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“DID THAT JUST HAPPEN?”: INFLUENCE OF EMBODIMENT AND IMMERSION ON CHARACTER IDENTIFICATION IN VIRTUAL REALITY ENVIRONMENTS

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A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Communication Studies

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by

Shane L. Burrell Jr.

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ABSTRACT

The purpose of this study is to explore character identification in virtual reality (VR) in connection to embodiment and immersion. Using previous data gathered from a qualitative study investigating character roles and character identification, I conduct a mixed-method study (survey and qualitative data analysis) to operationalize the concepts of character identification, embodiment, and immersion, study their relationships, and investigate the mediating role of character identification. This study, is a step toward building and validating measurement scales for character identification, embodiment, and VR immersion, suggests future avenues for exploring how character identification shapes user experiences in VR.

Keywords: *Character Identification, Virtual Reality, Embodiment, Immersion, Character Roles.*

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Finally, I would like to thank my friends and family for their support during my thesis. Without their motivation and belief in my abilities this thesis would have not been achievable.

DEDICATION

I would like to dedicate this thesis to those students who have been told, “you’re not good enough,” & “who do you think you are?”. These are the students within the world of academia that have been put down and made to believe they cannot make it. As a student who has experienced this first-hand, I would like to dedicate this thesis to these students to serve as a living document to the abilities of students who are profiled, discriminated against, and put down. This thesis serves as a testimony for future students who may encounter these same tribulations as proof to their abilities and their unwavering dedication to education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Arguably, virtual reality (VR) and virtual environments (VE) have been around for at least 50 years. Although the exact time when the VR technology emerged is difficult to pinpoint, Downey (2016) identifies three "generations" in the evolution of VR: a first-generation (1978-1984) of systems characterized by text-based displays, small-scale systems and fantasy-based VR games; a second-generation (1985-1996) characterized by the development of large scale systems using graphical displays, avatars, and user control over objects in game-like social worlds; and, a recent third generation (1997-) characterized by massive scale worlds and 3D environments in gaming, military applications, entertainment, commerce, and education. Increasingly, VR is showing the potential for transforming higher education by providing new methodologies and pedagogies (Rickman, 2019, & Stafford, 2005).

Virtual reality belongs to the larger class of technologies referred to as "Extended Reality" (XR). This group of technologies also include augmented reality (AR), which allows users to experience the "real world" with various overlays in digital content (Educause, 2017). Although the line between AR and mixed or merged reality (MR) continues to blur, MR is a blending of "real world" and digital content that incorporates users' contextual information (for example their position) and environmental intelligence into a hybrid display that still allows

the awareness of the real physical space around the user (Microsoft, 2018). In contrast, VR is an entirely constructed digital world in which users completely immerse themselves.

VR will presumably have a strong impact on education because of the potential of this technology to act on users' emotions. For example, the known documentary "Clouds over Sidra" boosted UNICEF donations and suggested that immersive technologies may be "empathy machines." Citing a Slate (2017) article, *Empathy at Scale*, Stanford University Human Interaction Lab claim that immersive technologies have promising application in education by helping students in community-based and social justice projects by counteracting compassion fatigue, empirical studies support this contention.

Although there is evidence that VR environments succeed at producing effects beyond particular simulations, due to the Head-Mounted Display (HMD) technology, ethical arguments need consideration. Scott (2015), for example, opposes the use of VR. Scott (2015) argues that using technology in our everyday life affects the potential connection we have with each other and the extent to which we can develop genuine empathy. Scott (2015) is concerned with how, unlike humans, machines obey the code of their programmers, which might prevent adolescents from developing needed skills to cope with complex relationship. While I acknowledge this point, in this thesis I am interested in the mechanisms through which gaming VR environments produce an impact on users, in particular the role of character identification in mediating effects.

Digitally constructed environments have played a pivotal role in society and gaming. A distinction between players in VR and digitally constructed environments needs to be made as the perspectives and experiences of these users of VR and digitally constructed environment are very different. The most salient difference is the fact that players use characters in VR and avatars in digitally constructed environments. This study makes a clear distinction between the definitions of characters in VR and avatars in digitally constructed environments. Characters in a simulation represent a first-person perspective for the user, while the user is using an HMD to see what the character sees in the simulation (Azevedo, S., Campos, P., & Jorge, J.,, 2014; & D'Alonzo, M., Mioli, A., Formica, D., Vollero, L., & Di Pino, G.,, 2019). While the users move through the simulation, they are seeing the environment as the character would see it. This manipulation of the character allows the user to see and feel the simulation through the perspective of the character. The fact that the user experiences the simulation as a character does makes the user more likely to become immersed within the simulation, identify with the character, and experience embodiment (Arriaga, P., Esteves, F., Carneiro, P., & Monteiro, M., 2008; & Dahlquist, L., Herbert, L., Weiss, K., & Jikeno, M.,, 2018; Stafford, 2005). Characters are unique to VR simulations as they are meant to place the user in the position of the character with the HMD, allowing the user to experience a simulation as if it were their own experience and not one that is mediated (Cohen, 2001; Stafford, 2005).

Much like characters, avatars are also characters that the user can manipulate; however, unlike characters, avatars give the user a third-person perspective within the digitally constructed environments. Avatars are also, mostly, customizable in most virtual simulations, this is most notably seen in the digitally constructed environment of *Second Life* (Wardle, et. al., 2018). The customization of a user's avatar allows the user to change the appearance of the avatar, although some characters are customizable within a first-person perspective such as costume, clothes, skin color, etc.; the importance of avatar customization gives a greater sense of user ownership over the avatar for the user (Wardle, et al., 2018). Customization of avatars is important because it allows users to place themselves within the simulation, adding to their overall experience (Ahn, J., Bostick, E., Ogle, E., Nowalk, K., McGillicuddy, K., & Bailenson, J.,, 2016; Reinhard, R., Shah, K., Faust-Christmann, C., & Lachmann, T., 2020; Wardle, 2018). Customized avatars allow their users to experience the simulation through the perspective of a character that acts like a representation of themselves or an aspect of themselves they cannot express in their reality (Farrow, R., & Iacovides, I., 2014).

To summarize, characters and avatars have similar definitions, it proves useful to differentiate between the two. Characters make the user experience a simulation in a first-person perspective, while an avatar allows the user to experience a simulation in a third-person perspective. Although characters are not as customizable as avatar, characters allow the user to see the digital world

through the eyes of the character, as if the environment was their “reality”, therefore allowing for a more “realistic” environment and experience for the user. Although it is important to acknowledge the difference between a character and an avatar, in this study I will only refer to characters and ignore the distinction, since a user typically experiences a VR simulation from the first-person only.

Unlike this study, other studies have used characters and avatars to find potential effects from a VR simulation. Additionally, these studies have primarily focused on empathy and education. In a study on VR and empathy, researchers asked if VR could create an effect on the users to establish more empathy for others and exhibit those feelings outside of the VE (van Loon, et al., 2018). In their study, participants were randomly assigned to one of three simulations (“treatments”): a simulation without a self-avatar or interactivity with the virtual environment and two simulations in which the participants took the viewpoint of two fictional characters with different backgrounds. Then, participants were asked to complete a behavioral game in which they were told that their answers would be paired with either the person they embodied in VR or a different person. The type of simulation and the pairing created a 3 x 2 experiment in which the control condition was when participants who embodied no character were paired with either fictional characters afterward. The results showed that when participants embodied a character in VR, they were more likely to adopt the viewpoint of the character in the behavioral game following the simulation. These

results demonstrate that a first-person perspective develops empathy and understanding for the character the users inhabit.

Rickman (2019) describes her classroom experimentation with VR headsets in her teaching for students with disabilities. She noticed that students with learning disabilities were not learning effectively in the traditional method of teaching. She developed a teaching method using VR that changed the students' relationship and overall paradigm to the lesson and their perspectives on learning. Rickman used an innovative practice in keeping the attention of the student with disabilities by utilizing VR headsets and showing students the geographical locations of the places students were learning. Despite the simplicity of this practice, Rickman established a better learning environment for her students using VR.

In a study conducted on adolescents with disabilities, due to the nature of their medical history, Beals (2010) established an experiment that created a safe space for these adolescents to communicate with one another. The adolescents were approximately the same age, (10 -14 years-of-age,) and had a similar situation regarding their medical history, (many of the subjects were transplant recipients). Beals established this platform to examine how the individual's identity development could progress in a positive environment, "as another environment of which youth are part, virtual worlds have the potential to support various social, emotional, and cognitive developmental needs of youth—for example, clearly there is an important socialization function inherent in most

virtual worlds—just as classrooms and playgrounds do," (Beals, 2010, p. 46). Beals' study examined the use of the virtual world to the benefit of constructing a space where adolescents could support each other through the struggles of being someone with severe medical issues that influence their daily routines. This platform helped adolescents build healthy and constructive relationships using the platform as their medium and mode of communication.

At University College London, UK., a team of researchers launched an app that allowed them to conduct in-field research illuminating possible effects of VR. The study created an app that was placed on the Google PlayStore for Android devices and the App Store for Apple devices. Users could access the app on either platform while using a headset to fully immerse themselves within the virtual environment created for the study. The study conducted evaluated the effects of the VR environment on users' psychology, particularly how users' brains "tricked" them into reacting to the digital environment stimuli as if they were real (Steed, et al., 2016). The results indicated that the participants of the study experienced a behavior change.

These studies all indicate the significant potential contribution of identifying within VR can have on the users of these systems. This significance of identifying within VR illuminates the capacity of VR and VEs have on users of these applications. The contributions of identifying within VR and VE, from these studies have shown, that users experience an impact, positive or negative, from the simulations. However, we lack knowledge of the mechanisms that connect

users' exposure to the VR medium and medium impact or effects on the users. Investigating the mechanisms for producing these impacts proves to show great promise in the realm of virtual worlds. Defining the dimensions by which users of VR and VEs identify with characters greater contributes to the overall understanding of these media and their potential implications on users. Additionally, the application of VR within multiple disciplines has become more prevalent in our society since our transition to a virtual learning and operations environment. The investigation of VR properties becomes more imperative to understand as the integration of VR and VEs weave their applications within daily lives.

This study investigates this impact of embodiment and immersion on character identification as they have the potential to increase character identification in VR and VE. This study is significant because it offers a clue into the possible influences that affect character identification, particularly by embodiment and immersion as media to VR. This study aims to fill the gap in our understanding of why immersive VR environments are said to revolutionize societal applications within the virtual world. First, I review the literature on character identification, embodiment, and immersive environments to comprehend the impact character identification has on users of VR. The review of literature on character identification, embodiment, and immersion discusses the full scope of dimensions of both, immersion, and embodiment, to contribute to this study. I have then provided context as to how embodiment, immersion,

and character identification have immerged from my previous qualitative study and the finding from that study. Additionally, I have provided a full explanation of my methods to this study and how I constructed this study from beginning to end. Lastly, I explain how I have interpreted the results of this study and how they contribute to the research on users of VR, character identification, embodiment, and immersion. Additionally, I discuss the limitations of this study and how changing and improving these limitations can further contribute to the validity of this study and research.

CHAPTER TWO

LITERATURE REVIEW

Character Identification

A person's identity develops with years of integration into social structures and exposure to social feedback. The enactment of social roles—a set of behaviors, norms, expectations, and responsibilities that define particular social obligations—becomes second nature (Fengfeng, K., & Moon, J., 2018; Hoeken, H., & Jop, S., 2014; Hoffner, C., Buchanan, M., & West, V., 2005; van Looy, J., Courtois, C., de Vocht, M., & de Marez, L., 2012; van Reijmersdal, E., Jansz, J., Peters, O., & van Noort, G., 2013) . An individual can establish and perform many roles, sometimes simultaneously: we are siblings, children, cousins, students, business owners, etc., however, what processes of identifications are present when individuals adopt VR roles? Sekimoto (2012) examined identity construction in the context of VR roles using a multimodal approach. She argues that identity is constructed by "being-in-the-world". Using this understanding of identity constructions within VR, the further investigation of character identification and therefore, participants' ability to identify with their characters within VR, becomes more imperative to examine.

