This is an Accepted Manuscript of an article published by Taylor & Francis in Behaviour & Information Technology on 29 Dec 2020 (published online), available at: https://doi.org/10.1080/0144929X.2020.1864018.

Perspective-Taking of Non-Player Characters in Prosocial Virtual Reality Games: Effects on Closeness, Empathy, and Game Immersion

Jeffrey C. F. Ho*, School of Design, Hong Kong Polytechnic University, Hung Hom, Hong Kong SAR, email: jeffrey.cf.ho@polyu.edu.hk

Ryan Ng, School of Design, Hong Kong Polytechnic University, Hung Hom, Hong Kong SAR, email: ryanngwinghim@gmail.com

Abstract

This study explores the effects of the perspective-taking of non-player characters (NPCs) on enhancing game immersion in prosocial virtual reality (VR) games. Prosocial games are games that focus on helping others. Game researchers and designers have been keen to investigate and identify factors that influence the immersive experience in digital games. Previous studies show that VR allows people to take the perspective of others, inducing empathy and prosocial behavior in the real world. In this lab-based study, we explore whether and how taking the perspective of other game characters—NPCs in a prosocial VR game—influences players' in-game empathy towards NPCs and game immersion. Prior to a gameplay, participants first experienced either a robot's perspective of being destroyed by fire in VR or read a text description about the same event. Then, they participated a prosocial VR game in which they saved robots. The findings show that perspective-taking experiences indirectly enhance participants' game immersion via the effects of closeness with the destroyed robot and empathy towards the four robots protected by the player. This indirect effect is moderated by players' weekly exposure to video games. These results suggest that VR-based perspective-taking of NPCs can indirectly enhance VR gameplay experiences in prosocial VR games. Theoretical and game design implications are discussed.

Keywords: perspective taking; virtual reality; prosocial games; empathy; digital games

1 INTRODUCTION

In everyday life, if we experience facing the difficulties currently experienced by other people, we feel more for them. In prosocial games in which players need to help non-player characters (NPCs), players normally only experience the challenges faced by the player characters. They do not have a chance to experience the suffering of the NPCs that they are supposed to help. This study investigated whether and how an experience of facing the suffering of NPCs would influence players' feelings for them and subsequently the gameplay experience in a prosocial virtual reality (VR) game context.

Prosocial behavior refers to the social behavior of helping or sharing with others. Prosocial behavior is a common theme in games and was so even before it became a research focus. For example, in the game *Bouncing Babies*, released in the 1980s, the player controls two firemen holding a net to save babies falling off a building on fire. *Super Mario World*, released in the 1990s, is about the protagonist Mario's quest to save Princess Peach. In the game *Death Stranding*, released in 2019, players control the player character Sam Porter Bridges to help people deliver packages to each other and eventually help reconnect the post-apocalyptic world. Such themes of prosocial behavior are also common in VR games. For example, in the first mission of *Ironman VR*, released in 2020, players need to control Ironman to rescue Pepper Potts from a falling airplane.

VR games have been growing more popular because of the recent introduction of consumer-grade VR headsets [37]. VR games offer a new form of gameplay and a new area of design space. Most VR games focus on the perspective of player characters. Through the player character's perspective, players tackle challenges and interact with other NPCs. The design of many VR games has been so focused on taking the perspective of the player characters that very limited attention has been paid to the perspective of NPCs. Experiencing the perspective of NPCs in VR games is a novel design intervention. Despite the rich body of literature on perspective taking, it has not been investigated in the context of game immersion. This research aims to fill the gap by

investigating whether and how experiencing the challenges of NPCs can influence players' gameplay experiences. In addition to being a novel design intervention, the current study was also motivated by previous findings in several studies, including studies on perspective-taking, empathy, and prosocial behavior.

The results of this study contribute to the literature on perspective-taking, its effect on fictional characters in fictional worlds, and its influences on immersion in the context of gameplay. The findings of this study also open up new avenues of VR game design for exploration by game designers and researchers.

2 Related Work

2.1 Prosocial Games

The focuses of research in digital games have expended from the negative effects of violent games to the positive effects of prosocial games (games involving prosocial behaviors). Research on video games has traditionally been largely focused on the negative effects of video games [e.g. 2,19,28] because of the commercial success of video games that involve violence, such as *Doom*, first released in 1993. Evidence has shown that violent video games have been associated with reduced empathy and an increase in aggressive behavior [2], as well as reduced guilt [28]. Later research has indicated that the influence of games on players does not have to be negative. In a meta analysis of 98 studies, Greitemeyer and Mügge [25] concluded that video games have social influences on players. Violent games increase aggression and decrease prosocial outcomes, while prosocial games have the opposite effect.

In the 2010s, psychologists started to explore the possibility of the positive effect of video games, especially in prosocial video games [23,24,27]. Evidence has supported the notion that prosocial games can increase prosocial behavior in the real world [49]. For instance, Greitemeyer and Osswald [26] found that playing a prosocial video game encouraged players to think about prosocial behavior and actually become more committed to prosocial behavior. They found that after participants played a prosocial video game, they were more likely to perform prosocial behaviors, such as helping to clean up after a cup of water was knocked over (see Passmore and Holder [49] for a detailed review).

Research on prosocial games has frequently focused on their effects on real-world behavior, but has seldom focused on their influences on game experiences and behaviors. One exception is a study by Lim [45] that focused on players' empathy towards characters in the game world. Based on a survey of 524 respondents' gameplay behaviors and perceptions, Lim concluded that players do have empathy towards player characters (NPCs). Such empathy can be a motivation for helping NPCs in the game world.

2.2 Perspective Taking

Researchers have been interested in the effects of perspective-taking, understood as the notion of taking the perspective of another person [7]. Perspective-taking has been the focus of interests in various contexts and thus there are different interpretations of the term [22]; it can be understood as (a) an action or cognitive process, (b) an ability, or (c) a personal trait. In the current study, we understand perspective-taking as a cognitive process. Perspective-taking can be achieved via interventions as simple as being asked to imagine the life of another person, which has been shown to influence people's attitude towards other social groups. In a series of studies, Galinsky and Moskowitz [21] instructed their participants to imagine and write a short essay about the life of an elderly person. Their findings show that this perspective-taking task suppressed the participants' stereotypical thoughts and enhanced their perceived closeness with the elderly. Scholars have investigated the effects of perspective-taking on different areas, such as prejudice [20] and the evaluation of others' creativity [29].

VR technologies have been studied by researchers as a medium for allowing users to experience the perspectives of others [e.g. 4,6,33]. For example, being embodied in a virtual body with a different skin color in VR has been shown to reduce implicit racial bias [6]. De la Peña et al. [50] argue that VR induces users' subjective feelings of presence in a virtual environment, which in turn helps them to understand others' perspectives. Most modern VR headsets, such as Oculus Rift™ and HTC Vive™, consist of a head-mounted display (HMD) for users'

view and two controllers for users' hands. The HMD presents a first-person view of virtual environments that can be simulations of real-world situations (e.g. in the use of VR in the construction industry [44]) or manifestations of fictional worlds (e.g. in VR games [36]). Users of VR can see what another person might see in the situation presented in the virtual environment.

