Role-Exchange Playing: An Exploration of Role-Playing Effects for Anti-Bullying in Immersive Virtual Environments

Xiang Gu, Sheng Li*, Member, IEEE, Kangrui Yi, Xiaojuan Yang, Huiling Liu, Guoping Wang

Abstract—Role-playing is widely used in many areas, such as psychotherapy and behavior change. However, few studies have explored the possible effects of playing multiple roles in a single role-playing process. We propose a new role-playing paradigm, called role-exchange playing, in which a user plays two opposite roles successively in the same simulated event for better cognitive enhancement. We designed an experiment with this novel role-exchange playing strategy in the immersive virtual environments; and school bullying was chosen as a scenario in this case. A total of 234 middle/high school students were enrolled in the mixed-design experiment. From the user study, we found that through role-exchange, students developed more morally correct opinions about bullying, as well as increased empathy and willingness to engage in supportive behavior. They also showed increased commitment to stopping bullying others. Our role-exchange paradigm could achieve a better effect than traditional role-playing methods in situations where participants have no prior experience associated with the roles they play. Therefore, using role-exchange playing in the immersive virtual environments to educate minors can help prevent them from bullying others in the real world. Our study indicates a positive significance in moral education of teenagers. Our role-exchange playing may have the potential to be extended to such applications as counseling, therapy, and crime prevention.

Index Terms—Role-exchange, role-playing, role reversal, anti-bullying, minor education, virtual reality

1 INTRODUCTION

CHOOL bullying is a very serious social problem. School **D** bullying has been reported all around the world, including America, Europe, and Asia [1], [2]. Lebrun-Harris et al. conducted a survey of 20,560 students aged 6-17 in the U.S.A in 2016. The results showed that 22.7% of the students were bullied and 6.4% of them bullied others in the past year [1]. Kyriacou et al. surveyed more than 400 college students in the United Kingdom, Greece, and Norway, and the results showed that a considerable proportion of the students believed that campus bullying was a serious problem on their campuses, and that anyone could become a victim of campus bullying [2]. A survey was conducted with 29,268 students, ranging from primary to secondary schools, in Zhejiang Province, China, in 2018. The results showed that 6,796 students had been bullied on campus, accounting for 23.2% of the total; 3803 students had committed bullying on campus, accounting for 12.9% of the total [3]. Various communities from education, law, and psychology have made great efforts to address this issue.

In order to reduce school bullying, many solutions had been proposed from different aspects, including training all adults who come in contact with students [4], [5], teaching bullies how to resolve conflicts [6], increasing students'

* Sheng Li is the corresponding author

- E-mail: {gu.xiang | lisheng | yikangrui | wgp}@pku.edu.cn.
 Xiaojuan Yang is at Shandong Normal University, China. Email: yxjuan08@126.com
- Huiling Liu is at Peking University, China, and Lamar University, USA. Email: hliu3@lamar.edu

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empathy [7], etc. Media-related computer systems were employed for anti-bullying [8], [9], [10], especially virtual reality systems. However, these systems generally focus on developing participants' skills to stop bullying (e.g., giving advice to the victim and helping resolve bullying) rather than moral education that can eliminate their bullying motivation or impulse in the bud. Therefore, we propose a novel approach using immersive virtual reality (VR) technology to help solve this severe problem. Unlike the aforementioned works, we pay particular attention to deepening the students' morally correct understanding of bullying and promoting prosocial behavior in the fight against bullying.

VR technology has shown its potential in areas such as reducing prejudice, promoting empathy, and altering attitudes and even beliefs through role-playing [11], [12], [13], [14], [15], [16]. A variety of roles were designed for different purposes and expected to produce corresponding effects. These designs include the Black role for white people to reduce prejudice against Black people [12], the female role suffering intimate partner violence for the batterer to rehabilitate [17], the colorblind role in promoting helpful behaviors for people with color blindness [18], etc. Generally, a participant only plays one specific role in such systems. Through immersive virtual reality experiences, users can convert themselves to their virtual roles and gain corresponding feelings [19]. Although role-playing in VR has shown to be effective in improving cognition, experiencing only one role does not guarantee to yield positive effects. It may even lead to adverse effects than expected [20].

Role reversal strategy was typically employed in psychodrama therapy [21], making the users switch from their actual role in society (such as identity, position, job, status,

[•] Xiang Gu, Sheng Li, Kangrui Yi, Guoping Wang are at Peking University, China.



(a) Paradigm of our role-exchange study

(b) Role playing

Fig. 1: (a) By role-playing in the immersive VEs, the cognition about bullying can be improved, as evidenced by an increased tendency to anti-bullying. Participants in B2V and V2B groups play both bully and victim roles with exchange but in different orders; the participants in group 1PP play victim only; the participants in 3PP group play bystander role. (b) Snapshot of the user playing a role using the VR suite.

etc.) to another role opposite to this role. For example, an employer, in reality, should play the employee role during the therapy. This strategy can help a person 'gain insight to themselves or another' and 'deepen their emotional experience' [22]. Inspired by role reversal, we try to explore whether two opposite roles played by one user can have a better effect on cognition or psychology issues than the traditional role-playing paradigm or not. We hypothesize that allowing users to play two opposite roles in a single role-playing procedure can better deal with the same issues.

Based on the analysis above, we propose a novel roleplaying paradigm called *role-exchange* that a user plays two opposite roles successively in the same event, so that they can obtain a more comprehensive and profound sense from the roles they played. Unlike role reversal [21], which makes participants first identify their actual role in the real world and then play the opposite role in the virtual world, our role-exchange playing requires users to experience two opposite roles in a VR system, regardless of their actual roles in the real world. Furthermore, role reversal was used to demonstrate intrapersonal conflicts [21], whereas role-exchange may contribute to developing one's morally correct view or promoting prosocial behavior in a broad sense. We use school bullying as the case study to verify our hypothesis about the role-exchange paradigm and use a VR simulated system with role-exchange playing for the expectation of a positive effect on anti-bullying.

To discover the effect of role-exchange playing in immersive VR and its positive effects on improving cognition of bullying, a participant would play both bully and victim roles during the role-playing in our experiment design. A single victim role and a single bystander role were introduced as the control groups [17]. By role-exchange playing, we expect the students to develop a legally and morally correct understanding of campus bullying and strengthen their empathy and sense of justice for victims in campus bullying incidents. Overall, our main contributions are summarized as:

- We propose a novel role-exchange playing paradigm that a user plays two opposite roles within the same virtual social scenario. Using bullying as a case, we find that the role-exchange paradigm works significantly better than traditional role-playing in regard to anti-bullying education. We further find that different orders of exchange have no significant effect on the results. Moreover, our role-exchange paradigm has the potential to contribute to other role-playing programs with opposite roles, such as anti-discrimination, anti-violence, etc.
- We develop an anti-bullying system with roleexchange play in the bullying scenario in the immersive virtual environments and conduct an intensive user study with hundreds of school students involved. Specifically, student participants developed more morally correct opinions about bullying. They showed increased commitment to stop bullying others, increased empathy for the victims, and more willingness to engage in supportive behavior.
- To the best of our knowledge, our method is the first to use virtual reality technology to conduct moral education and prevention on school bullying.