As spectators of media, we are exposed to heightened emotions and performances; for example, when watching a horror movie, we experience the terror and fear the character is feeling when being chased by the killer, or when

we feel afraid when a figure pops out in the film. In other words, these are moments when we are experiencing identification (Cohen, 2001). With these experiences and the willingness to be subjected to identification, we are taking on a role from the character as we navigate through VR. We are becoming a part of the media character and personifying the role, and by doing so, we are taking on characteristics and emotions of the character not meant to be our own (Cohen, 2001). This process of identification is not only seen within the consumption of media, with videos, music, video games, etc., but the latest research has shown that identification is happening within VR as well (Barberia, I., Oliva, R., Bourdin, P., and Slater, Mel., 2018). The more a participant becomes invested in a VR simulation, the more they can feel present within the simulation, thus establishing an effect (Dahlquist, et al., 2010). Identification within VR allows for the participants to feel present within a simulation while creating a more immersive environment for the participant. The factors that influence identification, when united, create for strong experience in VR; however, what these factors are and how they operate needs further study (Hennenberg, 2017).

Character identification is a key mechanism in achieving various outcomes from using VR, such as learning, enjoyment (e.g., when playing games), or medical treatment (Rickman, 2018; & Stafford, 2005). Additionally, how users identify with characters gives an indication of embodiment and immersion's role on character identification in immersive environments. I will use Cohen's (2001)

definition of identification as “a mechanism through which audience members experience reception and interpretation of the text from the inside as if the events were happening to them” and adapt the definition to VR (p. 245). This definition already suggests the influence of embodiment and immersion on character identification.

Studies have shown that users of VR feel a stronger connection to the VR simulation if they are playing in first-person rather than third person; this connection then enables users to take ownership of their character within the simulation (Bréchet, L., Mange, R., Herbelin, B., Theillaud, Q., Gauthier, B., Serino, A., & Blake, O., 2019; & van Dam, L., & Stephens, J., 2018). van Dam, et al. (2018) found that taking ownership of one’s character increases presence which, in turn, increases immersion. They write: “… ownership and agency of a virtual avatar or tool, the sense of presence is another qualitative subjective measure for how immersed we are in the virtual world” (van Dam, et al., 2018, p. 3). However the definition of presence as stated by Jennett, C., Cox, A., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A., (2008) is, “a psychological sense of being in a virtual environment” (p. 643). This study uses presence in association with immersion, however, I must not that presence and immersion are not interchangeable but work in tandem in this study.The stronger the character identification, the stronger immersion is. This finding suggests that the relationship between character identification and immersion have a possible positive correlation to one another; as character identification rises, so does

immersion. Identification with a character, or as a first-person experience in a simulation, potentially increases immersion within the simulation. Similarly, Lim, et al. (2006) argues that characters:

> increase the realism and consequence of media interactions. Players may feel more a part of the unfolding narrative on the screen, and the consequences of conversation and action, especially if it's competitive, create a response more aligned with fact than fiction. Rather than a willing suspension of disbelief, there is an automatic acceptance that the experience is real. (p.20)

Lim, et al. (2006) indicate that the increase in realism within the simulation will increase the level of immersion for the player. Additionally, the increase in the level of immersion can also suggest that the user within the simulation must also increase their character identification within the simulation. Therefore, the literature shows that the increase in "realism" or the more able the user can feel immersed within a simulation, the more likely this will be identifying with the character at the same time; suggesting a mutual relationship between character identification and immersion.

In a study examining near-death experiences (NDE) and how VR simulations and identification could affect an individual, Barberia, et al. (2018) examined users playing as humanoids (figures with human-like features) in a VR environment where they could experience the death of their character. This simulation allowed the participants to experience their development from being

born, to aging, and eventually dying. The participants were also able to experience the death of the other participants that were in the simulation at the same time. The participants were able to establish a sense of connection as they completed tasks and objectives together as a team. The study aimed to allow these individuals to experience death second hand and experience death for themselves to study the effect of the simulation on one's fear of death. Participants in the study reported that the identification they had with their character also contributed to their sense of immersion. (Barberia, et al, 2018). This study further provides evidence that immersion contributed to users' sense of identification with their characters. The participants reported that they felt ownership of their avatars and that when in the simulation, interacting with their co-participants gave them a sense of presence within the world which allowed them to become immersed within the simulation and have a change in perspective (Barberia, et al., 2018).

These studies have provided a sense of how users of VR interact with characters that have similar features as the user or are humanoid in nature. However, it is important to recognize that not all characters within a VR simulation are humanoid in nature (Ahn, et. al., 2016). With the various VR simulations that are available for those to download and experience, users of VR can experience VR simulations as animals, elements, deities, and many other entities. This distinction of characters is important to state, as users of VR can

identify with many different aspects of a VR simulation. Due to the nature of identification, I will investigate:

RQ: How, if at all does, character identification affect the association with immersion and embodiment?

Using this research question, I can narrow the gap in research of how users of VR identify with the character they play within a VR simulation, as well as give a clearer understanding to the nature of character identification and embodiment, and character identification and immersion.

Embodiment

So far, we established that users find it easier to inhabit characters in virtual environments. Embodiment is the process of how the user becomes a part of the character (Gui, D., 2018; Joo, S., Ahn, G., Minh, A., & Bailenson, J., 2013; Moghimi, M., Stone, R., Rotshtein, P., & Cooke, N., 2016; Pasfield-Neofitou, S., Huang, H., & Grant, S., 2015). Embodiment resembles “body transfer” and allows for the user to extend their sense of self within a virtual environment (Ahn, et al., 2016; D’Alonzo, et al., 2019; Wardle, et al., 2018; & Yoon, et al., 2014). Studies on embodiment show that users become more immersed in virtual environments as their level of embodiment in the simulation increases (Wardle, et al., 2018). Users in these studies explained how they feel while they are embodying a character and the data has

confirmed the more immersive the environment, the more the user can embody the character (Ahn, et al., 2016; & D'Alonzo, et al., 2019).

The literature gathered for this study has identified the dimensions needed when a user of a virtual environment embodies a character (Farrow, et al., 2014; Reinhard, et al., 2020; Wardle, et al., 2018). As embodiment is considered a form of "body transfer," (Ahn, et al., 2016; Yoon, et al., 2014) for the sake of this paper I will be using Kilteni, K., Groten, R., & Slater, M., (2020) definition of embodiment, "the ensemble of sensations that arise in conjunction with being inside, having, and controlling a body especially in relation to virtual reality application," (p. 374-375). This explanation of embodiment identifies three dimensions of embodiment: environmental, physical ownership, and autonomy of character.

The user must use a character with their characteristics (emotionally or physically) allowing the user a sense of autonomy over the character. Ahn, et al. (2016), tested this with participants taking on character roles of animals through testing the user's emotional response to the environmental impact. The results showed that the participants left the simulation appreciating the environment; although longitudinal effects are still yet to be determined (Ahn, et al., 2016). The results prove useful as users did not need to be humanoid (with human-like physical features) avatars to embody the characters in the simulation; however, by the user placing their emotional investment to the animal character they played, the participants of the study indicated a higher sense of embodiment.

By placing emotional and physical characteristics of oneself on an avatar, the user can embody the character; however, a dimension of embodiment extends the ownership of the character from the user and is guided by society's social rules and regulations pertaining to the users' current reality (Wardle, et al., 2018). The social standards placed on users, in reality, are extended to the avatars in the virtual simulation, and despite avatars being humanoid or not, the roles the avatars fill are determined by user or creator. Wardle, et al. (2018) examined users of *Second Life* speaking with their avatars and found that although the users created avatars (some who were not human), the avatars adhere to the social norms of the user's reality. This embodiment of an avatar, although different from oneself, plays the roles they believe they would play in the user's society (Wardle, et al., 2018).

The dimensions of embodiment determine how a user will act and react in the virtual environment as they see their character reacting within reality (Wardle, et al., 2018). A participant within Wardle, et al.'s (2018) study explained her avatar had strong emotions of its own that translated to her as a user, "…longer-term Second Life resident described how her avatar sometimes affected her actual world emotional state: 'She gets so emotional that sometimes it makes me cry too'" (p. 12). This dimension of embodiment illustrates the emotion users place on their characters and therefore that level of embodiment is increased by the user; however, from the argument made by Wardle, et al. (2018), it must be

noted that character identification and embodiment have a possible transactional nature to one another.

Yet the research on embodiment and character identification does not clearly indicate the relationship one has with the other. Soutter & Hitchens (2016) argue, “identification of a player with their [character] and the control of the player over the visual depiction of the [character] are good candidates to examine possible effects on the flow state within games” (p. 1031). Their study examined how the flow state, or immersion, presence, and embodiment, can influence a user’s ability to identify within their character. Although they found that the user’s ability to identify with their character using flow state theory was not significant when customization was introduced, the study could not definitively determine that immersion, presence, or embodiment were significant enough to determined character identification. However, character identification seems to have an impact on users of VR despite the character’s appearance. Ahn, et. al., (2016) examined a user’s ability to embody a character without humanoid features to determine if the users of VR would change their perspective of environmental issues. Their study suggest that the users of VR were able to embody their characters and had a change in perspective of environmental crisis (Ahn, et. al., 2016). Reinhard, et. al., (2020) examined the potential effects of embodiment and character identification could have on users of VR and found that the users of VR were more likely to embody their characters versus users of console-played games or digitally constructed environments. Despite the information from

these studies, the finding of these studies contradicts one another and therefore, there is still no definitive evidence that can suggest embodiment and character identification are associated positively or negatively. I seek to clearly define this relationship between embodiment and character identification by answering the hypothesis,

H1: Embodiment and character identification are positively associated.

Emotional Investment into the Virtual Reality Character

While the dimensions of embodiment are necessary to understand, the emotional impact a user experiences while embodying a character provides context to the ownership a user feels while playing a character. Studies have shown that the emotional impact on a user from their character comes from the emotional attachments or investments a user places on the character (Ahn, et al., 2018; Barbaria, et al., 2018; Wardle, et al., 2018). The emotional impact can vary from a wide range of emotions; however, the impact of the emotion allows a user to connect and bond with their character. Users with an emotional connection to their character are more likely to embody their character, due to the level of emotional investment the user has placed within the character. This emotional embodiment of the character is recognized as an ownership of the character and therefore the emotional impact from the character to the user is greater due to the level of embodiment and emotional investment.

Physical Investment into the Virtual Reality Character

The emotional impact gives an understanding of the impact a character can have on their users' emotions, however, the physical impact of characters on users can explain the users' physical reactions to their characters' abilities or interactions. The physical qualities of the character allow the user to feel more connected and embody the character, this embodiment comes from the physical motions and characteristics of the character. The physical motions and characteristics of the character allows for the user to have an extension of themselves within the character; by this, the as the user is experiencing a VR simulation, they control the gestures and movements of the character and as the user moves, so does the character. The physical attributes of the character allow the users to move within the simulation using the movements of the character. With these physical qualities, users are more likely to take agency of their characters and have a stronger sense of embodiment in the simulation (Barbaria, et al., 2018). The movements of the characters also contribute to the overall physical impact a user can have from the character, as the user manipulates the character in a particular direction the character moves within that direction. (Dahlquist, et al., 2016). The physical motions of the characters give the user a sense of connection to the simulation. Some also argue that the physical attributes of the characters are most important for the user to feel their actions affect the simulation (Wardle, et al., 2018).