VR-based perspective-taking has been compared with perspective-taking in other media, such as videos. For instance, Ahn et al. [1] presented participants with a VR-based experience of being a cow in nature. Such first-person experiences of animals shortened participants' perceived distance with nature (referred as inclusion of nature in self [59]) as compared to a video presentation. Although VR involves advanced technologies, it may not always be more effective than other formats. Herrera et al. [33] studied the long-term effects of VR-based perspective-taking on empathic feelings towards homeless people. They found that there were no significant differences in the self-reported measures of empathic feeling between the condition using VR perspective-taking and the one using mental simulation.

2.3 Empathy and Prosocial Behavior

Empathy is an area often studied when investigating the influence of perspective-taking on video games. Empathy refers to the understanding and sharing of another person's feelings [43 p.287]. It can be conceptualized as both a personal trait (trait empathy) and a psychological process (state empathy) [55]. The current study focuses on state empathy, which refers to the psychological process of sharing another's feelings at any given moment. State empathy is studied in many contexts, such as people's processing of persuasive messages [54], rape-prevention campaigns [17], media consumption [52], and learning in serious games [5]. Game design researchers have explored games that induce empathy through mixed reality [e.g. 41].

Empathy is considered to be a motivation for prosocial behavior. Researchers have been interested in how empathy can be induced through perspective-taking and video games, and how that may indirectly influence players' prosocial behavior in the real world. Previous evidence suggests that empathy can be a determinant of the effects of video games on aggression and prosocial behavior. For example, Happ et al. [30] had participants play as either a superhero (Superman) or a supervillain (Joker) in a violent fighting game. By manipulating the players' empathy towards the characters they controlled with perspective-taking, these researchers demonstrated that empathy influences the effects of avatars on players' perception of others. After the participants played as Superman, empathy induced the participants to view neutral faces as less aggressive. In the case of those who played as Joker, empathy induced the participants to view neutral faces as more hostile.

2.4 Game Immersion and Characters

Game researchers and designers have been keen to investigate factors influencing players' immersion in games. Game immersion refers to a person's engagement when playing a digital game [11]. It is a term that is often used by players to describe their gameplay experience [9]. It is often considered an important quality for a successful digital game to be able to immerse its players in the game world. Game designers and developers thus strive to make their games immersive [38].

Researchers have investigated the effects of various design elements in video games on players' sense of immersion. Examples include power-ups [16], points of view [15], gestural controls [8], mobile game control mechanisms [12], and peer players [10]. Researchers have also investigated the effects of game controllers [40] on immersion and game experiences across different game genres [39]. Factors such as audio may seem important, but have actually been found to have little impact on game immersion [53].

The experience of controlling a character in a virtual or game world may influence gameplay experiences. The *Proteus effect* refers to the influence of an avatar on its owner's social behavior [60] in contexts such as chatrooms, online forums, multiplayer games, and VR applications. Avatars' characteristics (e.g., a good-looking appearance) may cause players to behave differently (e.g., act more confidently). In one of Yee and Bailenson's lab experiments [60], participants controlling more attractive avatars were willing to get closer to a confederate and to disclose more information in a VR room. In the second study reported in their paper, Yee and

Bailenson demonstrated that participants assigned to a taller avatar in VR were more likely to enact an unfair money-split with others, while those using a shorter avatar were more likely to accept an unfair offer. In another study, Fox et al. [18] demonstrated that women assigned to sexualized characters in VR are more likely to have thoughts related to self-objectification.

3 Current Study : Taking the Perspective of NPCs

The current study investigates whether and how perspective-taking with regard to NPCs influences players' immersion in prosocial VR games. The studies reviewed above support our hypothesis that NPC perspective-taking has an influence on different aspects of gameplay experiences and indirectly influences immersion. In this section, we present our hypotheses.

3.1 Perceived Distance

In a prosocial VR game, the players are expected to perform prosocial behaviors to help or protect others. The characters to be helped are presented as victim NPCs in such games (e.g. the babies in *Bouncing Babies*, Pepper Potts in *Ironman VR*). Although prosocial games are not normally designed to let the players experience the struggles or pain experienced by these NPCs, the perspective-taking experience of being a victim NPC may influence players' gameplay experience.

First of all, the literature on perspective-taking has offered evidence to support the notion that VR-based experiences of others' perspectives are influential on viewers' attitudes and behaviors [e.g., 1,48]. We hypothesize that the same effect can happen in the case of victim NPCs in prosocial VR games. After experiencing the perspectives of NPCs, players may feel closer to them. Therefore, we derive the following hypothesis:

H1: In a prosocial VR game, players who take the perspective of victim NPCs will perceive themselves as emotionally closer to the NPCs than those who do not.

3.2 Empathy in Game World

Previous studies on perspective-taking have shown evidence supporting the notion that VR-based perspective-taking induces viewers' empathic feelings towards the person whose perspective has been experienced by the viewers [e.g., 33,48]. The influence on empathic feelings that these studies focused on are situated in the real-world. In prosocial VR games, the players' interactions with victim NPCs are purely in the fictional worlds of the games. If the players have a perspective-taking experience with the victim NPCs in a prosocial VR game, any effects on their empathic feelings would relate to their feelings towards fictional characters (the victim NPCs) in a fictional world (the virtual environment of the VR game). Although the settings are not entirely the same as those in previous studies, there are similarities.

In both settings, the audience experiences what happens to a character from a first-person perspective in VR. The characters concerned in the current study (victim NPCs) are fictional, unlike the characters in previous studies, who were real people. However, previous findings in media have shown that audiences can have feelings and even one-sided social relationships (so-called parasocial interactions [38, 50]) with characters presented in media such as television series. Therefore, we believe that the difference between fictional and non-fictional characters does not affect the effect of perspective-taking on inducing empathy.

Another similarity between the two settings is that the empathic feelings that are concerned in both settings are towards a character or a group of characters. People have feelings in both real and fictional worlds; for example, people enjoy playing games in the real world and can also have fun playing games in VR. There is no strong evidence for us to believe that such a difference would prevent the effect of perspective-taking from being applicable to players' empathic feelings towards victim NPCs in the fictional world of prosocial VR games. Therefore, we hypothesize that the effect of perspective-taking on people's empathy can be extended to the case of NPCs as well. We derive the following hypothesis:

H2: In a prosocial VR game, players who take the perspective of victim NPCs will have more empathy towards the NPCs than those who do not.

3.3 Game Immersion

Previous studies suggest that a character that is controlled by a person can influence that person [e.g., 18,60], and identification with a character that is controlled by a person can enhance that person's game enjoyment [32]. Therefore, we hypothesize that being a victim NPC in a prosocial VR game can deepen the player's game immersion. In prosocial VR games, players can face the experiences and struggles of victim NPCs that they are supposed to help during gameplay, which is when players play from the player characters' perspective and perform prosocial behaviors to help victim NPCs. Their encounter in the gameplay occurs from the third-person perspective (e.g., seeing that the victim is in need). Prior perspective-taking experiences of being a victim NPC may allow players to become more situated in and related to the game world, which deepens their immersion in the game's settings. Therefore, we derive the following hypothesis:

H3: In a prosocial VR game, players who take the perspective of victim NPCs will be more immersed than those who do not.

