and perceived recovery. The **stereotyping subscale** evaluated perceptions about capabilities and behaviors of people with schizophrenia on four items. The items were adapted to use gender-neutral language, from "How able is a person with schizophrenia to make his own decisions about the treatment he should receive?" to "A person with schizophrenia can make their own decisions about the treatment they should receive." The **separateness subscale** measured perceived basic differences between people with schizophrenia and others on four items. The items were adapted from questions to statements to facilitate participants' understanding and response. For example, "When you think of a person with schizophrenia, how different do you think he is from other people?" was addapted to"If you think of a person with schizophrenia, you perceive them as different from others." The **social restriction subscale** evaluate beliefs about limitations that should be placed on the life choices of individuals with schizophrenia regarding marriage, children, and childcare on three items. A representative item from this subscale is "A person with schizophrenia could be trusted to babysit small children." The **perceived recovery subscale** evaluated participants' beliefs about the ability of individuals with schizophrenia to maintain wellness and achieve personal goals on two items. For example, "I believe that a person with schizophrenia has a plan for how to stay well." The social restriction subscale demonstrated good reliability (pre-test α = .729, post-test α = .789). The stereotyping (pre-test α = .668, post-test α = .791) and separateness (pre-test α = .663, post-test α = .859) subscales showed acceptable to good internal consistency. For the perceived

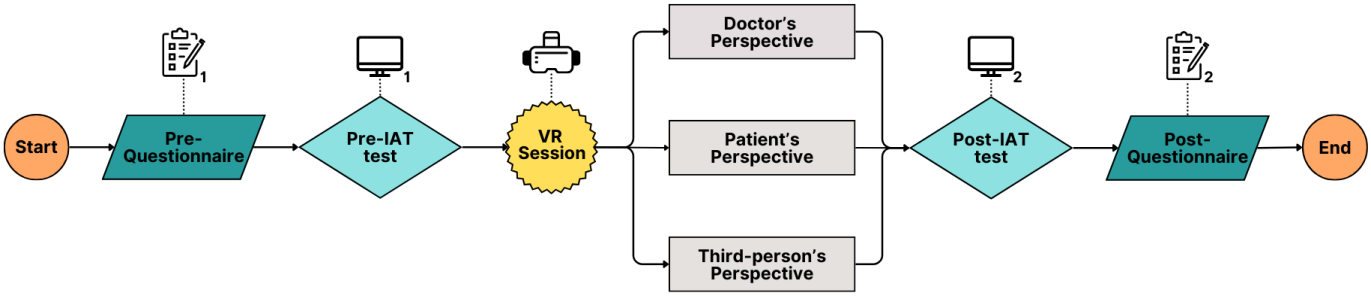

Fig. 5: **Experimental Procedure Flowchart.** The progresses from Pre-Questionnaire and Pre-IAT testing through a VR Session intervention, followed by different perspective evaluation (Doctor's, Patient's, and Third-person's), Post-IAT testing, and concludes with a Post-Questionnaire assessment.

recovery scale, which consisted of two items, correlation between items was large (pre-test r = .681, p < .001, post-test r = .577, p < .001). For each scale, items were recoded so that higher scores mean greater stigma. Scales were computed by the mean of the respective items.

4.2 Intergroup Empathy

Intergroup empathy was measured adapting Davis' Interpersonal Reactivity Index (IRI) [13] and the Group Empathy Index [46]. This scale captured empathic concern and perspective-taking toward individuals with schizophrenia. This 14-item scale comprises two key components: perspective-taking (cognitive) and empathic concern (affective). Perspective-taking items assessed a person's ability to adopt and understand the psychological viewpoint of individuals with schizophrenia, while empathic concern items measured the extent to which a person feels compassion and concern for individuals with schizophrenia.