Self-Location to the Character

Emotional and physical impacts of embodiment argue for a stronger connection of the user to the simulation. However, the environmental impact of embodiment contributes to the user's overall experience. Environmental embodiment can be understood by the users' ability to inhabit the virtual simulation their character plays within. This environmental embodiment allows for the user to embody the character's environment and take ownership of the resources that are given while playing within the simulation. For example, if a user is playing within a space station, the user would experience environmental embodiment within the simulation as they floated around the space station grabbing what they needed to move their character in the direction they wanted them to move in. An environmental embodiment allows for the user to not only have a strong connection with the emotional and physical influences of their character but also embodying the environment the character inhabits (Wardle, et al., 2018). The environmental embodiment for users contributes to the users' sense of realness within the simulation, this can be argued to be the dimension of embodiment that has a strong transactional connection with immersion. It is the environmental embodiment of the simulation that influences the users to believe their environment within the simulation can impact them and therefore adding to the users' sense of immersion.

Immersion

Immersion is defined by Slater (2003) as having a sense of “being there” or feeling that the environment you are in is real. Slater (2003) argues that immersion is related to embodiment, as immersive environments contribute to the overall sense of the character and realness of a simulation. Within gaming research, immersion means being within the gaming experience; the game is the only thing that matters (Jennett, et al., 2008). Other researchers have used immersion to refer to a psychological state of mind (Jin, S., 2009; Makransky, G., Terkildsen, T., & Mayer, R., 2019; Witmer, et al., 1998). Both definitions give a different theoretical perspective on immersion; however, for this study, I will use the term immersion as a sense of “being there” or a feeling that the simulation is your reality (Slater, 2003). More research is needed to arrive at a consistent definition of immersion in virtual environments (Adame, 2019).

Hoyt, et al. (2003) argued that the subjects are less likely to perceive the virtual environments (VE) as reality when the environment is less believable; however, when the depth of the environment is more interactive with the user, the user is more likely to be more participatory and exhibit fewer inhibitions to reality. However, Schuemie, M., Van Der Straaten, P., Krijn, M., & Van Der Mast, C., (2001) argue that, while the realism of the environment does impact immersion, the individual never forgets that the process is strictly make-believe:

> …part of the perception acknowledges that the experience is mediated by technology, while another part does not. This is rarely explicitly stated in presence literature even though it is an essential aspect of the concept. People always know the experience is mediated, and given the current state of technology, can always distinguish between mediated and direct stimuli. Nevertheless, at some level, the illusion of nonmeditation can be perceived. (Schuemie, et al., 2001, p. 185)

Schuemie, et al. (2001) show an explanation of dualism, or being within two "real" places at the same time, within the VE, giving an understanding that the participant is aware that their experiences within the VE are mediated and being presented by a program/algorithm. They also explain that the participant has hopes that they will somehow lose their inhibitions within the programing and become a part of the illusion.

The technical setup of the VR medium contributes to user immersion. The user must use a head-mounted display (HMD) which projects an image or video onto optical lenses in front of the eyes of the users and is matched with direct audio to the ears, allowing for the user to see and hear the simulation up close and simultaneously. Using this setup, users can become immersed within the simulation. Becoming immersed within a VR simulation has been shown to have effects on the users after leaving the simulation (Barbaria, et al., 2018; Dahlquist, et al.,2018; Stafford, 2005). Studies argue that, when using a VR immersive environment, the participants felt a sense of being there within the simulation, a

sense of autonomy over the characters they played and lingering feelings from the simulation, "…when the VR is programmed to respond appropriately to the reactions of participants, then they tend to behave as if their experience were real" (Barbaria, et al, 2018, p. 4).

Whether and to what extent virtual environments lead to long-term effects has yet to be researched. The sense of autonomy over the characters suggests that the level of immersion the user maybe feeling could lead to a higher sense of immersion with the character (Dahlquist, et al, 2018).

The fact that VR is a rich medium helps both to immerse the individual and to potentially create effect. Sekimoto (2012) argues that, during simulation processes, individuals rearticulate environmental knowledge to construct a role that is more effective when the medium is richer, with maximum effectiveness in VR. Jin (2009) also explored modality effects by measuring how avatars respond to messages delivered through different media in *Second Life*. Jin argues that messages have a more potent effect on the individual if they reach a particular depth of media richness, "the breadth dimension of media richness can induce affective responses like enjoyment and pleasure during interactive media experience" (Jin, 2009, p. 721). In combination, the work by Jin (2009) and Sekimoto (2009) seems to suggest that higher degrees of media richness in virtual environments lead to more immersive virtual experiences and possibly long-lasting effects.

A sense of real-ness in the game may emerge for participants from taking ownership within the game, but also from the extent to which users are familiar with the technology and the functionality of the game. For example, Arriaga, et al. (2008) found that unfamiliarity with VR technology led to less immersion: “It is conceivable that by asking players to use a technology they were unfamiliar with, we have unwillingly put them in a more challenging situation, therefore making it more difficult for them to successfully comply with the task” (p. 533). Despite the unexpected challenges, users of VR have had the ability to identify within the VR simulation by using their character as a mediator.

However, it is important to state that research conducted on immersion and character identification does not clearly state that immersion leads to character identification or mediates character identification. Gualeni, S., Vella, D., & Harrington, J., (2018) examined how character identification can have possible effects when the proper de-roling practices are not taken when leaving a character from an immersive environment. They explain that,

> the user’s experiential position towards the virtual environment, and the player’s engagement with the gameworld, cannot be separated from - and, in fact, directly implied - the adoptions of a subjective standpoint and existence within that world. Most often, this has been conceptualized as an embodiment in the form of the [character] – the figure the player identifies as ‘herself’ in the gameworld” (p. 10).

The connection the user of VR has with the simulation is suggested to have a direct impact on how the users of VR can perceive their character identification. Additionally, Chory-Assad, R., & Cicchirillo, V., (2005) examined how TV viewers empathized with characters based on their level of cognitive-emotional identification and their level of immersion. Their study found that, “feelings for or with another person was not predictive of sharing the character’s feeling and responses, … This suggest that perhaps it is easier for viewers to extend cognitive interpersonal tendencies to TV characters than it is for them to extend affective ones” (p. 154). The finding from both of these studies can suggest that immersion leads to character identification, however, in a study investigating identification and presence using violent video games, William (2013) found that presence was not a factor that contributed to character identification. Presence, although different from immersion, can be understood as placing the user of VR within a simulation, or, for William’s (2013) study, a contributor to identification. William’s (2013) argues that the user did not achieve identification when using examining physical presence however could identify when examining self-presence. These studies provide and interesting look into character identification and immersion, however, the information provided within these studies do not provide enough context to positively or negatively associate immersion and character identification. I seek to investigate the nature of the relationship of character identification and immersion using this hypothesis,

H2: Immersion and character identification are positively associated.

Emotional Investment and Immersion

Immersion not only allows a sense of presence in the simulation, but an emotional investment from a user contributes to immersion. The user's emotional investment in the immersive environment gives the user an attachment to the simulation (Barberia, et al., 2018). Research on the extent of users' emotional investment in a simulation has yet to be completed, however, emotional investments in immersive environments is argued to strengthen the sense of immersion the user is feeling while participating within the simulation (Ahn, et al., 2016; Barbaria, et al., 2018; Dahlquist, et al., 2018; Stafford, 2005). These investigations of emotional investment by the user in the simulation shows an interesting connection of how immersion, as it pertains to the users' emotions, can take on a different form from its intended purposed (Slater, 2003).

Environmental Investments and Immersion

While the influence of emotional investments and user attachments to the simulation provide an interesting perspective on how emotions can help users become more immersed in a simulation, the environmental aspect of the simulation is also important. The appearance of the virtual environment must be believable to the user to lead to a feeling that the user is invested in the environmental aspects of immersion (Ahn, et al., 2016; Jennette, et al., 2008; Slater, 2003). This visual aspect, along with the interaction between user and the environment, contribute to the users' belief that they are within the simulation.

The user and the simulation are in a symbiosis of operation and play. While the simulation is operating as it's supposed to, the user is benefiting from the operations of the simulation and participating within "play" as they are directed. The users believe that the environment is interactive, that they can manipulate it, and that it can cause them harm to them (Ahn, et al., 2016). The research conducted on the effectiveness of the environmental aspects of VR have not yet fully been investigated, however, research has shown that users of VR have experienced a shift in ideologies and mental states when exposed to peaceful and relaxing VR environments (Ahn, et al, 2016 & Barbaria, et al, 2018).

The quality of the simulation's environment influences the user's ability to perceive the realness of the simulation and therefore, gives the user a sense of power or agency with the environment. This sense of agency with the environment gives the user a perceived sense of belonging. It is with this sense, that the user believes that the environment is real.

Physical Investments and Immersion

The physical investments from the user to the simulation shows the user's ability to recognize the physical aspects of the simulation as they perceive them to be real (Gualeni, et al., 2018). The physical qualities of an immersive environment are interpreted by the users as something that can cause the user harm, however, there are other aspects of the simulation's physical qualities that do not cause harm to the user but still have a physical effect on them (Ahn, et.

al., 2016).This is something that can vary depending on user and simulation, however, the physical investments of immersion are known for the cognitive and biochemical stimulations an immersive simulation can have on a user. Additionally, the cognitive effects simulations can have on users are a change in perspective and different outlook regarding ontological well-being; while the biochemical responses can be a change in neuron firing, producing excess hormones within the brain, stimulating fight-or-flight responses, etc. These physical reactions are caused by the simulation and contribute to the immersive play of the play based on the belief of the user (Dahlquist, et al., 2018; Gualeni, et al., 2018; Peterson, et al., 2018).

Unlike environmental investment, physical investment can be recognized in the user's ability to perceive objects in the virtual space as real (Peterson, et al., 2018). These harms, or physical implications, although not real, are perceived by the users to be real. For example, if the user is walking on a beam in VR and falls off, the user believes that they would die (Peterson, et al., 2018). Research shows that the physical investments from the user can be measured by the user's heart rate during a dangerous or perilous situation in a simulation (Peterson, et al., 2018). The physical qualities of the simulation can also influence the user's reality. The physical aspects of the simulation can influence the physical factors of the user's sense of reality. This suggests that the physical implications of the simulation can translate to the user's reality and therefore

affects the user's physical body (Dahlquist, et al., 2018; Gualeni, et al., 2018; Peterson, et al., 2018).

H3: Embodiment is associated with Immersion.

Character Identification, Embodiment, and Immersion

The concepts of character identification, embodiment, and immersion provide a nuanced viewpoint from which to study user experiences in the virtual world. The relationships among these concepts may provide insight into how VR can impact users. The relationship of embodiment and immersion across the emotional, physical, and environmental dimensions contribute with a users' identification with their character. Steed, et. al., (2016) argue that participants who establish self-representation with their character, operate a character within a simulation that has the same physical traits as the user; height, weight, etc., are more likely to display actions of self-preservation while within a VR simulation. This would suggest that users of VR are more likely to keep out of dangerous scenarios while within a VR simulation to sustain the life of their character. In a study examining the sexual nature of characters within *Second Life*, Wardle, et. al., (2018) interviewed many users of *Second Life*, however, one user explained their relationship with their avatar, "'she gets so emotional that sometimes is makes me cry too'" (Wardle, et. al., 2018, p. 12). Wardle et. al., (2018) explains this as, "emotional responses are typical of the 'visceral empathy'

… and it is in such responses that the manifestation of Real avatar modality may be observed," (p. 12). This reaction proves interesting in investigating immersion and embodiment, as Steed, et. al., (2016) argue that immersion has an impact on a user's sense of embodiment, however, Wardle, et. al., (2018) observe that a user's level of embodiment has an impact on the immersion experienced within a digitally constructed environment. These studies provide preliminary evidence of the impact of immersion and embodiment on users, although they do not explicitly investigate the relationship of immersion to embodiment.