3.4 Indirect Effect

The hypotheses presented above are about the effects of the victim-NPC perspective-taking on perceived distance, empathy, and game immersion. These aspects are potentially related to one another. Previous studies show that perspective-taking experiences can shorten the perceived distance between oneself and others [e.g., 1]. Therefore, victim-NPC perspective-taking should shorten players' perceived distance with the victim NPC. If players feel closer to a character, it becomes easier for them to share and feel the feelings of the character. Empathy refers to the sharing of others' feelings [43 p. 287]. The perceived distance between oneself and others should influence empathy; hence, perceived closeness toward a victim NPC should influence empathy. Furthermore, identifying with a character in a game has been shown to enhance enjoyment [32]. If players have more empathy toward a character that they encounter in a game, it may be easier to immerse themselves in the game world. Empathy can thereby influence game immersion, and victim-NPC perspective-taking may have an indirect effect on game immersion through its effects on perceived closeness and empathy. We thus derive the following final hypothesis:

H4: In a prosocial VR game, taking the perspective of victim NPCs will indirectly enhance players' game immersion via an effect on perceived closeness and empathy.

4 METHOD

There were two conditions in the study: with or without VR-based perspective-taking (VRPT and Control conditions). The manipulation was achieved by presenting to the participants a prologue of a VR game in either a VR or text-based narrative format.

4.1 Participants

Forty participants (17 males, 23 females; age: M = 23.6 years, SD = 4.7 years) were recruited from a public university in an Asian city. They were evenly and randomly assigned to the two conditions. The average number of hours they spent on playing digital games every week was 9.0 hours (SD = 17.35 hours). The average score of trait empathy measured with questionnaire developed [57] was 80.28 (SD = 6.68).

4.2 VR Perspective Taking Condition

Before playing the game *Firefighting VR*, participants in the VR condition experienced a VR-based perspective-taking manipulation presented as a prologue to the game. The virtual environment of the VR prologue is the same as that of the game. The difference is that the participant sees from the perspective of a robot. As the prologue starts, the participant sees him/herself as a robot trapped in a scene surrounded by containers (the victim NPC). There are four other robots in the scene (the vulnerable NPCs). There is a mirror in front of the robot. A CCTV camera is attached above the mirror. The participant is reminded to look at his/her own body as a robot and wave the controllers (presented as the hands of the robot) at the mirror to experience what is like to be a robot. This inclusion of a mirror is based on the arrangement in [48]. A few seconds after the prologue begins, there is an audio announcement saying "Testing robot starts in… Three. Two. One." Then the robot catches fire. The robot is burned and destroyed gradually. There are sound effects of explosions and smoke effects throughout the process. The participant is instructed to wave at the CCTV camera to ask for help. When the robot is completely destroyed, the first-person view fades to black. The participant loses control of the robot as well (that is, moving the controllers does not move the robot's hands). An audio announcement is made, saying "Testing complete." The prologue ends. It lasts for 1.5 minutes. Figure 1 shows screenshots of the VR prologue.

4.3 Control Condition: Textual Description

In the control condition, the prologue was a textual description of what happened in the VR version. The textual narrative was printed on a piece of paper. Each participant was given 1.5 minutes to read the prologue. The textual description is presented in the Appendix. This control condition is based on the procedure of the study reported in [48].

(a) (b) (c)

Figure 1. Screenshots of the VR prologue: (a) A mirror for the participant to see him/herself as a robot (the victim NPC); (b) the start of the robot's destruction by fire; (c) the participant can see the robot's body being destroyed by fire via the mirror.

4.4 The *Firefighting VR* Game

We created a VR game called *Firefighting VR* with the Unity™ game engine and HTC Vive™ VR headset. Unity™ is a game development platform commonly used to develop VR applications and content for academic study [34,42,58]. Therefore, it was chosen. It is a prosocial game: the player needs to protect targets from a danger. The virtual environment of the game is an industrial scene surrounded by containers. There are five robots trapped by wooden boxes. One of them is already destroyed, with smoke coming out of its body, as the game starts. This represents the robot destroyed in the prologue (the victim NPC). The remaining four robots (the vulnerable NPCs) keep waving their hands towards the player character. On top of one of the containers, there is a notice board

showing the remaining time and robots. The player character is set on a balcony looking over the scene. On the right-hand side of the player character, there is a table with two water guns. Further towards the right-hand side of the player character, there is a box on fire for the player to practice using the water guns. Figure 2 shows screenshots of the VR game.

(a) (b) (c)

Figure 2. Screenshots of the game Fire fighting VR: (a) the industrial scene for the gameplay showing four robots (the vulnerable NPCs) waving at the player for help and a destroyed robot (the NPC), (b) with two water guns for the player to put out the fire by barrels on fire being thrown to the scene and set the wooden boxes in the scene ablaze, (c) the notice board shows the number of robots saved and a success message when time is up.

The game starts when a key is pressed on the keyboard (by a researcher when the participant indicates she/he is ready). When the game starts, a series of wooden barrels on fire are thrown from off-screen behind the containers into the scene. The flaming barrels will fall onto the wooden boxes, trapping the robots. A few seconds after landing on the boxes, the barrels will explode and light up the boxes. Fire will gradually destroy the robots. The player's goal is to use the water guns to put out the fire to protect the robots. There is a five-minute countdown shown on the notice board. If the player can keep at least one robot from being destroyed after five minutes, he/she wins. If all the robots are destroyed before the countdown finishes, he/she loses. Figure 3 shows a flow chart illustrating the logic.

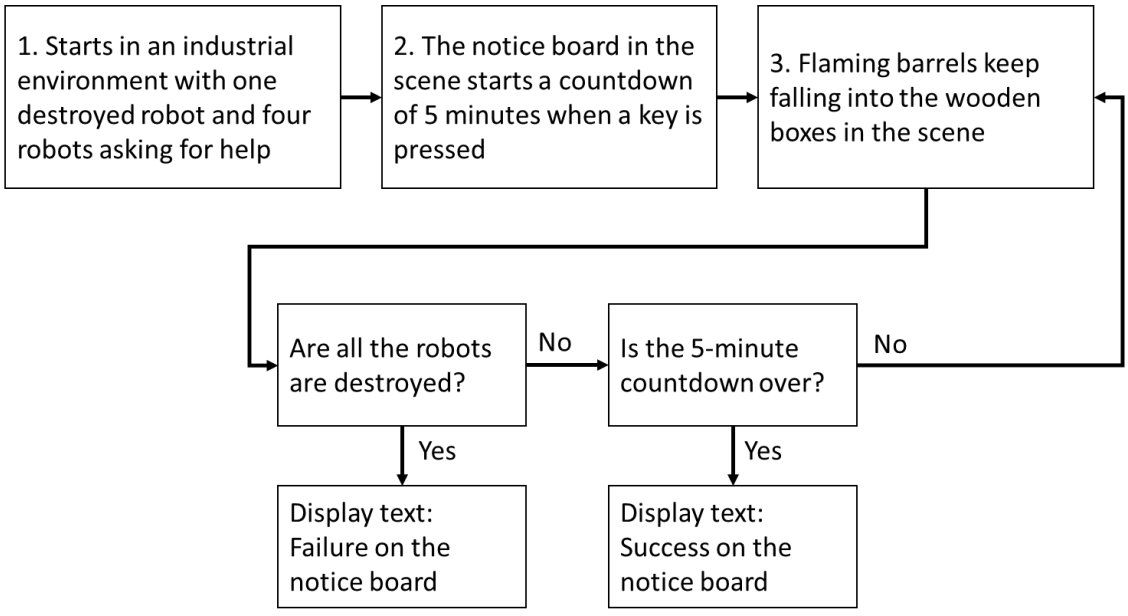

Figure 3. Basic Flow Chart of the Logic of the Game Loop of Firefighting VR

4.5 Measurements

Participants' trait empathy was measured with a questionnaire developed in [57]. The inclusion of other in the self (IOS) [3] was adopted to measure participants' perceived closeness with the robot (the victim NPC) after the prologue. This measure has been used in previous studies such as a study in which participants were exposed to the perspective of an elderly person in VR [48]. Although there have been efforts to develop measures of empathy in VR [13], we adopted a state empathy questionnaire [55] to measure participants' level of empathy towards the robots to be protected in the prosocial game (the vulnerable NPCs). The main reason for choosing this measure was that the state empathy questionnaire is designed specifically to measure one's empathy towards a person or a character, which made it particularly suitable for the study design. The game immersion questionnaire reported in [38] was used to measure participants' game immersion.