2 RELATED WORKS

2.1 Virtual Reality Exposure

Virtual reality technology has made great progress in various fields, including education [23], training [24], games, entertainment, and social networking [23], especially psychological treatment [25] like anxiety disorders, acrophobia, etc. Virtual reality can be used as an exposure technique for treatment, and it has higher accessibility over traditional in vivo treatment [26] due to its low-cost and lowrisk characteristics [27]. In principle, virtual environments could dynamically and exquisitely alter the stimuli variables that are hard to control readily in the real world, such as distractions and stimulus load [28], and bring a safe and stable experience. Besides, computer-controlled environments with varying inputs can be adapted to evoke different levels of emotion [29].

Regarding presence in the immersive environments, a general conclusion is that the level of presence is positively correlated to the treatment outcome [30]. In general, place illusion (PI) and plausibility illusion (Psi) [31] are treated as the key components of presence. PI is the illusion of being there, while Psi refers to the illusion what happens in the virtual scenarios really occurs. When both PI and Psi occur, players will respond realistically in the virtual scenario [31], contributing to a good treatment outcome. Besides, a virtual avatar substitute, at least partly, the player's real body. The VR systems track body movements and display the scene as if the virtual avatar is your own body [32]. The correspondence between the virtual avatar and the real body can bring users the sense of embodiment (SoE) [33]. SoE will emerge when users process the physical properties of the avatar as the properties of their own biological bodies.

In addition to anxiety disorders, virtual reality system through role-playing is used to improve cognition. In medical education, the VR system enhanced medical students' empathy [34], [35]. Virtual reality helped educate female college students about sexual coercion and rape-resistance skills [36]. When offenders were embodied in a female victim whom a man verbally abused, they would have a better ability to recognize fear in female faces [37]. When participants were embodied in Black virtual bodies and interacted with other virtual characters, they would show decreased implicit bias and more empathy for Black people [12], [38], [39]. Embodying in older avatars made participants walk significantly slower than either young avatar or control group participants because of the Proteus effect [40], [41]. Embodying in male avatars would buffer women participants from experiencing gender stereotype threats [42], [43]. Overall, immersive virtual reality has shown its potential in modulating sociocognitive processes [17].

2.2 Role-Playing Functions

As role-playing is so widely employed in virtual reality, an important question is how it works and how it can be more effective. Role-playing is an experiential learning strategy, encouraging individuals to reflect on their knowledge and use appropriate responses as defined by their roles [44]. It helps individuals change their attitudes by perspectivetaking. Virtual reality enables individuals 'to understand how a situation appears to another person and how that person is reacting cognitively and emotionally' [45].

Many experiments have been conducted based on roleplaying theories [46], [47]. However, traditional classroom role-play has restrictions. For example, it may be difficult for classmates to engage in new roles due to their familiarity with each other [48]. Also, all participants must be very familiar with and understand what they played to complete the role-play successfully [48]. Fortunately, with the help of virtual reality, the players can safely experience the scenarios repeatedly and get immediate feedback without facing or cooperating with real people. In summary, role-playing in virtual reality is cost-efficient and user-friendly [44], making it easier for players to get used to the role. Also, virtual reality can induce body-swap illusion [42], help users commit to the role, and finally promote the perspectivetaking process [49]. In addition, self-illusion may arise [19] when the players play roles that differ from themselves in the real world. With a high-level self-illusion, the players mentally perceive themselves as the role and act from this role's perspective.

The selection of perspective associated with a role is important because the perspective from which participants experience the virtual scenario can subsequently affect their perceived realness [17] and the outcome of role play. When virtual reality is used to rehabilitate abusers by asking participants to play from the body of the female victim role (i.e., first-person perspective, abbr. as 1PP condition) or the observer role (i.e., third-person perspective, abbr. as 3PP condition), 1PP tends to evoke greater physiological responses [17], [50]. Overall, compared to third-person perspective, first-person perspective 'facilitates taking the scene personally' [17] and is critical for 'triggering the illusion of full-body ownership' [51].

Role-playing generally involves identifying the role that a person plays. The process of identification forces one to take the perspective of another person. According to cognitive dissonance theory, one's behavior or attitude will change if he experiences enough discord or dissatisfaction [52]. Taking the bullying scenario as an example, if we expect the participants to be more sympathetic to victims and more willing to support them, we should ask them to play the victim role and experience enough dissatisfaction. That's why many studies have chosen 1PP to help change implicit attitudes and thereby reduce bullying behaviors [52], [53].

Simply playing from a first-person perspective while not experiencing the discord or dissatisfaction may have the opposite effect because of the stereotype activation effect [20]. The stereotype activation effect refers to the fact that stereotypes are automatically and unintentionally 'activated upon encountering with individual members of stereotyped groups' [54]. It was found that participants embodied in Black demonstrated increased implicit racial bias favoring Whites than those embodied in White [20]. Since the participants just observed their avatars from the mirror in the virtual environments for only 60 – 75 secs and experienced no dissatisfaction, the stereotype activation overwhelmed any positive effects of perspective-taking, leading to greater racial bias. However, other studies reported reduced implicit racial bias when participants embodied in Black with much longer duration [55] or fully explored and experienced their virtual Black bodies [12].

2.3 Role Reversal

What will happen when participants experience different perspectives is worth investigating. In psychodrama therapy, role reversal is often used, which can show one's intrapersonal conflicts [21]. For example, when playing the role of the wife, the husband participant can observe his performance from the wife's perspective. In addition, due to the multi-perspective nature of role reversal, it is now often used to intervene and improve people's psychological conditions. A typical application is the treatment of patients with Social Anxiety Disorder (SAD) [56], [57]. People with social anxious disorder have a negative self-image. Role reversal enables them to view themselves from others' perspectives, which may help correct their distorted negative self-image [56], [57]. H. Abeditehran et al. attempted to quantitatively reveal the effect of role reversal on negative cognition for patients with Social Anxiety Disorder [57]. Role reversal appears to have 'a stronger effect on negative cognition than role-playing' [57]. However, this conclusion was based on a less rigorous condition that the control group and role reversal group are not statistically equivalent before role reversal.

In most conditions, role reversal refers to the process that people 'move out of their own position or role into the significant other's position and enact that role' [21]. Role reversal helps resolve conflict within a group or helps participants better understand another person. By contrast, in our work, the participants do not have to be a bully or a victim ever before. They experience these two opposite roles in this process, and we expect the changes in their understandings of bullying and attitude towards the bullying incident. Based on the above analysis, we call our process *role-exchange* to emphasize its different role-playing procedures and possible different effects.