This study proposes to examine in-depth how embodiment, immersion and character identification might relate. I will examine these relationships by using a quantitative analysis of survey data collected from of sample of to examine the correlations of embodiment on character identification, the correlation of immersion on character identification, the association of embodiment and immersion, and the possible role character identification has to mediate immersion and embodiment. I aim to test these problems by using hypotheses influenced by an on-going qualitative study.

H1: Embodiment and character identification are positively associated.

H2: Immersion and character identification are positively associated.

H3: Embodiment is associated with immersion.

RQ: How does character identification affect the association of immersion and embodiment?

The research question and these hypotheses aim to investigate how these three concepts, embodiment, immersion, and character identification, relate in the context of virtual reality gaming. To study these relationships, I will create a multi-dimensional operationalization of each concept and validate it with survey data. This approach gives a relational understanding of how embodiment and immersion associate with one another, therefore bridging the gap in knowledge and further continuing the research on character identification in VR.

CHAPTER THREE

PRELIMINARY QUALITATIVE STUDY

I conducted a preliminary study between February and March 2020 to investigate character identification and explore two concepts that emerged from the literature, de-roling and a counter concept I have coined, en-roling. Stafford (2008) identified the phenomenon of de-roling when examining medical students' reactions to their virtual patient treatment plans. Medical student who lost their virtual patients experienced shame, grief, and overall emotions of loss. Stafford's insights led to my investigation of how players of VR games adapt to their character roles (en-roling) and relinquish these character roles (de-roling). My study, *Exploring En-Roling and De-Roling from Virtual Reality*, (Burrell, 2020) examined the experiences of first-time virtual reality users who played a VR game, *Lone Echo*, using the Oculus Rift headset. The simulation allowed the participants to experience a wide range of motion in VR, as well as a training module before the game proper. Because my participants were first-time users of VR, the training sequence was essential for their experience. All participants had 40 minutes of game play, after which they were asked to participate a semi-structured in-depth interview that lasted up to one hour. This interview asked participants about their experiences with *Lone Echo* and their perceptions of their character and the environment.

Lone Echo, a 2017 virtual reality adventure game developed by Ready At Dawn, is a single player story which takes place in zero gravity aboard a space station orbiting Saturn. Players are casts as the character of a service android, "Jack," who reports to a human crew member, Captain Olivia Rhodes. As a service android, players have to work with their captain to fix the station's systems knocked off by a space anomaly. In the process, they explore and use tools and other objects to solve puzzles. I chose this game because it allows players freedom of motion (they can grab almost any object and move around unrestricted). For first-time VR players, this locomotive freedom is important because the ease of motion makes their transition to the VR medium easier. I wanted to allow my participants to have agency and experience VR however they chose in the hope that they would identify with their character faster.

The original intention behind the study was to conduct a thematic analysis of the in-depth interviews with the participants. I chose a thematic analysis because the study was meant to be exploratory and to provide a research direction and testable hypotheses for the quantitative study that I intended to conduct in my thesis. In particular, I wanted to see what was common to the experiences of my participants. Due to the COVID-19 pandemic, my study was interrupted and ultimately canceled on March 9th, 2020, as one prerequisite for conducting this study was having participants play the game in person, in controlled lab conditions. Because of this interruption, I only collected four interviews, which I nevertheless transcribed and preliminarily analyzed.

A particularly interesting moment in my research was when one participant confessed during the interview to a feeling of dissociation: “I’m still trying to figure out if this is real.” Unknown to me, this participant was a person with disabilities and their experience was akin to what they described as a “suicidal haze.” I made an incident report to the Institutional Review Board (IRB), halted my study for a protocol revision, and followed up with the participant to provide additional resources and services. This incident gave me the first insight into how participants experience embodiment. During the follow-up appointments with this participant, they shared that they were experiencing this feeling of “still trying to figure out if this is real” for about four to five hours after their participation in the study. They explained that as someone who could not walk in the past, they did not want to leave the simulation because character’s abilities: they floated around a space station at their leisure and could move around in all directions. The insight that this participant shared suggested the connection between what I now call “embodiment,” a VR game character’s locomotory abilities, and character identification. This participant identified so strongly with their character that they were having trouble “de-roling” or relinquishing their character role for some time after the game was over!

I conducted the data analysis using the ATLAS.ti qualitative software. Because at the time there was not a lot of published research about players’ VR experience, I did not have expectations about what I was going to find in the data, just research questions about how players experience character

onboarding and character exit. For that reason, I adopted a grounded theory approach and conducted open (line-by-line) coding. In the open coding stage, which is the first stage in grounded theory analysis, the researcher seeks to describe the phenomena in the data. My initial coding process came up with approximately 200 different codes describing the participants' experiences during game play.

Because I had to interrupt the study after only four interviews, I did not continue with the next stage in grounded theory analysis, axial coding. (Axial coding is the process whereby the researcher organizes the large number of codes generated during the open coding stage by grouping them on the basis of their relations to each other). At the end of the first coding phase, I was able to pull three main concepts from the data, embodiment, immersion, and character identification. The following excerpts from the interviews will illustrate the textual cues that led to my focus on those three concepts.

Several observations on the existing interviews strongly suggested the importance of relating to one's character, physical sensations, and the experience of "flow." For example, the following statement illustrates the experience of embodiment seeks to get use with the game character:

> I think towards the end I started to grab things that were floating in the air, just to see – well, at first I – when I first saw things floating, I was like – I thought to myself like maybe I shouldn't. Like I don't know if I can grab those, but then considering I could have pulled from the side, like the little

> blue handles on the side, I thought maybe I could just grab everything, and then I did. So I grabbed like a – I opened a shelf, and then I reached in to grab like a tool, but then I grabbed that, and I saw everything was moving, so then I tried to put it back so it wouldn't come out, but then I couldn't close the door anymore. But I guess in that – at that point is – I realized it was more of like just exploring with the character, trying to see like what you can press, what you can like open or close, and grab, and pull, and throw. (Participant 1)

This explanation not only shows how the participant learned the environment through movement, but also the connection with "en-roling" (character onboarding).

Another participant described the relationship between character identification and embodiment from the perspective of the sensory experiences of the main character:

> I could feel like I was playing as him [the robot]. I was experiencing stuff that he would experience, like all the weird stuff that he could scan. I thought like press the thing, because I was – that was – I was intrigued by just being able to press a button on your wrist. And then being able to see how he would actually react to like the things around him. Like if you're at a corner, you do like an A-OK sign for a reason, like when you grab stuff at the corner of a table, like you do like an A-OK sign. And then the scanning part was kind of weird, and I like – I thought you could scan

> yourself in that scanning calibration, so I was like, hey, maybe she wants me to scan myself. So I turned around, I started to scan myself, or to scan something I'm in. (Participant 2)

In this excerpt, the relation between physical experiences and being able to adopt the perspective of the game character is made clearer. Note, for instance, how the participant refers to the robot first as "he," and then as "myself". This identification happens because the participant is able to experience a range of functional motions (pressing buttons, grabbing, scanning) that further embeds the gamer into the situational context.

The following excerpt further illustrates en-roling into one's character, a process necessary for character identification:

> But when she gave you that human characteristic by calling you Jack instead of whatever original name it was, it made me feel like did she have an intimate relationship with this robot? So that's just kind of interesting, because the whole time she's just like, "Are you going to miss me?" I'm like, I don't fucking know you. (Participant 3)

The participant describes their experience interacting with the simulated character in a more personable, intimate fashion. Here, character identification will presumably occur once the participant resolves the tension between her own emotions and the emotions they are invited to experience as part of their role. This description suggests that character identification (and possibly embodiment,

insofar as character identification and embodiment seem to be related) also involves processes of emotional identification. This type of comments illustrated how a simulation could have emotional, physical, and environmentally oriented embodied experiences.

Slater (2003) describes immersion as the “sense of being there,” and “real-world sensory modalities.” Although this description of immersion does not necessarily provide guidance for analyzing textual data, it did provide a context of the kind of statements that could illustrate the feeling of immersion, such as forgetting about “the real world”, getting absorbed by the tasks at hand, and so on. For instance, a participant explained: “I kept hitting the headset with my hands because I thought I had more space.” Another quote illustrates how another participant experienced a sense of freedom while the game was under way: “the end goal is the same, the starting point and ending point is exactly the same, it’s just what you do in the middle you can pretty much do whatever you want.” These coding groups gave me an understanding of how my participants were experiencing their sense of immersion and how they distinguished (or not) between their experiences while in the VR simulation and their own realities.

Participants also described their feelings during the game. One participant expressed feelings of love and empathy for another character in the game. They described this experience as a love interest between the character they were playing another simulated character within the game, “just by the way they were talking to each other, I think they had something else going on.” Being able to

provide a back story and “social texture” to the character further contributed to the participant’s immersion.

Of particular interest were statements that started with “I,” indicating how the participants were reflecting on their experience and on the tension between their own sense of self and the self they were invited to occupy. For example: “oh I was trying to be real slick, and trying to maneuver everywhere, and then I miss something and I was like damn.” These “I” statements gave me an understanding of how my participants were enacting their character’s abilities and how they perceived the merger between themselves and their character as their character moved throughout the simulation.

In addition to clues about the experience of character identification, which was the original focus on my study, the unexpected comments suggesting immersion and embodiment were striking. I was also surprised by the role of emotions and how they might contribute to all three phenomena. Although the idea of immersion was not as surprising as the idea of embodiment as prior studies have discussed immersion and presence in VR, the relationship with embodiment in VR was unexpected. For the participant who described their de-roling experience as a “suicidal haze,” their immersive experience was much more intense than those that experienced de-roling without having previous disabilities. My other participants were more aware that they were playing a game and used the term “immersion” to make that distinction: “you start to like, you really feel immersed.”

Despite the COVID-19 setback, the insights from this interrupted study shaped the study that constitutes my thesis and the hypotheses I formulated. The concepts of immersion, embodiment and character identification gave me an understanding of how I could further explore the role that character identification plays while also accounting for how embodiment and immersion contribute to en-roling and de-roling from a character role. One of my main takeaways from the study was that we are missing agreed-upon definitions of what constitute immersion, embodiment, and character identification in VR. Therefore, an important contribution that my thesis could provide was to propose operationalizations of these concepts and develop ways to measure them and procedures for validating those measurements.

I recognize that four interviews are not sufficient to draw strong conclusions, although the data the interviews provided is quite rich. Other limitations include the fact that all participants were all male between the ages of 21-26, with interest in gaming and VR. Although due to the study settings it is doubtful that I would have been able to recruit older participants or participants not interested in VR, it would have been interesting to compare the experience of male and female players. It needs to be mentioned that VR and gaming were created by white cis-male men and intended to be marketed to a similar audience. (Stanney, K., Fidopiastis, C., & Foster, L., (2020). Nevertheless, this initial exploration was a good source of insights that oriented my literature review and the present study.

CHAPTER FOUR

METHODOLOGY

The purpose of the study is to operationalize the concepts of immersion, embodiment, and character identification by creating measurement scales for each, to test the three-way correlation between these three constructs, and to investigate the moderating and mediating effect of character identification. I chose a mixed-method approach consisting of a survey with VR games and a qualitative thematic analysis of open-ended survey questions.