4.6 Procedure

Before the VR study began, written consent was obtained from the participants. They were then required to complete a questionnaire on their experience of playing video games and their trait empathy. The participants then were administered the prologue session, which allowed them to experience the robots' perspective in different forms of media. Participants were either administered the control (text-based) condition or the experimental (VR) perspective-taking condition. They were then asked to fill in a questionnaire assessing how much they identified with the victim NPC. Afterward, all participants played the *Firefighting VR* game. Finally, a questionnaire was given to participants to measure their empathy towards the vulnerable NPCs and their level of game immersion.

5 RESULTS

A t-test revealed participants' trait empathy was not significantly different across the two experimental conditions ($p = .98$).

No significance was found in the t-tests performed to examine the direct effect of VR perspective-taking on IOS towards the victim NPC ($p = .19$), state empathy towards the vulnerable NPCs ($p = .72$), or game immersion ($p = .61$). Thus, H1, H2, and H3 were not supported.

Mediation analysis was performed with model 6 (with two mediators) in the PROCESS macro for SPSS [35] with 10,000 bootstrap samples to examine the indirect effects of VRPT on the gameplay experience, via its effects on IOS towards the victim NPC and empathy towards the four vulnerable NPCs. No significant indirect effects were found. Thus, H4 was not supported.

We suspected that the effects of VR perspective-taking might vary according to participants' experience as gamers. Therefore, we conducted follow-up analysis with participants' weekly hours spent on digital gameplay as a moderator. The distribution of this measurement was highly positively skewed. Therefore, this variable was re-coded by splitting its value into two levels by the median (five hours). That is, participants were labelled as light gamers if they spent five hours or fewer on digital gaming every week. Otherwise, the participants were labelled as heavy gamers. Table 1 shows the distribution of the two levels of gamers across the two experimental conditions. We refer this new variable as gamer level.

Table 1. Distribution of participants across the two experimental conditions by their weekly exposure to digital games

	Control Condition	*VRPT Condition*
Light Gamers (≤ 5 hours)	11	10

Heavy Gamers (> 5 hours)	9	10
Total	20	20

A moderation analysis with model 1 in the PROCESS macro for SPSS [31] revealed that the effect of VRPT on IOS towards the victim NPC was moderated by gamer level, $F(1, 36) = 14.25$, $p < .001$. The conditional effect of VRPT on light gamers' IOS towards the victim NPC was 2.39 (95% CI: 1.07–3.71, $p < .001$) which was statistically significant. The conditional effect of VRPT on heavy gamers' IOS towards the victim NPC was -1.17 (95% CI: -2.55–0.22, $p = .10$) which was not statistically significant. No significant moderation effect was found in gamer level on the effect of VRPT on state empathy towards the vulnerable NPCs ($p = .25$). A moderation analysis with model 1 in the PROCESS macro for SPSS [31] revealed that the effect of VRPT on game immersion was moderated by gamer level, $F(1, 36) = 5.97$, $p < .05$. The conditional effect of VRPT on light gamers' game immersion was 6.91 (95% CI: -3.84–17.76, $p = .21$), which was not statistically significant. The conditional effect of VRPT on heavy gamers' game immersion was -12.07 (95% CI: -23.48– -0.66, $p < .05$), which was statistically significant. The pattern predicted in H3 was found among the heavy gamers.

Table 2 Conditional Effects of VRPT on the IOS Towards the Victim NPC of Light and Heavy Gamers.

Predictor		Outcome Variable	Gamer Level	Conditional Effect	95% Confidence Interval	p-value
VRPT	→	IOS Towards the Victim NPC	Light Gamers	2.39	1.07 to 3.71	p < .001
			Heavy Gamers	-1.17	-2.55 to .22	p = .10

Table 3 Effects of Mediators in the model in *Figure 3*

Predictors		Outcome Variable	Effect	95% Confidence Interval	p-value
IOS Towards the Victim NPC	→	Empathy Towards the Vulnerable NPCs	2.42	1.22 to 3.62	p < .001
Empathy Towards the Vulnerable NPCs	→	Game Immersion	.82	.23 to 1.41	P < .01

Moderated mediation analysis was conducted with model 83 in the PROCESS macro for SPSS [31] with 10,000 bootstrap samples. There was a significant moderated indirect effect of VRPT on game immersion, via its effect on IOS towards the victim NPC and empathy towards the vulnerable NPCs. The indirect effect is significantly moderated by participants' gamer level. Figure 3 illustrates the moderated indirect effect. Among light gamers, having VRPT before gameplay increased their IOS towards the victim NPC by 2.39 on average (95%CI: 1.07–3.71, $p < .001$). Among heavy gamers, having VRPT before gameplay decreased their IOS towards the victim NPC by 1.17 on average (95%CI: -2.55–.22, $p = .10$). The conditional effects are presented in *Table 2*. Every point enhanced in IOS towards the victim NPC increased state empathy towards the vulnerable NPCs by 2.42 (95%CI: 1.22–3.62, $p < .001$). For every one-point increase in state empathy towards the vulnerable NPCs, game immersion increased by .82 (95%CI: .23–1.41, $p < .01$). The effects of the mediators are presented in *Table 3*

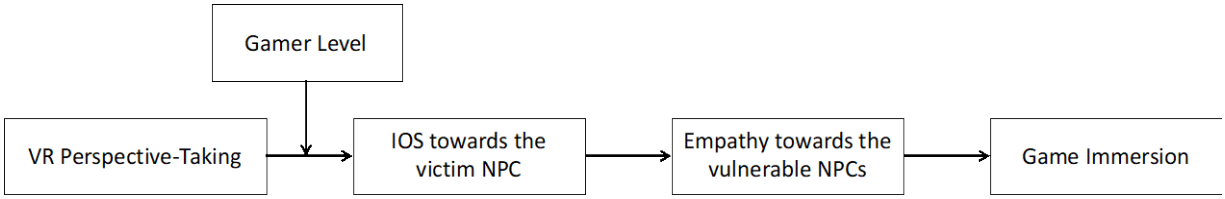

Figure 4. Moderated indirect effect of VR perspective-taking on game immersion.

Overall, the total conditional indirect effect of VRPT on light gamers' game immersion via its effect on IOS towards the victim NPC and state empathy towards the vulnerable NPCs was 4.74 (95% CI: .88–10.21). Since the 95% CI did not include zero, the effect was significant. The total conditional indirect effect of VRPT on heavy gamers' game immersion via its effect on IOS towards the victim NPC and state empathy towards the vulnerable NPC was -2.31 (95% CI: -5.55–.47). *Table 4* presents the total conditional indirect effect of VRPT. The effect was not significant since the 95% CI included zero. The difference in the conditional effects between light and heavy gamers was -7.06 (95% CI: -14.20– -1.65), which was significant because the 95% CI did not include zero. With the indirect effects in place, no significant direct effect was found (p = .45).