2.4 Bullying Prevention

From the pedagogical aspect, a few studies were conducted to help bullies learn reasonable ways to resolve interpersonal conflicts so that they stop resorting to violence. A representative way is conflict resolution training [6], which guides students to understand interpersonal conflict and realize the dangers of aggressive behavior. Different roles are also employed in bullying intervention programs. For example, in the 'Bullying Prevention Pack', students were asked to play the defenders by reporting bullying or directly intervening, and 'Confident Behaviours Exercise' was conducted to help students become better defenders [58].

Recently, bystander education received more attention. The bystanders generally make up the majority of those involved in bullying incidents. Research shows that bystander intervention can greatly influence bullying behavior [59]. And peer support is more effective than direct intervention from adults in creating a cooperative community [60]. Existing research focuses on bystanders' awareness of protecting the vulnerable and strengthening their ability to protect them. To help the victim, the bystanders do not necessarily have to 'stand up' to bullies. Simple actions such as comforting afterward can also bring relief to victims [59]. However, VR-based role-playing for bullying prevention has not been studied, and different roles (e.g., bystanders, and victims) should be considered and designed carefully.

3 Method

An overview of our role-exchange study is illustrated in Figure 1. The user plays the role of bully&victim, or victim only, or bystander only within an immersive virtual environment, and behaves consistently with the roles' characteristics. The TABLE 1: Four groups for between-group experiment.

Group	Num. of Participants	Role Experienced
B2V	54	bully \longrightarrow victim
V2B	54	victim \rightarrow bully
1PP	51	victim
3PP	55	bystander

user can interact with the virtual role and environments with the help of the VR apparatus. In our method, we propose a process of role-exchange playing in the virtual environment to analyze the resultant effect of changing individuals' cognition and attitudes toward bullying and strengthening their willingness to help victims.

3.1 Design

A between-group experiment is designed to determine the functions of different role-playing strategies on cognition improvement. Four groups, including B2V, V2B, 1PP, and 3PP, were designed, and each participant was randomly assigned to one of these groups and performed role playing, as shown in Table 1. Participants in the former two groups (B2V and V2B) experience role exchange but in a different order. Participants in the latter two groups (1PP and 3PP) will not perform role exchange, these two serve as the control groups.

Based on this design, we present two hypotheses:

Hypothesis 1: The role-exchange playing between the bully and the victim, i.e., B2V and V2B groups, can improve users' cognition about bullying and promote supportive behaviors.

Hypothesis 2: The effect of role-exchange playing is greater than that of 1PP and 3PP groups.

3.2 Role Behavior and Experiment Scenario

There are three perspectives from which participants can experience associated roles in the immersive virtual environments: the bully's perspective, the victim's perspective, and the bystander's perspective. When playing a specific role in our VR system, each participant should experience two bullying scenarios: first the classroom and next the restroom, in a fixed order. The player can interact with the virtual role and environments when role playing. Specifically, the agent controls the simulated virtual role in the virtual bullying scenario, where the players can move their arms and head naturally for interaction, and their avatars move accordingly unless otherwise stated. The virtual role is kept a fixed distance from the user to avoid visual artifacts caused by 3D model penetration in our simulation system.

3.2.1 Bully's Perspective

Classroom scenario: A virtual victim crouches on the ground in the classroom, and next to him stand two bystanders who are inciting the bullying behavior. Following the instructions shown on the HMD, the participant is asked to insult the victim behind a table verbally. The participant can smash all the stuff on the table and can throw this stuff at the victim using the controller, as shown in Figure 2(a) and Figure 3. When the participants engage in these bullying actions, they will notice that the simulated victim is



(a) Bully's view in the classroom (b) Bully's view in the restroom



(c) Victim's view in the class- (d) Victim's view in the restroom room



(e) Bystander's view in the class- (f) Bystander's view in the reroom stroom

Fig. 2: Different roles played by the participants in the simulated virtual bullying incidents in different locations of campus (left: in the classroom, right: in the restroom).

terrified and tries to evade. It will end when a participant completes this bullying or when this procedure exceeds the exposure time limit (\sim 90 seconds).

Restroom scenario: A virtual victim stands in the restroom corner, terrified. Three booing bystanders stand behind the bully role played by the participant. The participant is asked to attack the victim by manipulating the controller. The participants can punch and kick the victim in any way they like. The virtual victim would curl up in the corner as the bullying continues and make painful crying (see Figure 2(b)). It will end when a participant completes this bullying or when this procedure exceeds the exposure time limit (~90 seconds).

3.2.2 Victim's Perspective

Classroom scenario: A virtual bully kicks the victim played by the participant, then spits on the victim's glasses and abuses the victim repeatedly. When the bully spits, a piece of disgusting saliva will appear in the field of view, causing



Fig. 3: Snapshot of classroom bullying: the 'bully' uses the controller to grab some stuff and throw them at the victim.

the participant blurred vision. As informed in advance, the participants cannot react to the bullying behavior and they should endure this insult from the virtual bully (see Figure 2(c)). Several virtual bystanders surround the victim in this scenario, watching and making catcalls. It will end when the virtual bully finishes abusing according to a predefined script (\sim 60 seconds).

Restroom scenario: A virtual bully launches the physical attack on the victim played by the participant. The victim's virtual glasses will be broken during this process. As informed in advance, the participants will see this bully keep attacking themselves but should not react to the bullying actions (see Figure 2(d)), like fighting back. The participant can hear two bystanders standing behind the bully applauding this bullying behavior. It will end when the virtual bully finishes this attack according to a pre-defined script (~ 60 seconds).

3.2.3 Bystander's Perspective

Classroom scenario: The participant watches the entire process from the third-person perspective without any actions allowed. In this scenario, virtual bully and victim are simulated to act according to a fixed script. The virtual bully ferociously walks up to the virtual victim, scolding him repeatedly and spitting on the victim's face. This stage ends when the pre-defined script ends (~ 60 seconds).

Restroom scenario: The participant watches the entire process from the third-person perspective without any actions allowed. In this scenario, the virtual bully pushes the victim into a corner and perform physically attacks that eventually knocks the victim down. The virtual victim is powerless to resist. The participant can hear several bystanders standing behind the bully booing about this bullying. The stage ends when the pre-defined script ends (\sim 60 seconds).

Generally speaking, our system addresses two types of bullying: verbal bullying and physical bullying. In the system, we provide a variety of roles that may appear in real-life bullying incidents, which can help participants experience the bullying scenario from different perspectives, thereby affecting their cognition on bullying. We show different views when the participants play bully, victim, and bystander, respectively, in Figure 2. In each bullying scenario described above, the duration of exposure is decided by a pre-experiment. During an experiment, the participants can actively request to stop and then withdraw. This only happened to two students throughout the experiment.

4 USER STUDY

This study was approved by the ethics committee in our university. According to the law on the Education and Protection of Minors of our country, the middle/high school, as the main legal entity, exercises de facto guardianship for students during their stay in school. This VR-based experiment was part of the experimental course of moral and legal education for middle/high school students, which passed the review of the committee of teaching affairs department. The administrators and committee of the participating schools clearly understood the process, media content, format, and purpose of this experiment. That is, our study was endorsed by the guardian. Besides, to protect the privacy of minors, all student participants are anonymous.