Participant Recruitment

I chose several Facebook groups as recruiting sites. These VR interest groups are Oculus Virtual Reality, VR ART Live!, VR AR Testing, VR Basement Group, Virtual Reality Art, and Women in VR/AR. The interest groups were created by users of VR, VR enthusiast, and VR researchers. After the approval of the Institutional Review Board (IRB), I spoke with the administrators of the selected VR groups on Facebook to ask for their permission to administer the questionnaire to the members of the group. Once I received the approval from the administrators, I created a post on the forum explained my intentions of the questionnaire and what their information will be used for along with the purpose of my study. I created a 54-question survey in Qualtrics and distributed it (please

see questionnaire in Appendix 1). Due to the lack of a sufficient response to my initial query, I used the services of a data company called Centiment to supplement my study with additional participants for my study. The questionnaire took approximately 30 minutes and was self-administered.

Sample

Participants of this study were gathered using voluntary convenience sampling. Participants of this study were screened for their eligibility based on their age. Initially, the purpose of this screening process is to filter the participants based on the length of their VR experience. However, due to the low numbers of individuals reporting their play time in VR, I removed the requirement of play time from screening the participants. All participants were accepted for this study no matter their sex, sexual orientation, gender identity, or religious beliefs, as these are thought to have no influence on the participants ability to operate in VR. However, it must be noted that VR and VR technologies were made by white men and for men, because of this, women are more often subject to the adverse effects of VR can have on users: dizziness, nausea, imbalance, etc., (Stanney, et. al., , 2020). I have made sure to include VR interest groups made by women for women as best as possible, although, but it must be recognized that VR is a male-dominated world within technology. At the data cleaning stage, participants who left 10 percent or more of the questionnaire unanswered were excluded from the study.

The sample characteristics are listed below.

Table 1. Demographic Characteristics of the Sample

S**ex** **N=147**	
Male	**40 (27.2%)**
Female	**107 (72.8%)**
Age (in years) **N=151**	**Mean: 27.00 (std=9.64)** **Median: 23.00** **Valid N=151**
VR experienc**e** **N=151**	
Less than 2 months	**99 (65.5%)**
2 months or more	**52 (34.4%)**

Interestingly, female VR gamers represent three quarters of the sample. The mean sample age is 27 with a median of 23. Two-thirds of the participants had less than 2 months experience with video games, probably as a result of the fact that VR gaming is not yet mainstream.

Instrumentation

Measures

Demographic Information. The demographic information collected for the questionnaire asked participants to reveal their age, biological sex, gender

identity, and the amount of experience they have using VR. These variables served to provide information about the sample.

Character Identification

Character identification is the process of taking on a character role, with all that entails. Based on my literature review, I assumed that character identification is a (possibly multi-dimensional) latent construct. Consequently, I generated measurable items or indicators meant to contribute to the creation of a character identification scale (DeVellis, R., 2017).These indicators, listed below, were all measured on a five-point Likert scale where Strongly Disagree = 1 and Strongly Agree = 5.

Table 2. Character Identification Indicators

Variable	Items
CHID_1	I feel I am my character when playing in VR.
CHID_2	I feel hurt when my character is damaged in VR.
CHID_3	I feel happy when I am playing my character in VR.
CHID_4	I feel angry when I fail in VR.
CHID_5	I can be myself in VR.
CHID_6	When I play my character in VR, I feel I am most myself.
CHID_7	When my character in VR is upset, I become upset.
CHID_8	When my character in VR completes a task, I feel accomplished.

CHID_9	I believe I am my character while playing in VR.

Additionally, I asked the participants to answer three open-ended questions about their character in their favorite VR game, listed below.

Table 3. Open-Ended Questions about Character Identification

CHID_10	When experiencing a VR simulation, describe what your character looks like.
CHID_11	When experiencing a VR simulation, describe how your character moves in the simulation.
CHID_12	When experiencing a VR simulation, describe the abilities your character has.

Immersion

Immersion is the feeling of "being there" in the simulation, which could be understood as experiencing the environment as if it were real, believing that the objects in the simulation are real, and having an emotional reaction to the simulation. Immersion is also a latent construct. In generating indicators, I was influenced by a scale created by Jennett, et. al., (2008). However, the Jennette, et. al., (2008) scale was not developed for the VR environment. The questionnaire used in Jennette, et. al., (2008) did not specifically include questions about VR games but about games in general, for example: "To what extent did you feel that you were interacting within the game environment?" I modified these items to specifically apply to VR game play, for example: "While playing VR, I want to know everything that will happen." This construct comprises

three battery of items measuring emotional investment, transportation to a different place (environmental), and temporal dissociation (physical).

Emotional Investment. The emotional investment battery of items consists of five indicators measured using a five-point Likert scale (Strongly Disagree =1, Strongly Agree = 5).

Table 4. Immersion/Emotional Investment

Variable	Items
EI_1	While playing in VR, I become emotional.
EI_2	While playing in VR, I want to know everything that will happen.
EI_3	While playing in VR, I am happy when I win.
EI_4	While playing in VR, I am sad when I lose.
EI_5	While playing in VR, I speak to the game.

Transportation to a Different Place. Transportation to a different place pertains to the feeling of experiencing the VR game environment as if it were real. This battery of items consists of five indicators measured on a five-point Likert scale (Strongly Disagree = 1 Strongly Agree = 5).

Table 5. Immersion/Transportation to a Different Place

Variable	Items
TDP_1	While playing in VR, I felt I could interact with the environment.

TDP_2	While playing in VR, I felt that the environment was real.
TDP_3	While playing in VR, I feel that my senses are heightened.
TDP_4	While playing in VR, I often forget I am using controllers.
TDP_5	While playing in VR, I feel that I move at my own will.

Temporal Dissociation. Temporal dissociation refers to how users experience physical sensations in a VR simulation. This battery of items consists of five indicators measured on a five-point Likert scale (Strongly Disagree = 1, Strongly Agree = 5).

Table 6. Immersion/Temporal Dissociation

Variable	Items
TDS_1	While playing in VR, I lost track of time.
TDS_2	While playing in VR, I forget about the real-world.
TDS_3	While playing in VR, I forget about my daily concerns.
TDS_4	While playing in VR, I believe I am in the game.
TDS_5	While playing in VR, I felt that the event happening was happening in the real world.

Embodiment

Embodiment captures users' emotional, locomotory and spatial experiences when playing a VR character. Embodiment, too, is a latent construct

which I attempt to capture using three groups of items: emotional investment into the character, physical investment, and self-location.

Emotional Investment into the Virtual Reality Character. This set of six items measures how playing a character affects a user's mental states. As before, the items are measured a five-point Likert scale (Strongly Disagree =, Strongly Agree = 5).

Table 7. Embodiment/Emotional Investment

Variable	Items
EIA_1	I feel happy when I play with my character in VR.
EIA_2	I become stressed when my character in VR is distressed.
EIA_3	I feel happy when my character in VR is happy.
EIA_4	I feel sad when my character is sad.
EIA_5	I feel hurt when my character in VR is damaged.
EIA_6	I share the same emotions as my character in VR.

Physical Investment into the Virtual Reality Character. Physical investment pertains with how the VR gamer experiences physical sensations. I measured this dimension using a set of five indicators on a five-point Likert scale (Strongly Disagree= 1, Strongly Agree= 5).

Table 8. Embodiment/Physical Investment

Variable	Items
PIA_1	I feel that the character I play in VR has the same physical features as myself.
PIA_2	I become stressed when my character in VR is distressed.
PIA_3	I feel happy when my character in VR is happy.
PIA_4	I feel sad when my character is sad.
PIA_5	I feel hurt when my character in VR is damaged.
PIA_6	I felt that the character arms were a part of my own body.
PIA_7	I felt that the character arms were not a part of my body.

Self-Location. I define self-location as how the VR gamer experiences space navigation as a VR character. Self-location was measured with a battery of six indicators on a five-point Likert scale (Strongly Disagree = 1, Strongly Agree = 5).

Table 9. Embodiment/Self-Location

Variable	Items
SL_1	I feel that the character I play in VR is an extension of myself.
SL_2	I feel that the character I play in VR moved just like I wanted it to.
SL_3	I feel that the character I play in VR is myself in a different body.
SL_4	I feel that as I play through the game in VR the character becomes more like myself.
SL_5	I expected the character to move the same as my own body.
SL_6	I feel that the character I play in VR has the same attitudes I have in reality.
SL_7	I felt like I controlled the virtual body as if it was my own body.

CHAPTER FIVE

RESULTS

To probe the data, my analytic strategy is the following. First, using an exploratory factor analysis, I will investigate the dimensionality of the indicators I collected for each construct (character identification, immersion, and embodiment). Should the factor analysis indicate that the underlying structure of the latent constructs is multidimensional, I will then attempt to interpret these dimensions using the indicators that most strongly associate with each dimension. I will then investigate which indicators are good candidates for including in a scale by using a scale reliability analysis and construct the scales for each concept. I will use the scales to test my hypotheses. To conclude the quantitative analysis, I will explore the role of character identification (as measured with the scale I would have constructed) by comparing a mediation and a moderation analysis. Finally, I will examine the qualitative responses and extract themes that could add nuance and texture to the conclusions derived from the quantitative analysis.

Quantitative Analysis

The exploratory factor analysis helps find if the items describing each construct indicate underlying dimensions of the constructs. (For example, based on my observations and literature review, I already suspect that embodiment

might have a physical, spatial, and emotional dimension.) In a factor analysis, these underlying dimensions are called “factors.” They are not directly observable, but they can be inferred by studying the pattern of correlations among the indicators that measure a construct. When these indicators “cluster” together, this pattern might be due to an underlying factor (see Figure 1).

A factor analysis assumes that the correlation we observe among the items that define a construct is due to the influence of the construct. Factor analysis assumes that the variance can be partitioned among two groups:

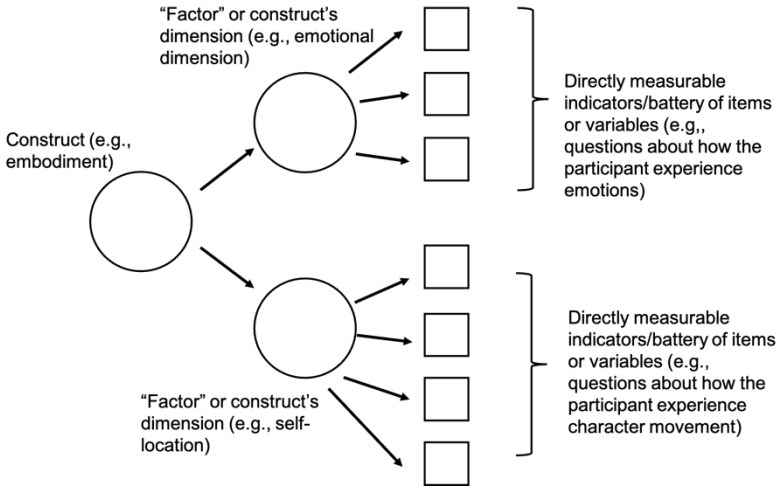

Figure 1. Factor Analysis Assumptions

common variance and unique variance. Common variance refers to items with shared underlying factors, or a dimension within the scale that correlates with more than one item, while unique variance refers to variations from errors of measurement or other external influences.