Table 4. Total Conditional Indirect Effects of VRPT on the Game Immersion of Light and Heavy Gamers via mediators IOS Towards the Victim NPC and Empathy Towards the Vulnerable NPCs

Predictor	Outcome Variable	Gamer Level	Total Conditional Indirect Effect	95% Confidence Interval
VRPT →	Game Immersion	Light Gamers	4.74	.88 to 10.21
		Heavy Gamers	-2.31	-5.55 to .47
		Difference between conditional indirect effects	-7.06	-14.20 to -1.65

In sum, VRPT was found to indirectly increase light gamers' game immersion via its effect on IOS to the victim NPC and state empathy towards the vulnerable NPCs. If VRPT is applied to heavy gamers, the indirect effect of VRPT is no longer statistically significant. Although it becomes insignificant, there seems to be a tendency to become negative, since the 95% CI range was mostly negative. This suggests that the indirect effect of VRPT on game immersion may be reversed if it is applied to heavy gamers. The pattern predicted in H4 was found among the light gamers. The predicted indirect effect was found to be moderated by gamer level.

6 DISCUSSION

Hypotheses H1, H2, H3, and H4 were not supported. Although our results are not exactly what we hypothesized, they reveal a more interesting relationship between VR-based perspective-taking, perceived closeness, empathy, game immersion, and gamer levels in the context of prosocial VR games than we hypothesized. These results offer partial support for the hypothesized indirect effect of VR-based NPC perspective-taking on game immersion via its effect on the closeness of players towards the NPCs they took the perspectives of, as well as empathy towards the groups to which the NPCs belonged. However, the evidence shows that this indirect effect differs between light and heavy gamers. The hypothesized indirect effect of VRPT on game immersion was found among the light gamers, while no significant effect was found for heavy gamers. The reduction of the indirect effect when comparing light and heavy gamers was statistically significant. There is a significant change in the indirect effect of perspective taking.

In other words, having players take the perspective of an NPC in a prosocial VR game indirectly enhances game immersion, but only for light gamers. For heavy gamers, such perspective-taking experiences before gameplay do not enhance their game immersion. The data even show a tendency for the perspective-taking experiences to actually make them less immersed in the game.

One of the major differences between the results and our hypotheses (especially H4) is the moderation effect of gamer expertise. Previous studies on other aspects of games also suggest that player expertise plays a role in how game elements influence player experiences. Game expertise is actually a topic of interest in game studies literature [e.g. 35,47]. Previous findings have shown that gamer expertise can influence the effect of various game elements on gameplay experience. For example, Cox et al. [14] found that gamers' expertise influences how they perceive challenge and the possibility of having the level of skills to match particular challenges.

Our hypothesized effect can be found in light gamers

A theoretical explanation might draw upon the Elaboration Likelihood Model (ELM) theory [51]. According to ELM, if people have good motivation and ability, they cognitively process media messages in a deep and careful way. If either motivation or ability (or both) are absent, people rely on peripheral cues and are thus more likely to be influenced by the messages presented in the media. From an ELM perspective, the explanation of why the indirect effect was found to be significant only among light gamers may be because their lower levels of regular gameplay give them a lower ability to judge the VR perspective-taking experience (e.g. graphics quality, whether the narrative makes sense). Therefore, they are more sensitive to the influence of the perspective-taking experience before gameplay. Heavy gamers, on the other hand, are frequently exposed to games in their daily routine. They have a stronger ability to examine video game content. Therefore, they are less sensitive to the influence of perspective-taking experiences.

With respect to the literature about game immersion, the implication of these results is that taking the perspective of fictional NPCs in a game world can influence light gamers' game immersion. Victim-NPC perspective-taking in prosocial VR games is a new design intervention for game immersion that should be explored by game immersion researchers [e.g. 8,10,12,15,16]. In the context of prosocial games, players' goals mainly involve prosocial behaviors towards NPCs. Taking the perspective of a suffering NPC before engaging in the actual gameplay of protecting them makes the players feel closer to the NPCs, even if they are fictional and exist only in the game world. They feel closer to and thus have empathy toward the NPCs' peers. When trying to achieve prosocial goals in gameplay, the players feel more immersed. Their perspective-taking-induced closeness and empathy towards the NPCs indirectly contribute to the enhancement of their immersion. This result offers evidence supporting the relationship between perspective-taking, closeness, empathy, and game immersion in a prosocial game context.

Shriram et al. [56] discuss the use of people's tendency to protect themselves to motivate prosocial behavior. The notion is that people in general have a tendency to protect themselves and members in their own social groups. Blurring the boundary and shortening the distance between the self and others induces people to feel empathy towards others, which can in turn activate the mechanism to protect oneself and thus motivate prosocial behavior towards other people.

The findings of our current study show evidence of a similar mechanism at work among light gamers. Our findings demonstrate that the egocentric tendency to protect oneself can be applied to fictional victim NPCs that players encounter in prosocial VR games. A shortened perceived distance influences their empathy. With the current study set in a game context, our findings show evidence that similar mechanisms can influence perceived distance and empathy even though the victims are fictional NPCs instead of real people in the real world, as in the previous studies. Furthermore, our evidence shows that such mechanisms can be extended to influence game immersion in prosocial VR games, which contributes to the literature on prosocial behavior and perspective taking. It also contributes to the discussion on the egocentric motivations of prosocial behaviors. The results warrant future studies on whether the tendency to protect oneself can occur and be leveraged in purely fictional settings.

There are design implications as well. The VR game format in itself offers an opportunity for players to take the perspectives of different characters. The results of the current study support the idea that perspective-taking does not have to mean taking the perspective of the player character in prosocial games. Letting the players experience what it is like to be the ones to be protected can enhance game immersion, suggesting a new aspect of game design for developers of prosocial games to explore. However, the conditional indirect effect also gives game designers a dilemma, in that whether their players are heavy or light gamers may have opposite effects. There could be an option to skip these pre-gameplay experiences if the players prefer to jump directly to the gameplay.

Another design implication is that perspective-taking can be a design option for immersing players into a game's narrative, which is often an important element in successful digital games. Narratives consist of characters and events. NPCs constitute the narrative in a game alongside the player character. Traditionally, players only interact with NPCs in a third-person perspective. However, the current study proposes a design

option to allow players to experience the perspective of NPCs. Furthermore, the result suggests that such an experience may immerse players deeper into a game. The result allows game designers to explore the possibilities of telling stories with the first-person perspective of NPCs without threatening players' immersion levels.

There is an implication for the societal level as well. The result suggests that VR games can raise the public's awareness toward social groups that need more care and understanding from society. VR has been suggested as an empathy machine because it allows people to take the perspective of other social groups to increase public empathy toward them. The result of the present study suggests that VR games can be an additional medium in which people can take the perspective of social groups that need more care from society. For example, a hypothetical VR game can include NPCs who are homeless, and the gameplay may be about helping those people. If the game allows players to take the perspective of the homeless (the NPCs), then the players may have more empathy toward homeless people in general. The potential impact of the proposed design intervention in games warrants further research with a societal view.