Each item was rated on a 5-point scale ranging from "does not describe me well at all" to "describes me extremely". Perspective-taking items such as "I try to look at everybody's side of a disagreement (including those of people with schizophrenia) before I make a decision" and "If I were upset at someone with schizophrenia, I usually try to "put myself in their shoes' for a while". Empathic concern items such as "I often have tender, concerned feelings for people with schizophrenia" and "I am often quite touched by things that I see happen to people due to their schizophrenia". This dual measurement allows for a comprehensive evaluation of how different VR perspectives might influence understanding and emotional resonance with individuals with schizophrenia. The perspective-taking subscale showed acceptable internal consistency (pre-test α = .613, post-test α = .716), while the empathic concern subscale had moderate reliability (pre-test α = .570, post-test α = .653). Mean scores were calculated across items, with higher scores indicating greater empathy toward people with schizophrenia.

4.3 Implicit Attitudes

The IAT was used to measure participants' implicit attitudes toward individuals with schizophrenia. Implicit attitudes are often manifested as actions or judgments influenced by automatically activated evaluations without the performer's conscious awareness [20]. Unlike explicit measures that can be influenced by social desirability bias, the IAT provides a more objective measure of unconscious attitudes by measuring response latencies in categorization tasks [32]. This is particularly crucial in mental health research, where participants might consciously modify their responses to appear less prejudiced [38].

We selected the IAT for this study based on its advantages in stigma research. Omori et al. [38] demonstrated that the IAT effectively measures implicit biases related to schizophrenia while avoiding the social desirability bias common in questionnaires. Their study specifically examined whether people unconsciously associate schizophrenia with negative concepts more strongly than with neutral or positive ones. Similarly, Lincoln et al. [30] validated the IAT's ability to detect unconscious biases toward schizophrenia when evaluating antistigma interventions. These capabilities make the IAT particularly suitable for our investigation of how VR perspective-taking might influence implicit attitudes.

In a typical IAT procedure, participants place their fingers on two designated keyboard keys (typically the 'E' key and the 'I' key). They are presented with words or images on screen that belong to different categories. They are instructed to press the left key (E) if the stimulus belongs to one category and the right key (I) if it belongs to another. The test consists of multiple blocks where category pairings are switched, requiring participants to rapidly categorise items while minimising errors. For a detailed illustration of the IAT procedure, see Supplementary Materials, Figure S1.

In this study, we adapted the IAT vocabulary from Omori et al. [38], which contrasted schizophrenia with hypertension (as a physical illness) and compared associations with victim and criminal categories. While Omori's study used this comparison to assess clinical residents' attitudes, we modified it for our VR intervention context to evaluate whether immersive perspective-taking experiences could influence these implicit associations. The stimulus included four words for each category: Hypertension: vessel, sphygmomanometer, antihypertensive, palpitation; Schizophrenia: hallucination, delusion, psychiatry, seclusion; Criminal: violence, jail, murder, theft; Victim: disaster, family, accident, the bereaved.

The IAT was run using Inquisit 6, a specialized software platform for administering psychological tests. The platform enabled accurate measurement of response latencies, which were recorded to assess the strength of implicit associations. Shorter latencies indicated stronger associations between categories. This measurement was conducted both before and after the VR experience to evaluate potential changes in implicit attitudes resulting from different perspective-taking experiences.

To quantify the strength of these implicit associations, the IAT D-score was calculated using the D algorithm. This method is derived from the average difference in response time across trials, where faster responses when two concepts implicitly share a response key indicate stronger associations [20, 38]. Specifically, the D-score reflects the difference in reaction times between incongruent (less associated categories sharing a key) and congruent (implicitly associated concepts paired with congruent attributes) conditions. The D-score itself yields a continuous measure, typically ranging from -2 to +2, representing an estimate of effect size for the strength of automatic association between concepts [32].

5 Experimental Procedure

The entire study lasted 40 minutes, including pre-experiment, VR experience and post-experiment session (Figure 5).

5.1 Pre-Experiment

After screening, participants signed informed consent forms and completed a pre-questionnaire, which includes measures of group empathy toward people with schizophrenia, stigma scales, the Big Five Personality questionnaire, and the Implicit Association Test (IAT).