I performed the exploratory factor analysis in four steps. First, for each battery of items operationalizing a construct, I ran a Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy test and Barlett's test of sphericity. These tests indicate whether a set of items indicate more than one underlying dimension. Specifically, the KMO test measures the proportion of the variance in the variables that might be caused by underlying factors. A high value (close to 1.0) indicates multidimensionality (in other words, it indicates that a factor analysis is necessary). Bartlett's test of sphericity tests the hypothesis that the indicators are not correlated. A factor analysis is a good approach is this test rejects the hypothesis of no correlation (in other words, the indicators that measure an item are correlated). Second, in the factor extraction stage, I made decisions about the number of factors to extract. Third, in the rotation stage, I sought to arrive at the simplest possible representation of the data in order to understand the nature of the underlying factors. Finally, I made decisions about which indicators to retain for the scale construction.

The KMO and Bartlett's test for each set of construct indicators is presented in Table 10.

Table 10. Kaiser-Meyer-Olkin and Bartlett's Test Results for Modifying Dimensionality

Construct	KMO test	Bartlett's test
Character identification (8 items)	0.79**	p<0.01*
Embodiment (20 items)	0.87**	p<0.01*

Immersion (15 items)	0.87**	p<0.01*

**KMO close to 1.0; * statistically significant

The KMO tests for all constructs are close to 1.0, indicating that, for each construct, there is more than one dimension in the data. All Bartlett's tests are significant, indicating that we can reject the null hypothesis that the indicators for each construct are uncorrelated.

After completing these tests and determining the data. I run several factor analysis sessions in order to study the best way to represent my data. As a result of these explorations, I realized I had to eliminate several items from my original battery of indicators. For example, when measuring character identification, two of my items (CHID_1 and CHID_9) were formulated in almost identical manner and thus were confusing the analysis. Other items had to eventually be eliminated for the other two constructs for interpretation reasons (for example, I had to eliminate an embodiment-related item that was formulated as a negative— "I feel that the character arms were not a part of my body," as well as a few items that seem to add an additional dimension, yet they were not interpretable). The following reports the final set of items that made it into the factor analyses.

The first step in a factor analysis is to make a decision about the method to be used in the extraction stage. The purpose of the extraction in factor analysis is to make a choice about the factors that need to be extracted from the model. The extraction method I chose was the principal axis factoring (PAF). I made this choice to use PAF instead of principal component analysis (PCA)

because the scales were all newly created and had not been tested before, therefore there was the possibility of a unique variance within the data.

Because it is likely that I have errors of measurement in data, which means that I have variance not attributable to the underlying factors. Therefore, the extraction method I used was PAF due to the assumption of unique variance (not attributable to factors) in the data.

Table 11 shows the total variance explained by the underlying factors for each construct.

Table 11. Total Variance Explained by the Extracted Factors

Factor	Commonality (% of variance explained)
Construct: Character identification (8 items)	
Factor 1	30.06
Factor 2	9.86
Construct: Embodiment (12 items)	
Factor 1	33.39
Factor 2	8.38
Factor 3	6.49
Construct: Immersion (15 items)	
Factor 1	35.47
Factor 2	5.02
Factor 3	4.01

For the construct “Character identification,” the factor analysis identified two factors which, together, explain approximately 40% of the variance in the 8 measured items. For the construct “Embodiment,” the factor analysis identified three factors which, together, explain approximately 48% of the variance in the

12 remaining items. For the construct “Immersion,” the factor analysis identified two factors which, together, explain approximately 44% of the total variance in the 15 items.

The rotation stage of the factor analysis serves to represent the underlying structure in a simpler way by maximizing the loading of items on one factor and minimizing the loadings on the rest. Here, the choice is between conducting an orthogonal rotation, which assumes that the factors are uncorrelated, or an oblique rotation, which assumes that the factors are correlated. I chose to assume that the underlying factors are correlated as the most likely assumption. The following tables show the item loadings on each factor for the rotated matrices.

Table 12. Character Identification Rotated Matrix of Factor Loadings

Indicator	Factor 1	Factor 2
CHID_6 When I play my character in VR I feel I am most myself	.**718**	-.071
CHID_8 When my character in VR completes a task, I feel accomplished	**.677**	.019
CHID_5 I can be myself in VR	**.675**	-.103
CHID_3 I feel happy when I am playing my character in VR	**.575**	.116
CHID_1 I feel I am my character when playing in VR	**.439**	.186

CHID_7 When my character is upset, I become upset	-.008	**.665**
CHID_4 I feel angry when I fail in VR	-.060	**.566**
CHID_2 I feel hurt when my character is damaged in VR	.210	**.531**

In reviewing the factor matrix table, one needs to pay close attention to the loading of the items on the factors: loadings higher than 0.40 indicate a strong correlation between the item and the underlying factor. The items most useful in interpreting the meaning of the factor are those that load high (over 0.4) on one factor and low on another.

In Table 12, we see that the first five items load high on Factor 1 but not on Factor 2, while the last three items load high on Factor 2 but not on Factor 1. Interestingly, all three items that load high on Factor 2 pertain to the transfer of negative emotions between the role that the VR character is playing (and therefore the normative emotions associated with it) and the player's own emotions. In contrast, the indicators that load high on Factor 1 are related to how players stop making a distinction between their VR character and themselves, particularly in task-oriented experiences. For scale-building purposes, I will only retain these items, although emotional identification with the character is a potentially revealing aspect that needs to be further investigated in the future.

Table 13 represents the rotated factor matrix for the construct Embodiment.

Table 13. Embodiment Rotated Matrix of Factor Loadings

Indicator	Factor 1	Factor 2	Factor 3
SL_4 I feel that as I play through the game in VR the character becomes more like myself	**.801**	-.098	-.038
PIA_6 I felt that the character arms were a part of my body	**.706**	.099	-.122
SL_5 I feel that the character I play in VR is a part of me	**.612**	.000	.093
SL_6 I feel that the character I play in VR has the same attitudes I have in reality	**.543**	.060	.076
SL_2 I feel that the character I play in VR is a redefinition of myself	**.542**	-.014	.163
PIA_5 My character in VR represents a part of my personality I cannot show in the real world	**.414**	.064	.303
EIA_4 I feel sad when my character is sad	-.082	**.869**	-.033
EIA_2 I become stressed when my character in VR is distressed	-.004	**.636**	.077
EIA_5 I feel hurt when my character in VR is damaged	.260	**.426**	.003
PIA_3 I have customized my character in VR to resemble me in the real world	.080	-.006	**.728**
PIA_1 I feel that the character I play in VR has the same physical features as myself	-.068	.045	**.726**
PIA_4 My character in VR represents the way I want to look in the real world	.061	.003	**.687**

In Table 13, the first five items load high on Factor 1, while the sixth item loads on both Factor 1 and Factor 3. Three items load high on Factor 2, and the last three items load high on Factor 3. The items highly correlated with Factor 1 seem to indicate how one's character is an extension or part of oneself (or even in some cases a better self) including as a body experience. Based on the factor loadings, Factor 2 seems to be associated with affective embodiment. Finally, Factor 3 seems to refer to processes of game character customization. I selected

for further analysis only Factor 1 because it is associated with more indicators, which means that I have a better chance of building a scale. However, the additional dimensions need to be explored in a future study with the addition of more items indicative of the underlying factors identified.

Table 14 represents the rotated factor matrix for the construct Immersion.

Table 14. Immersion Rotated Matrix of Factor Loadings

Indicator	Factor 1	Factor 2	Factor 3
TDP_1 While playing in VR, I feel I could interact with the environment	**.771**	.013	-.028
EI_2 While playing in VR, I want to know everything that will happen	**.657**	.102	-.021
TDP_3 While playing in VR, I feel that my senses are heightened	**.606**	-.143	-.096
TDS_1 While playing in VR, I lost track of time	**.570**	-.297	-.091
EI_3 While playing in VR, I felt that the environment was real	**.555**	.076	.140
TDP_2 While playing in VR, I feel that I move at my own will	**.552**	-.030	.188
TDP_5 While playing in VR, I speak to the game	**.465**	.002	.104
EI_5 While playing in VR, I forget about my daily concerns	.394	-.117	.191
TDS_2 While playing in VR, I forget about the real-world	.117	**-.910**	-.030
TDS_3 While playing in VR, I forget about my daily concerns	.029	**-.469**	.298
TDP_4 While playing in VR, I often forget I am using controllers	-.025	-.205	**.768**
TDS_5 While playing in VR, I felt that the event happening was happening in the real world	.208	-.176	**.506**
TDS_4 While playing in VR, I believe I am in the game	.135	-.144	**.483**
EI_1 While playing in VR, I become emotional	.263	-.059	.314

EI_4 While playing in VR, I am sad when I lose	.022	.092	.290

In Table 14, seven items load high (over 0.4 in absolute value on Factor 1), two items load high on Factor 2, and three items load high on Factor 3. Items EI_5, EI_1 and EI_4 don't load on any factors. Factor 1 seems to be associated with a feeling of presence: the senses are heightened, the environment seems real, and the player is captivated by the game. Factor 2 seems to refer to a sense of escapism and evasion: the player forgets about daily concerns and the real world. Factor 3 is more ambiguous, as it could indicate habituation with the interface (the player forgets that they are using controllers) but also the realism of the game. As before, I only retained the factor that had sufficient indicators for a scale, in this case Factor 1 (TDP_1, TDP_2, TDP_3, TDP_5, TDS_1, EI_2, and EI_3).

After completing the factor analysis and identifying the items to be retained in the construction of the three scales, the next step is to test whether the three scales are reliable, which is done by checking the internal consistency of the scale. To that purpose, for each set of items retained, I calculated Cronbach's alpha, which has a maximum value of 1.0. In a scale, all items should be correlated; as the average inter-item correlation increases, so does Cronbach's alpha. Therefore, a high Cronbach's alpha (over 0.8) indicates an internally consistent scale. In this study, I accepted alpha reliability scores at *a*= 0.70 and above. The results of the reliability test appear in the table below.

Table 15. Cronbach's Alpha for Each Scale Candidate

Scale	α	# items
Character identification	.760*	5
Physical embodiment	.795*	5
Immersion (presence)	.821*	7

* Indicates a reported α over 0.70.

Because each "candidate" scale had a high internal consistency, I created a composite scale score by adding up the values of each scale item for each construct. The descriptive for each scale appear in Table 16.

Table 16. Character Identification, Physical Embodiment, and Immersion Scales: Descriptive

Scale	Mean (standard deviation)
Character identification	16.93 (3.81)
Physical embodiment	18.71 (3.65)
Immersion	25.28 (5.03)

Once I constructed the scales, the next step is to test the hypotheses. The following table shows the Pearson bi-variate correlations among the three scales.

Table 17. Correlations Among the Scales for Character Identification, Embodiment, and Immersion

	Character identification	Physical embodiment	Immersion
Character identification	1.00		
Physical embodiment	53**	1.00	
Immersion	.66**	.63**	1.00

** indicates significance at p< 0.001

The bi-variate correlation matrix indicates that all three scales have a statistically significant, high positive correlation. Therefore, all my three hypotheses are confirmed, namely: (1) embodiment is positively correlated with character identification; (2) character identification and immersion are positively correlated; (3) embodiment and immersion are positively correlated.

So far, I have established that immersion, physical embodiment, and character identification are highly correlated. However, we don't know yet how these constructs influence each other. To answer the research question of how, if at all, character identification influences the association of immersion and embodiment, I constructed two different models. Model 1 assumes that character identification is a moderating factor of embodiment and immersion. In other words, we are testing if the strength of the relationship between embodiment and immersion depends on the level of character identification. Model 2 assumes that character identification is a mediating factor of embodiment and immersion, meaning that character identification carries the effect of embodiment on immersion. Essentially, the difference between model 1 and model 2 is the role that character identification plays within the relationship of embodiment and immersion, serving as a catalyst or as a medium. I tested both models using a PROCESS macro in SPSS created by Andrew F. Hayes (2017). The moderation analysis table below indicates the model used to test the moderation of variable that pertains to character identification (CHARID) of the causal relationship that

the variable that pertains to embodiment (EMBOD) had on the variable that pertains to immersion (IMMERS).