4.1 Apparatus

The apparatus used in the experiments is HTC Vive (immersive VR headset with controllers for user interaction, FOV: 110° horizontal and vertical, resolution: 1080×1200 per eye). The VR headset and controllers track user's head and hands movements, respectively. Our anti-bullying system is developed on Unity (2018.3.8f1), and the system runs on Win10 operating system.

4.2 Dependent Variables

We introduce two questionnaires, *Bullying Questionnaire* and *Virtual Reality Experience Questionnaire*, to compare the effects of different role-playing strategies. A header in each questionnaire collects participants' demographic information, including age, gender, whether they have ever bullied others, and whether they have seen any bullying situations (see the appendix).

4.2.1 Bullying Questionnaire

We created an original bullying questionnaire based on the programmatic guidance on teenage education and protection of our country. In this Questionnaire, we first examine participants' understanding of the bullying and its associated harm because forming a moral belief that bullying is wrong can facilitate bystanders' intervention to stop ongoing bullying [61]. In addition, we examine their empathy and willingness to engage in supportive behavior when faced with a bullying incident. This 7-point Likert scale questionnaire is listed in the appendix. Participants' cognition on bullying is studied using a mixed design, i.e., participants fill out Bullying Questionnaire twice (before and after role-playing) and we examines changes of each group before and after role-playing.

4.2.2 Virtual Reality Experience Questionnaire

After completing the questionnaire concerning cognition on bullying (post-test), participants were asked to fill out a questionnaire to evaluate the subjective experience during the entire VR process. This questionnaire was adapted from C. Gonzalez-Liencres et al. [17] with a 7-point Likert scale wherein 1 indicates 'extremely small extent' and 7 indicates 'extremely large extent'. The Virtual Reality Experience Questionnaire comprised questions related to the self-illusion [19], scene realism, plausibility illusion [62], immersion, feeling one's own avatar's emotion (emotion), feeling other avatars' emotion (empathy), the difference between this method and television (TV), and 'the potential of gaining a new perspective' (different view). A complete questionnaire is presented in the appendix. Participants' experience is studied using a between-group design, and we examines differences across four groups.

4.3 Participants

A total of 234 Chinese students were enrolled in our study, of which 125 are from a middle school, and 109 are from a high school. Basically, around 5 students were randomly selected from a class for diversity, aging from 13 - 18 (M = 15.32, SD = 1.46). Each of the selected students was informed that they would experience the virtual bullying scenario using the VR device, but they did not learn the purpose of our experiment. According to our experiment information provided, each student had the right/freedom to decide whether to withdraw from this experiment or not. The students could not proceed to the experiment procedure unless we got verbal assent from them. No written assent was required because each student was anonymous. All participants assented to participate in this bullying-related study. At last, twenty samples were excluded due to either dropouts halfway or outliers beyond +/- 3 standard deviations from the mean. Eventually, data collected from 214 participants was valid and would be used in the statistical analysis, of which 7 students reported having bullied others before, 70 reported having witnessed school bullying incident before. All the participants had watched violent bullying scenarios on the TV, video, or other digital media before. Specifically, 54 students were assigned to the B2V group (29 male, 25 female), 54 students were assigned to the V2B group (26 male, 28 female), 51 students were assigned to the 1PP group (17 male, 34 female), and 55 students were assigned to the 3PP group (42 male, 13 female).

4.4 Procedure

The experiment was performed as the following procedures. All forms and questionnaires were presented to the participants in Chinese (participants' native language), as well as the instructions, context of situation, and interaction interface in the VR system during the experiment. All participants acknowledged that they understood the meaning.

1. The participants confirmed their willingness to participate or not in the experiment after they learned our bullying-related role-playing. All participants were blind to the purpose of our experiment.

2. The experimenters then asked the participants to complete the pre-test Bullying Questionnaire (including de-mographic form, as stated in Section 4.2).

3. The participants mounted the VR HMD and performed a routine VR calibration process, and then learned to use the VR system smoothly. Both male and female participants observed their avatars through a mirror placed in the school toilet according to their assigned roles, as shown in Figure 4. Participants were instructed to embody the virtual



Fig. 4: Different roles' avatars used in the experiment. All are male avatars without gender difference. Participants observe their avatars from the mirror.

body by free upper body and upper limb movements. This procedure would last as long as the participants needed. We designed this process of aligning users with avatars to help participants gain the sense of embodiment [33].

4. The scene transitioned to the bullying incident scenario and the participants experienced specific perspective(s) according to Table 1. Throughout the experiment, the participants can see their virtual hands and bodies when performing interactions, and their physical movements are restricted to a small area (around $1 m^2$).

5. The participants performed the corresponding roleplaying, as described in Section 3.2, according to their assigned group, as described in Section 3.1.

6. The participants unmounted the VR device, and they were asked to complete the post-test Bullying Questionnaire and then completed the Virtual Reality Experience Questionnaire.

The experimenters, professional psychological counselor, and class head teachers were ready and would help pacify the minor participants if any emotional fluctuation was found after the experiment. In fact, no signs of emotional abnormality were found. After the experiment, all participants would go through an observation period guarded by their class headteachers. Notably, the participants completed all questionnaires anonymously using a tablet. No one stood by these student participants as they filled out the questionnaires, and they need not worry about their information being spied on or leaked. In this way, the answers to the questionnaires will not be biased.

5 RESULT

During the experiment, we collected Bullying Questionnaire scores (pre/post test) and Virtual Reality Experience Questionnaire score. Bullying Questionnaire statistics were analyzed using repeated measures ANOVA (analysis of variance), while Virtual Reality Questionnaire statistics were analyzed using one-way ANOVA. Statistical significance was set at p < 0.05 in general. We also conducted a demographics analysis for the possible effect of gender differences. We present our results and evaluate them on the following three components below.

5.1 Structure of Bullying Questionnaire

The reliability of the entire questionnaire is sufficiently high (*Cronbach's* α = 0.925). To disclose the underlying structure

of this Bullying Questionnaire, we conducted exploratory factor analysis (EFA). Three factors, accounting for 53.089% of the variance, were extracted. As shown in Table 2, Q(10) \sim Q(23) are associated with factor 1; Q(1), Q(3), Q(4), Q(6), Q(7), and Q(8) are associated with factor 2; Q(2), Q(5), and Q(9) are associated with factor 3. For convenience, we named factor 1 'Responses' (emphasizing one's emotional and behavioral responses towards bullying, e.g., empathy and willingness to engage in supportive behaviors), named factor 2 'Opinions' (emphasizing one's subjective opinions about bullying), and named factor 3 'Commitments' (emphasizing the commitment to stopping bullying others in the future). In the follow-up analysis, we use the average score of each separate item group as the score on corresponding factor.