This study is not without limitations. The study only involved one prosocial VR game. The prosocial VR game designed for the current study may not represent all types of VR games. However, the game mechanics and narrative of our game involved clear roles for the protected characters (the victims) and the protector (the hero); as such, they resemble those of many existing VR games, such as *Ironman VR* and *Batman: Arkham VR*. Another limitation is that the gameplay occurred in a laboratory setting and lasted only for 10 to 15 minutes. Although this is relatively short, similar lengths of exposure are adopted in studies on game immersion for digital games [34,46,53].

Our study was conducted with a sample of 40 participants. The sample size may not be large enough to represent different types of VR game players. Future studies can consider focusing on players that vary in different aspects such as personal preferences and personality.

The current study only focused on prosocial games in VR because the format of VR readily offers the opportunity for perspective taking. Future studies might wish to explore whether the effect occurs in the case of prosocial games with a traditional format (i.e., game played via regular screens).

7 CONCLUSION

We conducted a study to explore the influence of NPC perspective-taking in a prosocial VR game on game immersion, as well as perceived closeness and empathy towards NPCs. Our results show an interesting pattern to how this influence differs among light and heavy gamers. The findings offer insights for researchers and game developers to explore further concerning the influence of fictional-NPC perspective-taking on other aspects of gameplay and in other game formats.
(Word count: 6637)

Appendix

The following is the textual description used as the prologue in the Control condition of the study.

Prologue – The Robot

(You have 1.5 minutes to read this prologue)
It is a sunny day. In an industrial site, there are 5 robots surrounded by containers, wooden boxes, and barrels. The 5 robots are arranged to be evenly positioned in the site. Each of them are surrounded by several wooden boxes. There is a voice saying "Testing of burning robot begins in 3…2…1" Then, the wooden boxes surrounding one particular robot is on fire. The barrels next to the box are on fire, and then explode.
Gradually, there are some fire at the arms of the robot. The robot waves its hands at a camera (CCTV) to ask for help. After a while, the robot is completely broken. Black smoke emerges from its body. The voice says "Testing complete."

REFERENCES

[1] Sun Joo (Grace) Ahn, Joshua Bostick, Elise Ogle, Kristine L. Nowak, Kara T. McGillicuddy, and Jeremy N. Bailenson. 2016. Experiencing Nature: Embodying Animals in Immersive Virtual Environments Increases Inclusion of Nature in Self and Involvement With Nature. *Journal of Computer-Mediated Communication* 21, 6 (2016), 399–419. DOI:https://doi.org/10.1111/jcc4.12173

[2] Craig A. Anderson, Akiko Shibuya, Nobuko Ihori, Edward L. Swing, Brad J. Bushman, Akira Sakamoto, Hannah R. Rothstein, and Muniba Saleem. 2010. Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: A meta-analytic review. *Psychological Bulletin* 136, 2 (2010), 151–173. DOI:https://doi.org/10.1037/a0018251

[3] Arthur Aron, Elaine N Aron, and Danny Smollan. 1992. Inclusion of Other in the Self Scale and the Structure of Interpersonal Closeness. *Journal of Personality and Social Psychology* 63, 4 (October 1992), 596–612. DOI:https://doi.org/10.1037/0022-3514.63.4.596

[4] Tobin Asher, Elise Ogle, Jeremy Bailenson, and Fernanda Fernanda Herrera. 2018. Becoming Homeless: A Human Experience. In *ACM SIGGRAPH 2018 Virtual, Augmented, and Mixed Reality* (SIGGRAPH '18), ACM, New York, NY, USA, 7:1–7:1. DOI:https://doi.org/10.1145/3226552.3226576

[5] Christine M. Bachen, Pedro Hernández-Ramos, Chad Raphael, and Amanda Waldron. 2016. How do presence, flow, and character identification affect players' empathy and interest in learning from a serious computer game? *Computers in Human Behavior* 64, (November 2016), 77–87. DOI:https://doi.org/10.1016/j.chb.2016.06.043

[6] Domna Banakou, Parasuram D. Hanumanthu, and Mel Slater. 2016. Virtual Embodiment of White People in a Black Virtual Body Leads to a Sustained Reduction in Their Implicit Racial Bias. *Front. Hum. Neurosci.* 10, (2016). DOI:https://doi.org/10.3389/fnhum.2016.00601

[7] C. Daniel Batson, Shannon Early, and Giovanni Salvarani. 1997. Perspective Taking: Imagining How Another Feels Versus Imaging How You Would Feel. *Pers Soc Psychol Bull* 23, 7 (July 1997), 751–758. DOI:https://doi.org/10.1177/0146167297237008

[8] Nicolas Bourgault, Bruno Bouchard, and Bob-Antoine J. Menelas. 2014. Effect of Ecological Gestures on the Immersion of the Player in a Serious Game. In *Serious Games Development and Applications* (Lecture Notes in Computer Science), Springer International Publishing, Cham, 21–33. DOI:https://doi.org/10.1007/978-3-319-11623-5_3

[9] Emily Brown and Paul Cairns. 2004. A grounded investigation of game immersion. In *Extended abstracts of the 2004 conference on Human factors and computing systems - CHI '04*, ACM Press, Vienna, Austria, 1297. DOI:https://doi.org/10.1145/985921.986048

[10] Paul Cairns, Anna L. Cox, Matthew Day, Hayley Martin, and Thomas Perryman. 2013. Who but not where: The effect of social play on immersion in digital games. *International Journal of Human-Computer Studies* 71, 11 (November 2013), 1069–1077. DOI:https://doi.org/10.1016/j.ijhcs.2013.08.015

[11] Paul Cairns, Anna Cox, and A. Imran Nordin. 2014. Immersion in Digital Games: Review of Gaming Experience Research. In *Handbook of Digital Games*. John Wiley & Sons, Ltd, 337–361. DOI:https://doi.org/10.1002/9781118796443.ch12

[12] Paul Cairns, Jing Li, Wendy Wang, and A. Imran Nordin. 2014. The influence of controllers on immersion in mobile games. In *Proceedings of the 32nd annual ACM conference on Human factors in computing systems - CHI '14*, ACM Press, Toronto, Ontario, Canada, 371–380. DOI:https://doi.org/10.1145/2556288.2557345

[13] Kate Carey, Emily Saltz, Jacob Rosenbloom, Mark Micheli, Judeth Oden Choi, and Jessica Hammer. 2017. Toward Measuring Empathy in Virtual Reality. In *Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play* (CHI PLAY '17 Extended Abstracts), Association for Computing Machinery, Amsterdam, The Netherlands, 551–559. DOI:https://doi.org/10.1145/3130859.3131325

[14] Anna Cox, Paul Cairns, Pari Shah, and Michael Carroll. 2012. Not doing but thinking: the role of challenge in the gaming experience. In *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems - CHI '12*, ACM Press, Austin, Texas, USA, 79. DOI:https://doi.org/10.1145/2207676.2207689

[15] Alena Denisova and Paul Cairns. 2015. First Person vs. Third Person Perspective in Digital Games: Do Player Preferences Affect Immersion? In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15*, ACM Press, Seoul, Republic of Korea, 145–148. DOI:https://doi.org/10.1145/2702123.2702256

[16] Alena Denisova and Eliott Cook. 2019. Power-Ups in Digital Games: The Rewarding Effect of Phantom Game Elements on Player Experience. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play* (CHI PLAY '19), Association for Computing Machinery, Barcelona, Spain, 161–168. DOI:https://doi.org/10.1145/3311350.3347173