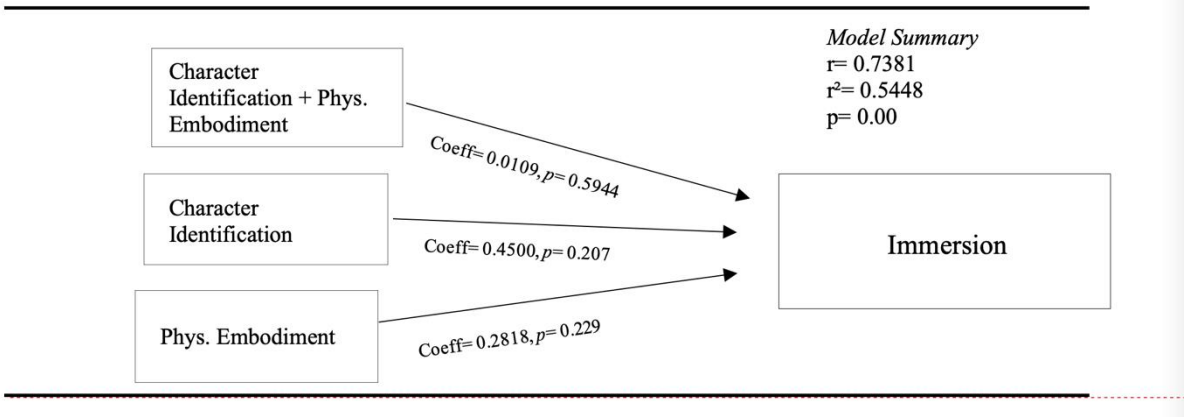

Figure 2. Moderation Analysis Model

The model summary indicates a general significant value with p< 0.05 an r value of r= 0.7381, an r squared value of r^2= 0.5448. However, the variables CHARID and EMBOD, when combined, have a p value of greater than p<0.05 (*p*= 0.4152) and the Lower-Level Coefficient Interval (LLCI) and Upper-Level Coefficient Interval (ULCI) values at (LLCI= -0.00295 and ULCI= 0.0513). The LLCI and ULCI values indicate no significance as their values reach a 0 value from -0.00295 to 0.0513 on a number line, indicating no statistical significance of the moderating factor of variable CHARID has on the relationship of variables EMBOD to IMMERS. Therefore, character identification is not a moderating factor of physical embodiment and immersion.

Next, I conduct a mediation analysis using the same PROCESS to explore the role of CHARID on the relationship between embodiment (EMBOD) and

immersion (IMMERS). If CHARID is a mediator, then a change in EMBOD will lead to a change in CHARID, which will then lead to a change in IMMERS.

Below, Figure 3 shows a model with character identification as mediator.

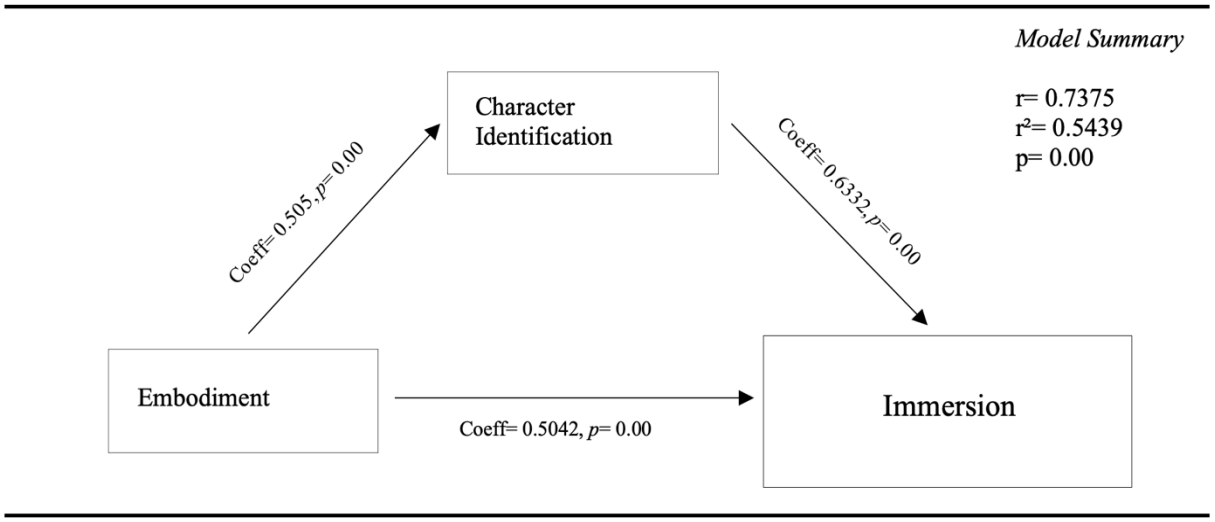

Figure 3. Mediation Analysis Model

The results of the mediation analysis indicate a statistical significance of the influence of CHARID on the relationship between EMBOD and IMMERS. The model summary shows a statistical significance with a p value $p<0.05$, an r value of $r= 0.7375$, and a r squared value of $r^2= 0.5439$. The model shows that variable CHARID has a statistically significant influence on the causal impact that variable EMBOD has on variable IMMERS. This significance is shown within the p value of variable CHARID as $p<0.05$ and the LLCI value as (0.4516, 0.8148). As seen within the moderation analysis, the values of the LLCI and the ULCI on a number line do not reach a 0 value and therefore can be indicated as a significant value.

Most important, the indirect causal relationship of the variable CHARID has on variables EMBOD and IMMERS is indicated as LLCI and ULCI (0.1956, 0.4553). This result shows that the variable CHARID has an indirect causal relationship on the relationship between variables EMBOD and IMMERS. Therefore, to answer my research question (how if at all, does character identification affect the association of immersion and embodiment), character identification does not moderate the relationship of physical embodiment and immersion. However, character identification does serve as a mediating factor for the relationship of embodiment and immersion. This result means that character identification does not influence the strength and direction of the relationship between physical embodiment and immersion; however, a change in embodiment may lead to changes in character identification which, in turn, leads to changes in immersion.

Qualitative Analysis

In analyzing the three open-ended questions included in my questionnaire, I wanted to make sure that I was representing my participants words correctly. My initial coding described aspects of character identification that showed how my participants were perceiving their characters and their roles in the simulation. In the following, I break down the coding process to show how my participants understood character identification.

When Experiencing a Virtual Reality Simulation, Describe What your Character Looks Like

Participants used five major categories to describe their character: (1) body characteristics such as height or skin color (45% of the responses); (2) stylistic characteristics such as clothes, unusual hair colors, or style (e.g., “punk”; “goth”) (15% of the responses); (3) particular roles or known game characters such as “emperor” or “Sonic the Hedgehog” (13%); (4) different types of creatures such as “elf” or “cat girl” (15%) and (5) self or characters customized to look like the self (e.g., “me”; “my character was an avatar I customized to look like myself”) (11%). A majority of the responses referred to physical characteristics.

The reader will recall that several items that constitute the Character Identification scale pertain to the participants’ feeling that the VR character represent themselves in a fundamental way. This representation may mean that the VR character is an idealized version of the ego. Indeed, several participants who opted to describe their character as an idealized self-explained that their VR character “…look like how I wish I look,” “Exactly like me but more dream-like and favorable” or “Really like me in a way it made me happy.” These observations confirm that VR players, like other gamers, use their character to create idealized selves capable of either fulfilling an ideal of physical perfection or endowed with abilities that the players wished they had. Wardle, et al., (2018) examined this same phenomenon in their participants. They explained a user of

Second Life and their role while playing the game as a "…an extremely chatty, helpful and often flirty young female. Her avatar dresses in colorful summery dresses and flitters around on shimmering moth wings." (p. 10) However, Wardle, et al., (2018) explained that when they had the chance to meet this user in-person that they were, "…extremely shy that for the duration of the event she stood on the outer edge of any activity and even when I attempted to engage her in conversation she avoided eye contact and spoke as little as possible" (p. 10). These findings gave me an understanding of how social interactions happen in virtual simulations and how users' characters may display characteristics that the users themselves cannot display in "real-world" interactions.

References to clothes or style play the role of culturally situating the character. For example, one participant described their character as a "[f]emale with multicolored hair with urban clothing with a cat." Other characterizations included descriptors such as "goth and hot" or "Always pink hair with war paint."

Among those who chose to describe their character in terms of physical characteristics, of particular interest is the great number of responses (19 out of 41) that identified the character in terms of biological sex (male/female), race/ethnicity as signaled by skin color (e.g., black, "lightskin") or sexualized attributes. Examples of sexualized characters included: "A anime chick with big boobs and a big booty," "A blonde girl with green eyes and big butt," or "She has big boobs, butt, long white hair, fair skin, and white eyes." Wright (2005) shows in her study the experiences of African-American women as they navigate the

internet, negotiating their identity and race: “[r]ace and gender take on a number of different forms when they intersect with technology, although most of those permutations resemble their ‘real time’ counterparts, where atavistic attitudes and practices exist alongside progressive views and activities” (p. 48). Nakamura (2002) argues in her book, *Cybertypes: Race, Ethnicity, and Identity on the Internet*, that it is a myth to consider cyberspaces as, “raceless, genderless, and sexuality-free” (p. 5). She goes on to explain that “race is constructed as a matter of aesthetics, or finding the color that you like, rather than as a matter of ethnic identity or shared cultural referents. The fantasy of skin color divorced from politics, oppression or racism seems to also celebrate it as infinitely changeable, customizable; as entirely elective as well as political” (p. 53). My observations confirms Nakamura’s (2002) findings and the claims in Wright (2005) that the descriptions of race, gender, and sexualizations are reflective attributes of character identification. The comments about character identifications made by my participants were influenced from their “real-world” experiences and their construction of social identities. My participants used social and cultural markers (race, gender, and overall sexualization) to describe their character, which attests to the importance of these characteristics in building an identity.

Some participants described their character as a fantastic creature. Prevalent among “creatures” were anime or cartoon-like characters (7 out of 14 responses), as in “anime girl with cow ears and maid outfit.” Other examples included elves, lions, dragons, and fairies.

To note, unlike video games, games in VR have not reached a sufficient level of customization to enable infinite character possibilities. This observation means that, in practice, VR players are constrained in their choice of characters by what is currently available on the market.

Although it is difficult to know exactly why a player would play as a dragon in a VR simulation, nevertheless the participants of this study express their wants and wishes in the VR medium. In this context, perhaps these participants are expressing their version of self-acceptance by projecting their own selves onto their character.

When Experiencing a Virtual Reality Simulation, Describe How Your Character Moves Within the Simulation

The second open-ended question did not produce interpretable results, perhaps because its meaning was unclear. My intention when asking this question was to understand how a player uses their character to explore the VR environment, for instance, how the players self-locate. However, the participants seemed to have misunderstood the question. For instance, participants responded that their character moved just like they did (“the character moved exactly how I attempted to move”). Ultimately, the answers to this open-ended question did not provide any insights into how participants experienced character identification.