TABLE 2: EFA of the bullying cognition sub-scale (absolute value of correlation coefficients < .4 excluded)

Component	Factor 1 Responses	Factor 2 Opinions	Factor 3 Commitments
O(1)		0.582	
$\widetilde{Q}(2)$			0.854
Q(3)		0.742	
Q(4)		0.758	
Q(5)			0.847
Q(6)		0.733	
Q(7)		0.708	
Q(8)		0.493	
Q(9)			0.735
Q(10)	0.671		
Q(11)	0.632		
Q(12)	0.776		
Q(13)	0.637		
Q(14)	0.470		
Q(15)	0.696		
Q(16)	0.580		
Q(17)	0.631		
Q(18)	0.728		
Q(19)	0.587		
Q(20)	0.524		
Q(21)	0.619		
Q(22)	0.704		
Q(23)	0.556		
Variance explained (%)	26.203	16.228	10.658

5.2 Bullying Questionnaire

5.2.1 Gender Analysis

Considering that gender difference may affect the results from different role-playing strategies, we firstly performed ANCOVA (Analysis of covariance) using gender as a covariate. We used **pre/post** to indicate before role-playing and after role-playing.

On factor 'Responses', gender shows neither significant main effect (p = .190) nor significant interaction effect (**pre/post** × **gender**, p = .726). On factor 'Opinions', gender shows neither significant main effect (p = .153) nor significant interaction effect (p = .962). On factor 'Commitment', gender shows neither significant main effect (p = .682) nor significant interaction effect (p = .344). Furthermore, gender has already been demonstrated not an essential factor in the literature about anti-bullying [63], [64]. Since there are no significant effects from the covariate and gender has also not been included in our hypothesis, gender-related issues will be excluded from the subsequent analysis for simplicity and clarity.

5.2.2 Effect on factor 'Responses'

The descriptive statistical analysis is shown in Table 3. To find the difference in the effect of each role-playing (B2V, V2B, 1PP, and 3PP), we employed repeated measures ANOVA with the within-group factor **pre/post** and the between-group factor **group** (B2V, V2B, 1PP, and 3PP).

TABLE 3: Participants' 'Responses' score before and after the experiment, presenting mean value and standard error.

Group	Pre	post
1	M(SD)	M(SD)
B2V	5.594 (0.806)	5.771 (0.852)
V2B	5.571 (0.775)	5.837 (0.826)
1PP	5.754 (0.915)	5.763 (0.911)
3PP	5.726 (0.758)	5.906 (0.806)

The main effect of **pre/post** on participants' responses is significant (F(1, 210) = 23.764, p < .001). The main effect of **group** is insignificant (F(3, 210) = .307, p = .821). These main effects are qualified by a significant interaction between **pre/post** and **group** (F(3, 210) = 2.651, p = .049), which indicate that different role-playing paradigms have different effects on participants' responses towards bullying.

We used LSD test (the most liberal post hoc test) to determine the statistical homogeneity of the pre-test across groups. No significant difference can be found from pairwise comparisons (p > .2 for all comparisons), which ensures the homogeneity across groups. As to the effect of different role-playing strategies, Bonferroni-adjusted comparisons indicate that participants in B2V (p = .007), V2B (p < .001), and 3PP (p = .005) groups show more intention of supportive behavior and higher emotional responses towards bullying. In contrast, there is no significant effect after playing 1PP (p = .883).

As shown in Figure 5, B2V and V2B groups significantly increase participants' empathy and encourage their supportive behavior, suggesting that Hypothesis 1 is supported. 1PP group has no significant effect, whereas 3PP has. Therefore, the effect of role-exchange playing is greater than that of 1PP group, which partially supports Hypothesis 2.

5.2.3 Effect on factor 'Opinions'

The descriptive statistical analysis is shown in Table 4. To find the difference in the effect of each role-playing 8



Fig. 5: Participants' responses on bullying before and after the experiment, presenting mean value and standard error of each group. Except 1PP, all other role plays can significantly increase participants' empathy and encourage their supportive behavior.

function, we employ repeated measures ANOVA the same as described in Section 5.2.2.

TABLE 4: Participants' 'Opinions' score before and after the experiment, presenting mean value and standard error.

Group	Pre	Post	
- I	M(SD)	M(SD)	
B2V V2B 1PP 3PP	6.173 (0.678) 6.210 (0.669) 6.333 (0.650) 6.167 (0.626)	6.435 (0.583) 6.432 (0.558) 6.382 (0.601) 6.327 (0.617)	

The main effect of **pre/post** on participants' opinions is significant (F(1, 210) = 40.719, p < .001). The main effect of **group** is insignificant (F(3, 210) = .325, p = .807). These main effects are qualified by a significant interaction between **pre/post** and **group** (F(3, 210) = 2.852, p = .038), which indicate that different role-playing paradigms had different effects on participants' opinions on bullying.

We used LSD test to determine the statistical homogeneity across groups in the pre-test. No significant difference can be found from pairwise comparisons (p > .2 for all comparisons), which ensures the homogeneity. As to the effect of different role-playing strategies, Bonferroni-adjusted comparisons indicate that, as hypothesized, participants in B2V (p < .001), V2B (p < .001), and 3PP (p = .003) groups show more morally correct opinions on bullying. In contrast, there is no significant effect after playing 1PP (p = .380).

As shown in Figure 6, B2V and V2B groups significantly modulate participants' sociocognitive process and help develop more morally correct opinions on bullying, suggesting that Hypothesis 1 is validated in this regard. 1PP group has no significant effect while 3PP has. Thus, the effect of roleexchange playing is greater than that of 1PP group, which partially supports Hypothesis 2.



Fig. 6: Participants' opinions on bullying before and after the experiment, presenting mean value and standard error of each group. Except 1PP, all other role plays can significantly develop more morally correct opinions on bullying.

5.2.4 Effect on factor 'Commitments'

The descriptive statistical analysis is shown in Table 5. To find the difference in the effect of each role-playing function, we employed repeated measures ANOVA the same as Section 5.2.2.

TABLE 5: Participants' 'Commitment' score before and after the experiment, presenting mean value and standard error.

Group	Pre	Post	
1	M(SD)	M(SD)	
B2V	6.22 (0.902)	6.45 (0.677)	
V2B	6.38 (0.702)	6.58 (0.554)	
1PP	6.31 (1.104)	6.36 (1.085)	
3PP	6.30 (0.718)	6.42 (0.599)	

The main effect of **pre/post** on participants' commitments is significant (F(1, 210) = 12.231, p = .001). The main effect of **group** is insignificant (F(3, 210) = .457, p = .712). The interaction effect (**pre/post** × **group**) is also insignificant (F(3, 210) = .951, p = .417).

We used LSD test to determine the statistical homogeneity across groups in the pre-test. No significant difference can be found from pairwise comparisons (p > .2for all comparisons), which ensures the homogeneity across groups. As to the effect of different role-playing strategies, we conducted simple main effect analysis with Bonferroni correction when the interaction effect is not significant according to J. C. Hsu [65]. As shown in Figure 7, the post hoc test indicates that, participants in B2V (p = .007) and V2B (p= .019) groups both show increased commitment to stopping bullying while participants in 1PP (p = .595) and 3PP (p =.165) groups do not show such a significant increase, which supports both Hypothesis 1 and 2.