5.2 VR Experience

The VR experience was delivered via a Quest 3 headset running a Unity-developed environment. Participants were randomly assigned to experience one of the three perspective conditions. The VR scenario developed from professional training videos and real consultation observations, depicted a therapeutic interaction between a doctor and a schizophrenia patient. In the 8-minute scenario, participants experienced a doctor conversing with a patient suffering from schizophrenia in a clinical room. The patient in the scenario is a 17-year-old who, due to a drug overdose, experiences delusions and hallucinations, believing that the government is monitoring him and that everyone around him has been brainwashed. Through the doctor's guidance, the patient gradually relaxes and describes his condition and medication history.

5.3 Post-Experiment

Immediately after the VR experience, participants completed a post-questionnaire that included repeated measures of empathy, stigma, an embodiment questionnaire, and the post-IAT test. The questionnaire data was collected through the Qualtrics platform, while the IAT data was recorded using Inquisit 7 software.

6 Results

We conducted a between-subjects experiment to evaluate the psychological effects of our VR experience, which immerses users in a pre-animated social interaction from one of three perspectives: Doctor, Patient, or Third-person observer. Initially, 62 participants were recruited, but 2 were excluded: one due to reported motion sickness during the VR experience and another due to insufficient English understanding of the VR dialogue despite passing initial screening. Participants (N=60) completed baseline measures of empathy, stigma towards individuals with schizophrenia, and personality traits. They then underwent the VR experience based on their assigned condition, followed by a post-VR assessment of the same constructs and an embodiment questionnaire.

6.1 Explicit Stigma Towards Schizophrenia

6.1.1 Behavioral Intentions

A 2×3 mixed-model ANOVA was conducted to examine the effect of time (pre-test, post-test) and condition (Doctor vs. Patient vs. Third person) on social distance. All assumptions were met with Shapiro-Wilk tests of normality indicating normal distributions in scores across all levels, Levene's test of equality was non-significant indicating equal error variance between groups. A within-subjects effect of time was not significant, $F(1,57) = 0.05$, $p = .824$, $\eta^2 = .001$, suggesting that there was no significant difference in social distance between pre-test and post-test. A between-subjects effect of condition was also not significant, $F(2,57) = 0.15$, $p = .860$, $\eta^2 = .005$, indicating that the assigned conditions did not significantly differ in their overall social distance scores. However, there was a significant interaction between time and condition, $F(2,57) = 6.84$, **p = .002**, $\eta^2 = .194$, suggesting that changes in social distance over time were dependent on the condition. These differential changes in social distance across the three conditions are visually illustrated in Figure 6 (a).

Further simple effect analyses were conducted. To compare changes in social distance between the conditions, a social distance change score was computed by subtracting the pre score from the post score, this meant that a positive change score indicated an increased rating of social distance and a negative change score indicated a decreased rating. Independent-samples t-tests were conducted to compare the social distance change score between the three conditions. The Holm-Sidak procedure was used to correct for multiple comparisons. There was a significant difference in the social distance change score between condition Doctor ($\Delta M = -0.14$, $\Delta SD = 0.30$) and Third person ($\Delta M = 0.19$, $\Delta SD = 0.36$), t(38) = 3.15, **p = .003**, d = 1.00, where the Third person condition increased social distance while the doctor condition decreased it. There was also a significant difference in the social distance change score between the Patient ($\Delta M = -0.03$, $\Delta SD = 0.16$) and Third person ($\Delta M = 0.19$, $\Delta SD = 0.36$), t(26.47) = 2.43, **p = .02**, d = 0.77, conditions, indicating a significant difference in the change between the two conditions where the Third person condition increased social distance while the Patient condition decreased it. There was no significant difference between Doctor and Patient conditions, t(29.36) = 1.52, p = .140, d = 0.48.