[17] John Foubert and Johnathan T. Newberry. 2006. Effects of Two Versions of an Empathy-Based Rape Prevention Program on Fraternity Men's Survivor Empathy, Attitudes, and Behavioral Intent to Commit Rape or Sexual Assault. *Journal of College Student Development* 47, 2 (March 2006), 133–148. DOI:https://doi.org/10.1353/csd.2006.0016

[18] Jesse Fox, Jeremy N. Bailenson, and Liz Tricase. 2013. The embodiment of sexualized virtual selves: The Proteus effect and experiences of self-objectification via avatars. *Computers in Human Behavior* 29, 3 (May 2013), 930–938. DOI:https://doi.org/10.1016/j.chb.2012.12.027

[19] Ashley M. Fraser, Laura M. Padilla-Walker, Sarah M. Coyne, Larry J. Nelson, and Laura A. Stockdale. 2012. Associations Between Violent Video Gaming, Empathic Concern, and Prosocial Behavior Toward Strangers, Friends, and Family Members. *J Youth Adolescence* 41, 5 (May 2012), 636–649. DOI:https://doi.org/10.1007/s10964-012-9742-2

[20] Adam D. Galinsky and Gillian Ku. 2004. The Effects of Perspective-Taking on Prejudice: The Moderating Role of Self-Evaluation. *Pers Soc Psychol Bull* 30, 5 (May 2004), 594–604. DOI:https://doi.org/10.1177/0146167203262802

[21] Adam D. Galinsky and Gordon B. Moskowitz. 2000. Perspective-taking: Decreasing stereotype expression, stereotype accessibility, and in-group favoritism. *Journal of Personality and Social Psychology* 78, 4 (2000), 708–724. DOI:https://doi.org/10.1037/0022-3514.78.4.708

[22] Jessica Gasiorek and Amy S. Ebesu Hubbard. 2017. Perspectives on perspective-taking in communication research. *Review of Communication* 17, 2 (April 2017), 87–105. DOI:https://doi.org/10.1080/15358593.2017.1293837

[23] Douglas A. Gentile, Craig A. Anderson, Shintaro Yukawa, Nobuko Ihori, Muniba Saleem, Lim Kam Ming, Akiko Shibuya, Albert K. Liau, Angeline Khoo, Brad J. Bushman, L. Rowell Huesmann, and Akira Sakamoto. 2009. The Effects of Prosocial Video Games on Prosocial Behaviors: International Evidence From Correlational, Longitudinal, and Experimental Studies. *Pers Soc Psychol Bull* 35, 6 (June 2009), 752–763. DOI:https://doi.org/10.1177/0146167209333045

[24] Tobias Greitemeyer. 2013. Playing Video Games Cooperatively Increases Empathic Concern. *Social Psychology* 44, 6 (January 2013), 408–413. DOI:https://doi.org/10.1027/1864-9335/a000154

[25] Tobias Greitemeyer and Dirk O. Mügge. 2014. Video Games Do Affect Social Outcomes: A Meta-Analytic Review of the Effects of Violent and Prosocial Video Game Play. *Pers Soc Psychol Bull* 40, 5 (May 2014), 578–589. DOI:https://doi.org/10.1177/0146167213520459

[26] Tobias Greitemeyer and Silvia Osswald. 2010. Effects of prosocial video games on prosocial behavior. *Journal of Personality and Social Psychology* 98, 2 (2010), 211–221. DOI:https://doi.org/10.1037/a0016997

[27] Tobias Greitemeyer, Silvia Osswald, and Markus Brauer. 2010. Playing prosocial video games increases empathy and decreases schadenfreude. *Emotion* 10, 6 (2010), 796–802. DOI:https://doi.org/10.1037/a0020194

[28] Matthew Grizzard, Ron Tamborini, John L. Sherry, and René Weber. 2017. Repeated Play Reduces Video Games' Ability to Elicit Guilt: Evidence from a Longitudinal Experiment. *Media Psychology* 20, 2 (April 2017), 267–290. DOI:https://doi.org/10.1080/15213269.2016.1142382

[29] Jiantao Han, Haiying Long, and Weiguo Pang. 2017. Putting Raters in Ratees' Shoes: Perspective Taking and Assessment of Creative Products. *Creativity Research Journal* 29, 3 (July 2017), 270–281. DOI:https://doi.org/10.1080/10400419.2017.1360062

[30] Christian Happ, André Melzer, and Georges Steffgen. 2013. Superman vs. BAD Man? The Effects of Empathy and Game Character in Violent Video Games. *Cyberpsychology, Behavior, and Social Networking* 16, 10 (June 2013), 774–778. DOI:https://doi.org/10.1089/cyber.2012.0695

[31] Andrew F. Hayes. 2017. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach* (2nd ed.). Guilford Press.

[32] Dorothée Hefner, Christoph Klimmt, and Peter Vorderer. 2007. Identification with the Player Character as Determinant of Video Game Enjoyment. In *Entertainment Computing – ICEC 2007* (Lecture Notes in Computer Science), Springer Berlin Heidelberg, 39–48.

[33] Fernanda Herrera, Jeremy Bailenson, Erika Weisz, Elise Ogle, and Jamil Zaki. 2018. Building long-term empathy: A large-scale comparison of traditional and virtual reality perspective-taking. *PLOS ONE* 13, 10 (October 2018), e0204494. DOI:https://doi.org/10.1371/journal.pone.0204494

[34] Kieran Hicks, Kathrin Gerling, Patrick Dickinson, and Vero Vanden Abeele. 2019. Juicy Game Design: Understanding the Impact of Visual Embellishments on Player Experience. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*, ACM, Barcelona Spain, 185–197. DOI:https://doi.org/10.1145/3311350.3347171

[35] Jeffrey C. F. Ho. 2016. Effect of Real-World Experience on Immersion in Virtual Reality Games: A Preliminary Study. In *Proceedings of the Fourth International Symposium on Chinese CHI* (ChineseCHI2016), ACM, New York, NY, USA, 6:1–6:5. DOI:https://doi.org/10.1145/2948708.2948709

[36] Jeffrey C. F. Ho. 2020. Real-World and Virtual-World Practices for Virtual Reality Games: Effects on Spatial Perception and Game Performance. *Multimodal Technologies and Interaction* 4, 1 (2020), 1–15. DOI:https://doi.org/10.3390/mti4010001

[37] Jeffrey C. F. Ho and Xinzhi Zhang. 2020. Strategies for Marketing Really New Products to the Mass Market: A Text Mining-Based Case Study of Virtual Reality Games. *JOItmC* 6, 1 (2020), 1. DOI:https://doi.org/10.3390/joitmc6010001

[38] Charlene Jennett, Anna L. Cox, Paul Cairns, Samira Dhoparee, Andrew Epps, Tim Tijs, and Alison Walton. 2008. Measuring and defining the experience of immersion in games. *International Journal of Human-Computer Studies* 66, 9 (September 2008), 641–661. DOI:https://doi.org/10.1016/j.ijhcs.2008.04.004

[39] Daniel Johnson, Lennart E. Nacke, and Peta Wyeth. 2015. All about that Base: Differing Player Experiences in Video Game Genres and the Unique Case of MOBA Games. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15*, ACM Press, Seoul, Republic of Korea, 2265–2274. DOI:https://doi.org/10.1145/2702123.2702447