5.2.5 Effect Size

According to meta-analysis [66], bullying prevention programs can increase bystander intervention behavior by 20% of one standard deviation than participants in the control



Fig. 7: Participants' commitments to stopping bullying before and after the experiment, presenting mean value and standard error of each group. The two role-exchange groups showed increased commitment to stopping bullying.

group. Wherein, these programs have no significant effect on empathy (g = .05, p = .38, 95% CI = -.07 to .17). We calculated the effect size of our experiment in the same way and made a comparison. We found that the B2V and V2B manipulations have a relatively greater effect (g = .21to .41, as shown in Table 6) than prior bullying prevention programs. In contrast, the 1PP manipulation has a relatively smaller effect (g = .01 to .08). This demonstrates that our role-exchange paradigm obtains sufficiently large effect size.

TABLE 6: Effect size of our experiment (*g* value presented)

Group	Responses	Opinions	Commitments
B2V	0.21	0.41	0.28
V2B	0.33	0.36	0.31
1PP	0.01	0.08	0.04
3PP	0.23	0.25	0.17

5.3 Virtual Reality Experience Questionnaire

Since four participants failed to complete this questionnaire by carelessness, data from 210 participants were adopted in this analysis. We conducted one-way ANOVA on participants' scores. The ANOVA result is shown in Table 7. No statistically significant difference can be found across the four groups.

6 DISCUSSION

6.1 Role-Exchange Effects for Bullying Intervention

From the EFA results shown in Table 2, we can conclude that our questionnaire is reasonable with a clear underlying structure. In all sub-scales, both B2V and V2B show significant improvement, as shown in Figure 5, 6, and 7. This result supports Hypothesis 1. In addition, there is no significant difference between groups B2V and V2B, which indicates that the order of role-exchange has no significant effect. However, 1PP group show no significant improvement,

TABLE 7: Scores of Virtual Reality Experience Questionnaire from participants in different groups, presenting mean value and standard error. The one-way ANOVA result is also presented.

B2V	V2B	1PP	3PP	F(3, 206)	p
3.96 (1.64)	3.92 (1.89)	4.02 (1.91)	4.4 (1.58)	.823	.483
3.89 (1.65)	3.66 (1.85)	3.75 (1.52)	3.67 (1.76)	.198	.898
4.17 (1.68)	4.45 (1.77)	4.37 (1.9)	4.13 (1.62)	.405	.750
3.92 (1.69)	3.94 (2)	3.65 (1.84)	3.79 (1.54)	.302	.824
4.45 (1.62)	4.23 (2.03)	3.96 (1.92)	4.31 (1.5)	.700	.553
4.6 (1.74)	4.17 (1.96)	4.53 (1.63)	4.33 (1.58)	.695	.556
5.19 (1.36)	4.85 (1.86)	4.69 (1.8)	4.79 (1.76)	.842	.472
5.68 (1.6)	5.49 (1.73)	5.33 (1.75)	4.94 (1.7)	1.793	.150
	B2V 3.96 (1.64) 3.89 (1.65) 4.17 (1.68) 3.92 (1.69) 4.45 (1.62) 4.6 (1.74) 5.19 (1.36) 5.68 (1.6)	$\begin{array}{c ccccc} B2V & V2B \\ \hline 3.96 & (1.64) & 3.92 & (1.89) \\ 3.89 & (1.65) & 3.66 & (1.85) \\ 4.17 & (1.68) & 4.45 & (1.77) \\ 3.92 & (1.69) & 3.94 & (2) \\ 4.45 & (1.62) & 4.23 & (2.03) \\ 4.6 & (1.74) & 4.17 & (1.96) \\ 5.19 & (1.36) & 4.85 & (1.86) \\ 5.68 & (1.6) & 5.49 & (1.73) \\ \end{array}$	B2V V2B 1PP 3.96 (1.64) 3.92 (1.89) 4.02 (1.91) 3.89 (1.65) 3.66 (1.85) 3.75 (1.52) 4.17 (1.68) 4.45 (1.77) 4.37 (1.9) 3.92 (1.69) 3.94 (2) 3.65 (1.84) 4.45 (1.62) 4.23 (2.03) 3.96 (1.92) 4.6 (1.74) 4.17 (1.96) 4.53 (1.63) 5.19 (1.36) 4.85 (1.86) 4.69 (1.8) 5.68 (1.6) 5.49 (1.73) 5.33 (1.75)	B2V V2B 1PP 3PP 3.96 (1.64) 3.92 (1.89) 4.02 (1.91) 4.4 (1.58) 3.89 (1.65) 3.66 (1.85) 3.75 (1.52) 3.67 (1.76) 4.17 (1.68) 4.45 (1.77) 4.37 (1.9) 4.13 (1.62) 3.92 (1.69) 3.94 (2) 3.65 (1.84) 3.79 (1.54) 4.45 (1.62) 4.23 (2.03) 3.96 (1.92) 4.31 (1.5) 4.45 (1.62) 4.23 (2.03) 3.96 (1.92) 4.31 (1.58) 5.19 (1.36) 4.85 (1.86) 4.69 (1.8) 4.79 (1.76) 5.68 (1.6) 5.49 (1.73) 5.33 (1.75) 4.94 (1.7)	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

which is different from the literature about the impact of virtual reality exposure from different perspectives [17]. In fact, acting from the first-person perspective has been considered an effective way to improve specific cognition in many studies, such as experiencing the virtual world as a redgreen colorblind one [18], embodiment in a dark-skinned virtual body for reducing racial bias [55]. As discussed in the study [17], 1PP can induce greater emotional and behavioral responses, and contributing to a better effect than 3PP.

This seemingly contradictory situation can be explained if we dig deeper into the nature associated with different roles they played. In these studies, participants usually play roles unavailable to them in real life, such as disabled people [18], other genders [17], or different races [55]. That is, the participant can hardly be the role they played in reality, for example, white people cannot change their race and really become Black. In addition, before the role-playing, the specific participants might already have negative attitudes, like discrimination against such roles. Thereby, they experience negative emotions in the role-playing and thus change their attitudes because of the cognitive dissonance theory [52].

In contrast, the participants can play any role in the bullying scenario, and they could be any of them in real life. In our study, more than two-thirds of the student participants have not witnessed actual bullying incidents, as stated in Section 4.3, and those minor participants who never experienced the bullying incident before may not have developed a clear and correct cognition of bullying. In this case, simply playing the victim role may only provoke resentment and fear of the bully rather than reflection on the bullying itself. Furthermore, back to reality, if merely playing the victim role can help users improve their cognition of bullying, then the first-hand experience of being bullied on campus should also produce a similar effect in reality. This is clearly contrary to the facts.

Therefore, we infer that the alteration of individual cognition through role-playing should be a compound of all key roles in the event, especially for adolescents whose moral and legal concepts have not yet been fully formed. Basically, only the victim's perspective is needed for students who had bullied others before while not being bullied. Likewise, being embodied in a dark-skinned virtual body can reduce racial bias in light-skinned participants without being embodied in a light-skinned virtual body [55].