6.1.2 Explicit Attitudes

Similar 2×3 mixed-model ANOVAs were conducted to examine the effect of time (pre-test, post-test) and condition (Doctor vs. Patient vs. Third person) on the four explicit attitude scales. Shapiro-Wilk tests of normality indicated that normality was violated for the following levels of each measure: stereotyping: the pre-test patient (p = .011) and 3rd person (p = .011) conditions; separateness the post-test doctor condition (p = .004); social restrictions: both pre and post-test Doctor (p = .002, p = .008) and Patient (p = .013, p = .046) conditions; perceived recovery: pre-test doctor (p = .004) and Patient p = .011) conditions and both pre and post-test 3rd person conditions (p = .002, p = .008). However, ANOVA is considered robust to deviations from normality [36], especially given our sample size. Levene's test of equality was non-significant for stereotyping, separateness, and social restriction but significant for the perceived recovery in the pre-test condition indicating that the assumption of homogeneity was violated. However, given the equal group sizes this was not considered to invalidate the use of ANOVA for this analysis [23]. Here, we present our initial analysis with ANOVA, but also include extra non-parametric tests for significant results.

There were no significant interactions between time and condition, and no significant main effects of condition in any of the scales. There were significant main effects of time for social restriction and perceived recovery. Social restriction increased from pre-test ($M = 1.93$, $SD = 0.53$) to post-test ($M = 2.08$, $SD = 0.62$, $F(1,57) = 5.842$, **p = .019**, $\eta^2 = .093$). Perceived recovery also increased from pre-test ($M = 1.88$, $SD = 0.57$) to post-test ($M = 2.08$, $SD = 0.60$, $F(1,57) = 8.769$, **p = .004**, $\eta^2 = .133$). There were no effects for stereotyping or separateness. As both Social restriction and perceived recovery violated normality, we also conducted non-parametric tests. Wilcoxon signed-rank tests showed similar results, i.e., there was a significant increase in Social restriction ($Z = -2.434$, **p = 0.015**), as well as for Perceived recovery ($Z = -2.771$, **p = 0.006**). The increase in stigmatization for social restriction and perceived recovery across all conditions is depicted in Figure 6 (b) and (c). In sum, the impact of the intervention on social restriction and perceived recovery over time was independent from the condition. Both subscales increased after the intervention, indicating a stronger stigmatization post VR.

6.2 Intergroup Empathy

The same 2×3 mixed-model ANOVAs were conducted to examine the effect of time (pre-test, post-test) and condition (Doctor vs. Patient vs. Third person) on intergroup empathy. Shapiro-Wilk tests of normality indicated that normality was violated only for empathic concern in the post-test 3rd person (p = .024) condition. Levene's test of equality was non-significant for either measure.

There were no significant interactions between time and condition, and no significant main effects of condition. There were significant main effects of time for both perspective-taking and empathic concerns. For perspective-taking, a within-subjects effect of time was significant ($F(1,57) = 8.573$, **p = .005**, $\eta^2 = .131$) indicating that perspective-taking increased from pre-test ($M = 2.99$, $SD = 0.48$) to post-test ($M = 3.13$, $SD = 0.46$). For empathic concern, a within-subjects effect of time was significant ($F(1,57) = 5.832$, **p = .019**, $\eta^2 = .093$), showing that empathic concern increased from pre-test ($M = 2.93$, $SD = 0.49$) to post-test ($M = 3.05$, $SD = 0.47$). As empathic concerns violated normality, we confirmed our results with a Wilcoxon signed-test ($Z = -2.706$, **p = 0.007**). As shown in Figure 6 (d) and (e), both perspective-taking and empathic concern demonstrated a consistent increase from pre-test to post-test across all three conditions. Overall, the impact of the intervention on intergroup empathy showed significant main effects of time on both perspective-taking and empathic concern. Both