[40] Xiaobo Ke and Christian Wagner. 2019. The Impact of Game Peripherals on the Gamer Experience and Performance. In *Augmented Cognition*, Dylan D. Schmorrow and Cali M. Fidopiastis (eds.). Springer International Publishing, Cham, 256–272. DOI:https://doi.org/10.1007/978-3-030-22419-6_18

[41] Martijn J.L. Kors, Gabriele Ferri, Erik D. van der Spek, Cas Ketel, and Ben A.M. Schouten. 2016. A Breathtaking Journey. On the Design of an Empathy-Arousing Mixed-Reality Game. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play* (CHI PLAY '16), ACM, New York, NY, USA, 91–104. DOI:https://doi.org/10.1145/2967934.2968110

[42] Andrey Krekhov, Sebastian Cmentowski, and Jens Krüger. 2018. VR Animals: Surreal Body Ownership in Virtual Reality Games. In *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts* (CHI PLAY '18 Extended Abstracts), Association for Computing Machinery, Melbourne, VIC, Australia, 503–511. DOI:https://doi.org/10.1145/3270316.3271531

[43] Richard S. Lazarus. 1991. *Emotion and adaptation*. Oxford University Press, New York.

[44] Xiao Li, Wen Yi, Hung-Lin Chi, Xiangyu Wang, and Albert P. C. Chan. 2018. A critical review of virtual and augmented reality (VR/AR) applications in construction safety. *Automation in Construction* 86, (February 2018), 150–162. DOI:https://doi.org/10.1016/j.autcon.2017.11.003

[45] Ji Soo Lim. 2019. Different Frames of Players and the Motivation of Prosocial Behaviors in Digital Games. In *DiGRA '19 - Proceedings of the 2019 DiGRA International Conference: Game, Play and the Emerging Ludo-Mix*. Retrieved from http://www.digra.org/wp-content/uploads/digital-library/DiGRA_2019_paper_219.pdf

[46] Anna Lisa Martin-Niedecken, Katja Rogers, Laia Turmo Vidal, Elisa D. Mekler, and Elena Márquez Segura. 2019. ExerCube vs. Personal Trainer: Evaluating a Holistic, Immersive, and Adaptive Fitness Game Setup. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19*, ACM Press, Glasgow, Scotland Uk, 1–15. DOI:https://doi.org/10.1145/3290605.3300318

[47] Ryo Mizobata, Chaklam Silpasuwanchai, and Xiangshi Ren. 2014. Only for casual players?: investigating player differences in full-body game interaction. In *Proceedings of the Second International Symposium of Chinese CHI on - Chinese CHI '14*, ACM Press, Toronto, Ontario, Canada, 57–65. DOI:https://doi.org/10.1145/2592235.2592244

[48] Soo Youn Oh, Jeremy Bailenson, Erika Weisz, and Jamil Zaki. 2016. Virtually old: Embodied perspective taking and the reduction of ageism under threat. *Computers in Human Behavior* 60, (July 2016), 398–410. DOI:https://doi.org/10.1016/j.chb.2016.02.007

[49] Holli-Anne Passmore and Mark D Holder. 2014. Gaming for good: Video games and enhancing prosocial behaviour. In *Video games: Parents' perceptions, role of social media and effects on behavior*, Graham, Jeffrey (ed.). 141–166.

[50] Nonny de la Peña, Peggy Weil, Joan Llobera, Elias Giannopoulos, Ausiàs Pomés, Bernhard Spanlang, Doron Friedman, Maria V Sanchez-Vives, and Mel Slater. 2010. Immersive Journalism: Immersive Virtual Reality for the First-Person Experience of News. *Presence: Teleoperators and Virtual Environments* 19, 4 (August 2010), 291–301. DOI:https://doi.org/10.1162/PRES_a_00005

[51] Richard E. Petty and John T. Cacioppo. 1986. The Elaboration Likelihood Model of Persuasion. In *Communication and Persuasion: Central and Peripheral Routes to Attitude Change*, Richard E. Petty and John T. Cacioppo (eds.). Springer New York, New York, NY, 1–24. DOI:https://doi.org/10.1007/978-1-4612-4964-1_1

[52] Sara Prot, Douglas A. Gentile, Craig A. Anderson, Kanae Suzuki, Edward Swing, Kam Ming Lim, Yukiko Horiuchi, Margareta Jelic, Barbara Krahé, Wei Liuqing, Albert K. Liau, Angeline Khoo, Poesis Diana Petrescu, Akira Sakamoto, Sachi Tajima, Roxana Andreea Toma, Wayne Warburton, Xuemin Zhang, and Ben Chun Pan Lam. 2014. Long-Term Relations Among Prosocial-Media Use, Empathy, and Prosocial Behavior. *Psychol Sci* 25, 2 (February 2014), 358–368. DOI:https://doi.org/10.1177/0956797613503854

[53] Katja Rogers, Giovanni Ribeiro, Rina R. Wehbe, Michael Weber, and Lennart E. Nacke. 2018. Vanishing Importance: Studying Immersive Effects of Game Audio Perception on Player Experiences in Virtual Reality. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*, ACM Press, Montreal QC, Canada, 1–13. DOI:https://doi.org/10.1145/3173574.3173902

[54] Lijiang Shen. 2010. Mitigating Psychological Reactance: The Role of Message-Induced Empathy in Persuasion. *Hum Commun Res* 36, 3 (July 2010), 397–422. DOI:https://doi.org/10.1111/j.1468-2958.2010.01381.x

[55] Lijiang Shen. 2010. On a Scale of State Empathy During Message Processing. *Western Journal of Communication* 74, 5 (October 2010), 504–524. DOI:https://doi.org/10.1080/10570314.2010.512278

[56] Ketaki Shriram, Soon Youn Oh, and Jeremy Bailenson. 2017. Virtual Reality and Prosocial Behavior. In *Social Signal Processing*, Judee K. Burgoon, Nadia Magnenat-Thalmann, Maja Pantic and Alessandro Vinciarelli (eds.). Cambridge University Press, Cambridge, 304–316. DOI:https://doi.org/10.1017/9781316676202.022

[57] James B. Stiff, James Price Dillard, Lilnabeth Somera, Hyun Kim, and Carra Sleight. 1988. Empathy, communication, and prosocial behavior. *Communication Monographs* 55, 2 (June 1988), 198–213. DOI:https://doi.org/10.1080/03637758809376166

[58] Bert Vandenberghe, Jef Meijvis, Thomas Sodermans, Kathrin Gerling, Vero Vanden Abeele, and Luc Geurts. 2019. Sailing Skweezee: An Exploration of Squeeze Interaction in VR. In *Extended Abstracts of the Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts - CHI PLAY '19 Extended Abstracts*, ACM Press, Barcelona, Spain, 131–138. DOI:https://doi.org/10.1145/3341215.3356983

[59] P. Wesley schultz. 2001. THE STRUCTURE OF ENVIRONMENTAL CONCERN: CONCERN FOR SELF, OTHER PEOPLE, AND THE BIOSPHERE. *Journal of Environmental Psychology* 21, 4 (December 2001), 327–339. DOI:https://doi.org/10.1006/jevp.2001.0227

[60] Nick Yee and Jeremy Bailenson. 2007. The Proteus Effect: The Effect of Transformed Self-Representation on Behavior. *Human Comm Res* 33, 3 (July 2007), 271–290. DOI:https://doi.org/10.1111/j.1468-2958.2007.00299.x