6.2 Gender Differences

Regarding the avatars used in the experiment were uniformly males, a potential 'gender-swap' effect could be introduced in this regard: female participants might feel a bit disconnected (i.e., a lower self-conversion into the role) since the virtual role they played was clearly not themselves. This could lead to a bias in the perception of bullying, and the female participants are assumed to yield weaker outcomes on items with an overall significant increment.

Although gender has already been shown not to be an essential factor in anti-bullying [63], [64] and has no significant effects as the covariate, as analyzed in Section 5.2.1, we split the participants into male/female and conducted additional statistical analysis for both genders separately to detect the sign of gender swap. We present the results for male and female participants in four groups separately, as shown in Figure 8. Overall, male and female participants follow a similar pattern. However, we still find some discrepancies. In B2V group, females significantly improve responses (consistent with the overall significance) while males can not. In V2B group, females significantly improve commitments (consistent with the overall significance) while males can not. Interestingly, female participants even contribute more to the final results than male participants, which is inconsistent with above assumption. On the contrary, in 3PP group, males obtain significant improvement in responses (consistent with the overall significance) while females can not. From these results, no gender-swap evidence can be found. We infer that female participants using male avatars gain roughly equal self-conversion as male participants. This may be due to the fact that the classes are gender-mixed, and girls and boys coexist in Chinese schooling system, where inter-gender bullying is possible. More importantly, in traditional Chinese culture, males are always considered the embodiment of violence rather than females. Therefore, the male avatars used as the bully or as the victim to suffer bullying from the virtual male character is reasonable. Male avatars, but not female avatars, can be easily accepted by both the female and male students. This is exactly why we only choose male avatars for our experiment.

From Figure 8, only male participants in 1PP (using male avatars) failed to yield a significant improvement in all three factors: responses, opinions, and commitments. This also demonstrates that 1PP is less efficient in dealing with minors' anti-bullying education when compared to our role-exchange method, regardless of the gender of the avatar used. Since the participants were randomly assigned to four groups, there was unbalanced gender distribution in 1PP and 3PP groups. 1PP does not significantly improve in all three factors while B2V and V2B do (see Section 5.2). One may doubt that is due to more female participants. As shown in Figure 8, neither males nor females can make any significant improvements on all three factors (all consistent



(a) Four groups' responses of male and female



(b) Four groups' opinions of male and female



(c) Four groups' commitments of male and female

Fig. 8: Scores of Male/Female before and after the experiment; 'M' refers to male (cool colors) and 'F' refers to female (warm colors).

with the overall results), which implies no bias can be found from the gender imbalance. This also indicates that the gender factor will not threaten the validity of our method.

6.3 Comparison between Role-Exchange and 3PP

Similar to our role-exchange paradigm, 3PP can significantly alter participants' cognition of bullying and promote supportive behaviors, as shown in Figure 5 and Figure 6. Here, 3PP exposure as a degenerate form of role exchange might be an explanation, which implies that 3PP works like a role-exchange paradigm but is less effective. More precisely, users who experience 3PP can witness both bully and victim's behavior in the virtual scenario and thereby evoke the dual bully/victim sensation indirectly, even not bullying others or being bullied directly. As a result, the

Since 3PP can help introduce a positive effect on bullying cognition, one may expect that watching bullying incidents in reality can have the same effect. In fact, most individuals involved in the bullying incidents are not like the 'bystanders' designed in our experiment. According to the studies [67], [68], the bystanders can be classified into four: reinforcer (of the bully), assistant (of the bully), outsider, and defender (of the victim). Only the outsiders witness the bullying situation but do not get involved, while other roles actively help the bully or victim. The percentage of actual outsiders is quite small in real bullying incidents from the study [67], and especially boy outsiders only make up 7.3% of the boys. In our study, the participants in the 3PP group act exactly as outsiders without any intervention. Therefore, being an ordinary bystander in reality does not work equivalently to 3PP in our experiment.

Let's further compare 3PP and 1PP. From the bystander's perspective (3PP), participants can provoke either bully's or victim's feelings because of their empathy. According to a study [66], bystanders felt anxiety or insecurity when witnessing the bullying incidents. However, from the victim's perspective (1PP), participants would experience anger and vengefulness [69]. These negative high-arousal emotions that arise when being bullied prevent individuals from reflecting on the bullying incidents calmly or changing their cognition of bullying, especially teenagers. Furthermore, participants from 1PP and 3PP groups were immersed in the virtual environments with the equal time of exposure, demonstrating that their effect difference is due to the different perspectives the participants took but not the time of exposure. It should be noted that 1PP as the victim is often employed for cognition improvement in virtual reality [17], [37], whereas 1PP as the bully/offender was seldom used for research or clinical purposes in prior works. 1PP as the bully may have some effect on anti-bullying, but it is beyond our scope and needs further investigation in the future.

6.4 VR Experience

Most of the VR Experience Questionnaire items do not show significant differences across the four groups, similar to the results shown in study [17]. Subjective questions' differentiation may not be sufficient to make the difference of effect on cognition manifest.

However, participants in different groups reported similar level of 'taking the scene personally', which differed from the literature [17]. Possibly because, in our experiment, participants observed their avatars and were able to manipulate them while experiencing the bullying scenario, which is essential for a sense of embodiment [33]. The mean values of presence factors, including self-illusion, scene realism, plausibility illusion, and immersion, seem to be pretty low (~4 points). This reflects the quality of the interaction and animation of our simulated system is not sufficiently high. In fact, we cannot provide minors with overly realistic stimuli not to cause them real psychological harm. Otherwise, our research will not pass the ethical review. We will improve the quality of our system in future research on adults.

6.5 Limitation

Our study also has limitations. In our design, the exposure time is not the same for different role-playing strategies. More exposure time was used for B2V and V2B groups as there were two role-playing processes in these two groups, which may contribute to the differences between B2V-V2B groups and 1PP-3PP groups. In prior studies about employing VR exposure training for the treatment of music performance anxiety, the users' anxiety level may increase, decrease, or stay the same as the exposure time gets longer [70], [71]. No evidence shows that a longer exposure time would result in a better or worse effect. Therefore, the effect of different exposure times on anti-bullying still needs further investigation. In addition, more male and female avatars should be provided for players, which players can choose according to their preferences. This can diversify our system and make the results more convincing.

Only seven participants admitted they had bullied others before in our study (see Sec. 4.3). It was difficult to find actual bullies due to the limited subject source or the socially desirable response [72], e.g., the students intentionally conceal bullying history. In this case, effectiveness of role exchange can not be validated by making the 'actual' bully simply experience the victim role. Besides, whether the student participants have ever been bullied before should also be surveyed, which is a factor in analyzing the roleexchange effects for bullying interventions.