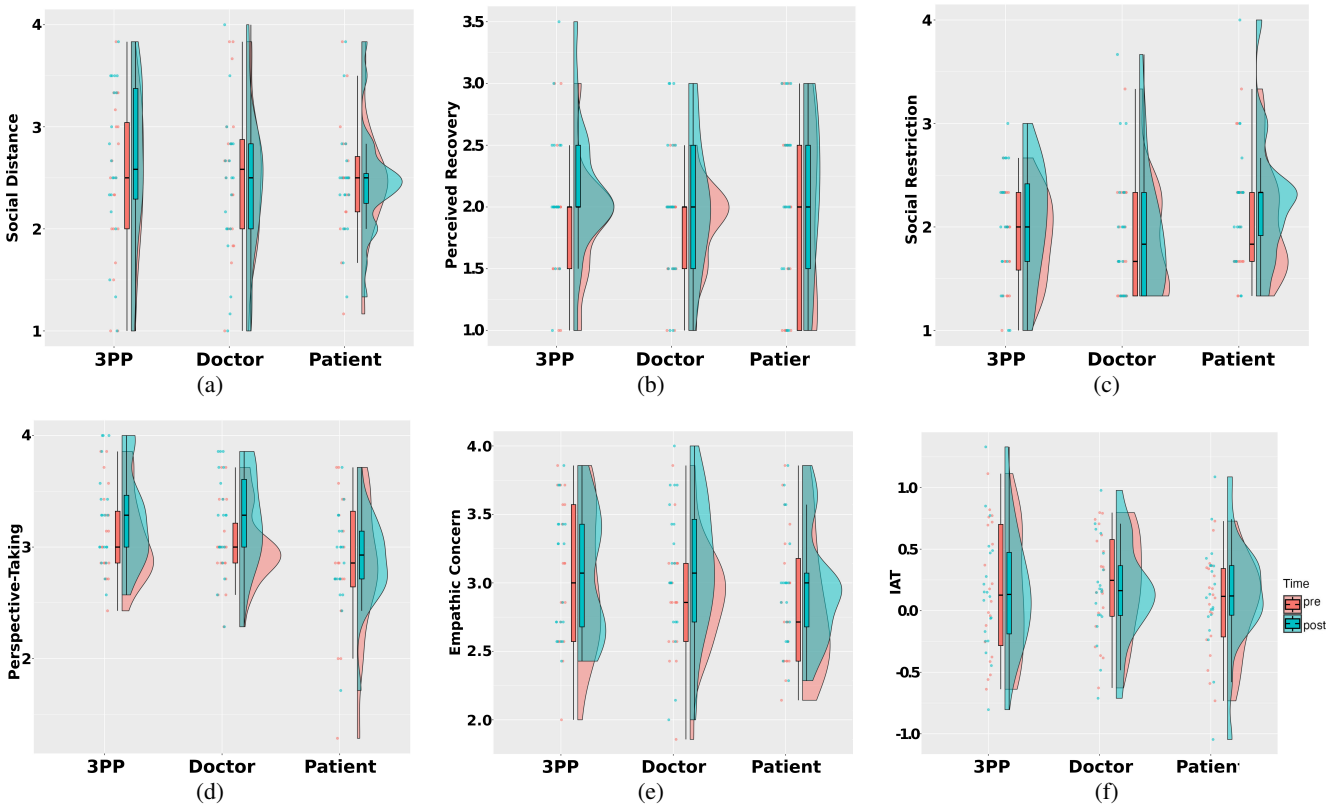

Fig. 6: **Experimental result**. Plots illustrating changes in (a) Social Distance, (b) Perceived Recovery, (c) Social Restriction, (d) Perspective-Taking, (e) Empathic Concern, and (f) IAT across conditions (Third-person, Doctor and Patient) from pre-test (red) to post-test (teal). For the Explicit Stigma subscales (social distance, perceived recovery, and social restriction), high value indicates higher stigmatization; for the Intergroup Empathy subscales (perspective-taking, Empathic Concerns), higher value indicates higher empathy

empathy dimensions increased after the VR intervention regardless of the perspective condition experienced.

6.3 Implicit Attitudes

In the Doctor condition (n = 20), participants showed a pre-test D-score of 0.220 (SD = 0.428) and a post-test D-score of 0.154 (SD = 0.409). In the Patient condition (n = 20), the pre-test D-score was 0.055 (SD = 0.394) and the post-test D-score was 0.127 (SD = 0.453). For participants in the Third-Person condition (n = 20), the pre-test D-score was 0.166 (SD = 0.535) and the post-test D-score was 0.153 (SD = 0.496).

A 2 $\times$ 3 mixed-model ANOVA was conducted to examine the effect of time (pre-test, post-test) and condition (Doctor vs. Patient vs. Third person) on IAT D-scores. All assumptions were met with Shapiro-Wilk tests of normality indicating normal distributions in scores across all levels, Levene's test of equality was non-significant indicating equal error variance between groups. Results showed no significant effect of time, condition, or the interaction between time and condition. The relative stability of implicit attitudes is represented in Figure 6 (f), where the pre-test and post-test IAT D-score distributions show substantial overlap across all conditions, with only minimal shifts that did not reach statistical significance. In sum, implicit attitudes toward schizophrenia as measured by the IAT remained relatively stable across all three perspective conditions.

7 Discussion

This investigation assessed the different effects of various VR intergroup contact formats on participant attitudes regarding individuals with schizophrenia. Our findings indicate that the type of VR perspective experienced by participants differentially shaped their levels of stigma towards individuals with schizophrenia, but only with the behavioral intentions subscale (social distance). Here, the impact of the intervention over time was dependent on the condition: social distance increased after the intervention for the Third person condition, decreased for the Doctor and Patient conditions. This means that after observing the interaction from a Third person perspective, participants expressed a greater desire for social distance from individuals with schizophrenia; while having intergroup contact in form of embodiment in the Doctor or the Patient reduced this desire.

For the other explicit attitudes measures, we found that the intervention had an effect independently of conditions: participants were less likely to think that individuals with schizophrenia can recover after the VR intervention, and more likely to believe they should be socially restricted. Both findings indicated that the intervention itself, regardless of conditions, increased participants' stigmatization towards individuals with schizophrenia.

We posit that the increase in stigma, particularly in the Third-person condition, can be attributed to the experience functioning as a form of negative intergroup contact. Recent advances in contact theory highlight that not all contact reduces prejudice; contact perceived as threatening or involuntary can exacerbate it [43]. Our VR scenario depicted a patient experiencing a severe mental health crisis with erratic and potentially violent, triggering participants' reaction to the perceived threat. This probably made participants' existing stereotypes about people with schizophrenia stronger.

Additionally, although VR has been demonstrated to be effective in reducing stigma in general [45], the case for schizophrenia could be different - some participants came in knowing little about the topic at all, and expressed that they were surprised to find that individuals with schizophrenia could act violently. This is in line with existing literature where a large percentage of nursing undergraduates were found to have concerns over patients with schizophrenia. The only exception to

this increase of stigmatization is when participants took the Doctor's perspective, where they showed more acceptance of those patients in terms of Social Distance. It is also worth noting that viewing it from a Third person perspective is also worse than taking the perspective of the patient.

The interaction observed in social distance but not in other measures reveals an important pattern that merits further explanation. This pattern can be understood through the lens of contact theory, which differentiates between directly experiencing intergroup contact and vicarious contact (observing intergroup contact) [40]. Our findings show a striking contrast: Doctor embodiment (direct contact) led to a decrease in stigma (reduced social distance), , while Third-person observation (vicarious contact) actually increased stigma (greater social distance). This differential effect is particularly interesting considering previous research on attitudes toward mental illness. While vicarious contact has been shown to reduce prejudice in some contexts, our results suggest that for mental illness stigma—particularly the social distance dimension—mere observation may emphasize the "otherness" of individuals with schizophrenia, thereby increasing psychological distance rather than bridging it. Future research should consider measuring contact quality in the VR experience to understand whether the VR experience was positive or negative.

For our Intergroup Empathy measurements, our results are in line with the existing literature showing that the sense of presence and immersion in VR within a situation relevant to the stigmatized group increases empathy [12]. Participants indicated that they were more willing to "put myself in their shoes." However, it is important to note that this did not then lead to direct attitude change towards stigmatization. This maybe can be explained by Leon Festinger's theory of cognitive dissonance [17]. The theory suggests that holding psychologically inconsistent cognitions—such as feeling empathy for a person while also perceiving them as a threat—creates an uncomfortable state of dissonance. To resolve this discomfort, individuals are motivated to alter their beliefs which has led to an overall increase of explicit stigma towards schizophrenia, with the exception of an decrease for behavioral intentions only when they were embodied as the Doctor or the Patient.