Because school students are not familiar with the manipulation of VR device, they need to be guided by adult experimenters. Some students may raise their senses of restraint when a guide stands beside them. Thus, future studies could design more precise and concise in-VR directions to reduce the involvement of the experimenter. Finally, our study focused on users' understanding of and responses to bullying. To further reduce campus bullying, our future systems would better include an interactive technique for bullying intervention, such as making several sets of safety plans in advance and training the user to stop bullying in the VE, or guiding the user to pacify the virtual victim by engaging in positive conversation.

7 CONCLUSION AND FUTURE WORK

In this study, we propose a novel role-playing paradigm, role-exchange play, along with an anti-bullying VR system to enhance teenagers' understanding of bullying, increase their commitment to stopping bullying others, enhance their empathy and promote their supportive behaviors when facing bullying incidents. Specifically, our role-exchange method could achieve a better effect than traditional roleplaying methods in situations where participants had no prior first-hand experience associated with the virtual roles they played. Therefore, it can educate these minors and somewhat successfully prevent the participants from becoming problem juveniles in real life. Our study shows a positive potential in the moral education of teenagers. It would help the anti-bullying in campus, and would be conducive to their growth consequently. Teenagers' education on morals and law is a long-term issue. To eliminate or reduce school bullying is also a longterm task and should be carried out persistently. The user study had validated the short-term effect of our proposed role-playing paradigm. However, the long-term effect of our role-playing method still needs further investigation or maybe need years of observation during the growth cycle. Unfortunately, the epidemic of COVID-19 hindered subsequent follow-up investigations. The validation of longterm effects will be our future work. In the future, we will also explore a role-playing VR system to develop a sense of justice, responsibility, and empathy in students, and therefore reduce campus bullying. We will also develop a VR system to help relieve the emotional uncomfortableness of the former bullies on campus.

Our study using the role-exchange playing paradigm may have the potential to such applications as counseling, therapy, and crime prevention. Therefore, designing appropriate VR scenarios and extending this paradigm to these applications will also be our future work. We would love to expect this paradigm to play a positive role in these applications as well.

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APPENDIX

Personal Information in the header of questionnaire

- 1) gender
- 2) age
- 3) whether you have ever bullied others before?

- 4) whether you have ever witnessed school bullying incident?
- 5) whether you have ever watched violent bullying scenarios on the TV, video or other digital medias before?

Bullying Questionnaire

This is a 7-point Likert scale with following response anchors.

- 1) Strongly disagree
- 2) Disagree
- 3) Slightly disagree
- 4) Neutral
- 5) Slightly agree
- 6) Agree

.

7) Strongly agree

- 1) I believe that violently attacking a schoolmate will cause harm to that schoolmate.
- 2) If I had ever violently attacked a schoolmate, I would restrain myself from doing such behavior in the future.
- I believe that verbal assault (verbal abuse, intimidation, ridicule, or sarcasm) of a schoolmate is a form of bullying.
- 4) I believe that verbally assaulting (verbal abusing, intimidating, ridiculing, or sarcastic) a schoolmate will do harm to that schoolmate.
- 5) If I had ever verbally assaulted (verbally abused, intimidated, ridiculed, sarcastic) a schoolmate, I would restrain myself from doing such behavior in the future.
- 6) I believe it is another form of bullying to look on a bullying incident and to incite violence behavior.
- 7) I believe that onlookers and incitement to bullying will cause more harm to the victim who is being bullied.
- 8) I think that onlookers and incitement to bullying foster the bullies to bully.
- 9) If I had ever looked on and incited bullies to bully, I would restrain myself from doing such behavior in the future.
- 10) When I see a schoolmate being bullied, I will go to help the victim.
- 11) When I see a schoolmate being bullied, I will call on others to come together and help the victim.
- 12) When I see a schoolmate being bullied, I will try to stop the bully's behavior.
- 13) When I see a schoolmate being bullied, I think it's none of my business, so I'll leave as a passerby.
- 14) When I see a schoolmate being bullied, I will stop the bullying by calling the teacher or the police.
- 15) When I see a schoolmate being bullied, I will comfort and help the bullied schoolmate afterwards.
- 16) When I see a schoolmate being bullied, I wish I had the ability to stop the bullying.
- 17) When I see a schoolmate being bullied, I feel angry about the bullying.

- 18) When I see a schoolmate being bullied, I have an urge to protect the bullied schoolmate.
- 19) When I see a schoolmate being bullied, I feel indifferent.
- 20) When I see a schoolmate being bullied, I feel guilty if I can't help the bullied.
- 21) When I hear about a bullying incident happening around me, I get angry with the bully.
- 22) When I hear about a bullying incident happening around me, I feel sympathy for the victim.
- 23) When I hear about a bullying incident happening around me, I feel indifferent.

Virtual Reality Experience Questionnaire

This is a 7-point Likert scale with following response anchors.

- 1) To an extremely small extent
- 2) To a very small extent
- 3) To a small extent
- 4) To a moderate extent
- 5) To a large extent
- 6) To a very large extent
- 7) To an extremely large extent

- 1) To what extent did you feel like you became the character you were playing (bully/victim/bystander)?
- 2) To what extent did you feel that the scenes in VR were real?
- 3) To what extent did you feel that what is happening in VR was real?
- 4) To what extent did you feel immersed in the scene?
- 5) To what extent did you feel the emotions of the character you were playing and take the scene personally?
- 6) To what extent did you feel the emotions of the other characters in the game?
- 7) To what extent did you feel that the experiment gave you a new perspective on bullying?
- 8) To what extent did you feel that the VR experience was better than watching a similar video?



Sheng Li is currently a Professor of the School of Computer Sciences, Peking University. He works as a member of the Graphics & Interactive Technology Lab. and has published over 40 refereed papers in prestigious journals and conferences, including ACM TOG, IEEE TVCG, CGF, etc. His research interests include virtual reality, rendering, physical simulation and animation. He is a member of ACM and IEEE.



Kangrui Yi graduated from Graphics & Interactive Technology Lab., Peking University, and obtained his Master degree in 2020. His research interests include realtime rendering and virtual reality technology.



Xiaojuan Yang is currently a Professor with the Faculty of Education, Shandong Normal University. She has published more than 40 papers in journals and international conferences. Her current research interests include artificial intelligence education, learning behavior analysis, especially the optimization of TPACK development path for primary and secondary school teachers in the intelligent era.



Huiling Liu is currently a master student in Computer Science at Lamar University. She has completed her M.S. degree in Neuroscience and Education at Teachers College, Columbia University on May 2021 and her B.A. degree in Psychology at University of Connecticut on May 2018. She has been a research assistant at Graphics & Interactive Technology Lab., Peking University, utilizing the knowledge of cognitive science to apply on the VR technology.



Xiang Gu is a Ph.D. candidate at Graphics & Interactive Technology Lab., School of Electronics Engineering and Computer Science, Peking University. His research interests include virtual/augmented reality and its psychological principles and applications.



Guoping Wang is currently a professor in Peking University, where he is also the director of Graphics & Interactive Technology Laboratory. He achieved the National Science Fund for Distinguished Young Scholars in 2009. His research interests include Virtual Reality, Computer Graphics, Human-Computer Interaction, and Multimedia.