In terms of our Implicit IAT result, our findings are consistent with literature on VR-based interventions for stigma reduction. Our null finding on the IAT is consistent with the systematic review by Tassinari et al. [49], which noted that VR interventions frequently affect explicit attitudes without altering implicit bias, and that a strong correlation between the two is not typically expected [48]. This is because explicit and implicit attitudes are widely considered to be distinct psychological constructs, and that brief, single-exposure experiences may be insufficient to modify deeply ingrained automatic associations.

Overall, our findings partially support our **H1** with evidence that virtual social contact with a patient while embodying the doctor decreased social distance while vicarious observation of the session increased social distance. However, we also found that some measures of stigmatizing attitudes, i.e. perceived recovery and social restriction increased across all conditions.

Similarly, our **H2** is also partially supported. Viewing the interaction from the Doctor's perspective may be is significantly more effective in bias reduction than taking the Third-person's view.

8 Limitations

First, a significant portion of our data relies on self-report measures. While we included the IAT to capture implicit attitudes, our measures of stigma and empathy are susceptible to demand characteristics, where participants may infer the study's hypotheses and adjust their responses accordingly [39]. The observed increases in empathy, though consistent with our expectations, may reflect participants' attempts to be a "good participant" rather than genuine attitude change. Future research should incorporate more objective measures to validate these self-reported changes, such as physiological and behavioral measurements.

Second, our findings are based on the immediate effects of a single VR session. In line with intergroup contact theory [42], while a single encounter can successfully initiate processes like empathy, more substantial and lasting attitude change often requires time and repeated positive interactions. Future longitudinal research should examine whether repeated VR exposure produces more substantial stigma reduction.

Last but not least, there could be potential ethical issues by putting participants in a realistic simulation of mental illness conditions. For instance, one participant was moved to tears, sharing that their twin sister has schizophrenia and that the experience was an exact reflection of the reality. They expressed that the VR simulation allowed them for the first time, to truly comprehend the depth of their sister's suffering. Although this participant in particular expressed their appreciation for the VR experience, it might trigger stress or anxiety for others. Future studies should consider implement more rigorous pre-screening to mitigate potential psychological distress for potentially vulnerable individuals.

9 Conclusion

This study investigated the impact of different forms of perspective taking during intergroup contact in VR on implicit and explicit stigma toward schizophrenia. Through an experiment comparing Doctor, Patient, and Third-person perspectives in a virtual clinical consultation, we found that the VR contact conditions differentially influenced participants' explicit stigma toward people with schizophrenia.

Our findings show that the type of perspective experienced significantly impacted social distance, with Third-person observation unexpectedly increasing social distance (increasing stigma), Doctor and Patient embodiment decreasing it. Additionally, independent of the VR contact condition, the intervention enhanced intergroup empathy.

We also found an increase in stigmatization in other explicit attitude measurements. This could be due to the fact that our VR experience could be considered negative by many participants not familiar with symptoms of schizophrenia and that the intergroup contact experience was of low quality. A similar increase in bias after a negative VR experience has been shown in [3]. This highlights the importance of understanding the impact of VR experiences with appropriate measurements: some scenarios, while effective at increasing empathy, could at the same time be introducing other undesirable negative effects such as increasing stigmatization.

To answer our Research Question—*Can VR interventions based on different forms of intergroup contact reduce explicit and implicit mental health stigma?*—we found no evidence that our VR intervention reduced implicit stigma. However, our findings allowed us to explore the complex ways in which different forms of perspective-taking can influence participants explicit bias. In real-life, bias and stigma are complex psychological construct influenced by many factors, and the deployment of VR to address these issues is similarly nuanced and variable. We hope our results provide useful insights for future researchers seeking to use VR as a tool to address issues that are important to society.

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