When Experiencing a Virtual Reality Simulation, Describe the Abilities Your Character Has

The third open-ended question provides further information about character identification. In this question, I ask the participants to describe their character's abilities. Of the 69 valid responses, 30 participants (43%) identified these abilities in purely physical terms, for instance: "run fast jump high very strong," "the ability to run jump punch and kick," or "stunning good looks." 27 responses (39%) identified the characters in terms of their supernatural abilities (although not always exclusively), for example: "she can float, dance and teleport," "Water element, electric power," "Jump hop skip with super powers." A very small percentage (3 responses or 4%) identified the character in terms of their psychological characteristics: "He can conquer most things he attempts to do," "Fight for the win," "amazing, strong, and creative." Interestingly, 9 participants (13%) directly identified with their character by describing their character in the first person pronoun, for example: "I was a war mech, so shooting, jumping, etc." "Normal abilities I had was walking around a virtual forest it was dope and an escape."

To a certain extent, the VR game that the participants liked to play defined the abilities of the character; in this sense, the participants do not have unlimited power to customize their character. Still, what is of interest in these descriptions is what the participants choose to focus on. Notably, 8 participants described

their character, in addition to the other characteristics coded above, in terms of armed combat. The characters could shoot, carry an AR-15 or slash with a lightsaber.

To conclude, I found that VR gamers established their connections with their characters in different ways. They identified with game characters through a sense of style or fashion, through a character's abilities, or through personalizing their characters to represent themselves in the simulation. However, as noted, one limitation is that customization in VR is not as sophisticated as in other computer-generated environments. These representations of the "self" may stand for versions of their ideal selves, "exactly like me but more dream-like and favorable." The open-ended responses thus provided a new layer of investigation of how VR users build character identification as an expansion and idealization of their own selves.

My analysis shows that the character ideation, character attributes, and character power all allow for the users of VR to manipulate their characters as extension of themselves. A possible future direction of my analysis could be to connect this still-existing longing for superheroes with research on the nature fandom in superheroes and gaming. As Acu (2016) argues, fans of superheroes and games develop their characters and sustain fandom of superheroes based on the ideations, attributes, and the powers of their gaming character. We can understand that users of VR select their simulations and characters based on personal explorations of their own personal identities. As users of VR express

their alternate identities through gaming, they are expressing their need to explore their personal attributes in different scenarios using their characters as the medium.

CHAPTER SIX

DISCUSSION

This study provides context to the developing nature and relationship of character identification, physical embodiment, and immersion. In this study, I was concerned with operationalizing and measuring three constructs (character identification, immersion and embodiment), testing hypotheses about their relationships, and looking more in-depth to the nature of character identification. Because the study was exploratory, an exploratory factor analysis proved useful in determining scale construction for all three constructs. The variance explained by the three factor analyses was on the low side (less than 50%), indicating that more items are needed to capture these constructs.

The character identification scale was inspired by Cohen's (2001) definition of identification, but its application to VR represents my own contribution. In addition to a component indicating how VR gamers perceive their characters as a version of themselves, the factor analysis also showed an affective dimension of character identification that is worth exploring in the future. For now, the character identification scale is on the lower end of reliability (a= 0.76). Future research needs to identify additional items to see how the reliability score might be improved.

In this study, I understood embodiment as a process of experiencing one's character and its environment physically and spatially, through motion and self-location. The physical embodiment scale, much like the character identification

scale, represents my contribution derived from the literature research on embodiment. The physical embodiment scale was also on the lower end, *a*= 0.795, as expected in an exploratory analysis. Similar to the character identification scale, future research needs to experiment with the battery of items that would best capture the physical aspect of embodiment. The factor analysis showed that embodiment might also have an emotional aspect and that customization could play a role in how embodiment is experienced, all good directions for future research.

The immersion scale was tailored from two previous scales used to measure immersion, Jannette et. al., (2009) Presence and Multi-Modal scale and Slater's (2001) Immersion scale but was adapted in this study to apply to VR game play. Immersion also proved to be multi-dimensional, with elements of "presence" (feeling "in the game") and "escapism" (forgetting about worries and the real world) included. A third dimension resulting from the exploratory factor analysis was more difficult to interpret, but it suggested that the technical aspects of the VR interface, such as the ease of manipulating the controllers, might play a role. This observation is consistent with prior findings that immersion depends on the quality of the VR simulation (Dalquist et. al., 2010). A possible future direction of research might look at how VR gamers experience time and what aspects of the VR simulation might induce feelings of "flow." Flow theory, refers to the state of enjoyment a player or user of VR is having while playing a video game or VR simulation, (Soutter, A., & Hitchens, M., 2016). From a uses and gratification

perspective, the escapist role of VR gaming is also worth exploring as flow could be a possible contributor of character identification, embodiment, and immersion.

The immersion scale as restricted to “presence” also proved to be reliable, with a reliability score within the generally acceptable range, which is *a*= 0.80 or higher. However, it must be noted that the tailoring of the Jannette et. al., (2009) scale and the Slater (2001) scale needs to be further examined. As before, generating more items and testing their effect on scale reliability is needed.

The correlation analysis indicated a strong positive association of embodiment and character identification, therefore supporting Hypothesis 1. Immersion is also strongly and positively associated with character identification, which supports Hypothesis 2. Finally, embodiment has a strong positive associated with immersion, which supports Hypothesis 3. These results confirm the fact that in a VR simulation, each of these aspects, character identification, embodiment and immersion, support each other. The implication for VR game designers is that the most successful game experiences should facilitate all three aspects. However, these results cannot be generalized based on my sample, which was non probabilistic and skewed toward female gamers.

The correlation test cannot offer insight into the directional paths of the variables for each hypothesis. To investigate causality, I asked about the causal role of character identification and performed a moderation and mediation analysis. Prior research on character identification, embodiment, and immersion have not given any indication of a directional relationship among these three

constructs. For that reason, my moderation and mediation analysis represent a contribution to the literature.

Moderation analysis is a type of structural equation model designed to understand if one variable enhances the directional relationship between two other variables. For this study, I conducted a moderation analysis on the impact that embodiment has on immersion using character identification as the moderator or the enhancer variable. The model summary had a significant p value, however, when looking at the Lower-Level Coefficient Interval (LLCI) and the Upper-Level Coefficient Interval (ULCI) of character identification and embodiment, there was no statistical significance of the moderating factor. This result makes sense since the correlation between immersion and character identification is positive, character identification as a moderating cannot prove significant.

Unlike the moderation analysis, the mediation analysis indicates if character identification is an agent or medium of the relationship between embodiment and immersion. The model summary was also statistically significant. However, unlike the moderation analysis, the mediation analysis proved statistically significant when analyzing the LLCI and ULCI. Unlike other analysis, like the correlation analysis, the p values of these analysis do not carry as much weight as the LLCI and the ULCI scores. However, these scores determine whether there is an indirect and direct effect of the variables. The indirect effect of character identification also proves to be significant with the

LLCI and the ULCI scoring. Therefore, the relationship between embodiment and immersion is increased by the medium of character identification. The mediation analysis shows that there is a strong relationship between embodiment and immersion, with a coefficient of 0.5042, but when character identification is added as a mediator, there is a significant increase of the relationship between embodiment and immersion (from 0.1975 to 0.4570). The increase in the coefficient rises by approximately 43%. This increase suggests further research. Although the mediation effect is small, it could be that a refinement of the scales will affect the mediation effect.

The mediation analysis also showed that there was an indirect effect of character identification on embodiment and immersion. This model does not definitely prove the overall relationship of character identification's relationship to embodiment and immersion but suggests that character identification could serve as a mediating factor, something that needs to be explored in future research.

The qualitative analysis of user comments about their VR characters indicates that VR users have an inherent interest in playing characters that constitute some type of representation of themselves, a representation that captures how they would like to present themselves in the virtual world. Although previous studies support these findings in specific computer-generated environments (Wardel et. al., 2018; Ahn et. al, 2016; & Barberia et. al., 2018), the statements participants made regarding their character's appearance and their aspirations of how their characters should reflect themselves within VR ("exactly

like me, yet more dream-like, and favorable") suggests that character identification research is a rich site to examine individuals' perception of themselves.

Participants' descriptions of their VR character's abilities are particularly revealing. Most participants' responses indicated a power dynamic in their character selection. This dynamic of character identification is seen in the abilities of the character and how the users of VR can use their character to experience their own perceived realities. One participant indicated that his character could, "…conquer most things he attempts to do." This statement along with similar others suggests that VR users need to feel powerful in their lives. When that need is not fulfilled, they seek a reality they can construct to meet these needs (Wardell, et al., 2018). Character ideations and the choice of character attributes supplement the need to feel in powerful and in control. Character ideations and the choice of character attributes work in tandem to help VR gamers construct a perceived reality in which their characters, as extensions of themselves, are all powerful.

Superheroes and superpowers are important in gaming. Sanil (2017) describes the superhero trope to be one that is rooted in religion and mythology. "Almost all comic book superheroes have taken shape in character and form inspired by religion and the notions of divinity" (p. 286). It goes without saying that video game characters are modeled after the superheroes in comic books before them, and therefore take after the gods of historic times. Comic book

superheroes like Superman and Batman remind one of stories of Greek and Roman mythical heroes, such as Hercules and Perseus. However, it must be noted that many gamers, including users of VR, are not very attracted to the demi-gods of Greek and Roman times, and outside of the latest DC and Marvel movies, the attraction to these classic superheroes is fading (crcomics.com, 2021).

Despite an emerging loss of interest in superheroes, the analysis I present in this study still indicates that users of VR want to experience superpowers. Acu (2016) provides a critical look at the Marvel Universe and their representations in cinema. Particularly, they argue that the superhero genre is changing and therefore the classic superhero archetype is no longer appealing to the masses. “The current Marvel Cinematic University (MCU) superheroes render their predecessor’s escapism, and the MCU’s popularity may imply that the greater culture’s appetite is maturing” (p. 204). Acu (2016) makes the point that the general idea of superheroes and therefore the culture of fandom behind them is changing.

Further investigation of this data or expansion of the qualitative approach could provide a greater foundation to understanding how users of VR and their character selections effect embodiment, immersion, and character identification. Users of VR want their characters to have idealized, yet culturally-embedded, features that model how the users themselves want to be perceived. The concept of character power or ability also contributes to users’ sense of immersion by

allowing the user to construct idealized and absorbing realities with character selection as the conduit.

Future plans for this study are to expand on the three scales and achieve scale validation, to better understand the mediating role of character identification on embodiment and immersion, and to explore the affective dimensions of embodiment and character identification. I plan to advance the character identification scale in my Ph.D. program.

The study has some notable limitations. First, the non-probabilistic, voluntary nature of the sample limits generalization. I would also like to reflect on the selected groups recruited for this study. When recruiting members from the Facebook interest groups, I contacted administrators of each group before administering my survey. However, outside my control, the survey was shared from one Facebook interest group to another, landing in groups I did not select as a part of my study. As a result, I encountered upset administrators of these groups and was threatened to be canceled (referring to the social media phenomenon of making a person on social media accountable for their wrong doings). This challenge suggests that any future researcher interested in replicating this study should do so in an experimental setting in order to control social bias and prevent ideological altercations. Due to the lack of participation from these Facebook groups, I needed to employ Centiment to help collect data. Initially, 285 responses to the survey were collected; however, due to the lack of

completion of the survey or participants' age, 134 responses were eliminated, which further biased the sample.

Additional limitations include the fact that the questionnaire did not ask participants to identify the games they were playing, which, as established, may limit the choice of characters. Lastly, it could be that the relationship between character identification and embodiment was an effect of how I operationalized embodiment in the context of experiencing a character. Future research might explore embodiment as an aspect of exploring VR experiences in general.

Reflection about this study gave me an understanding of the need to develop qualitative research skills. I believe that having an additional perspective to the qualitative analysis would provide additional insights into participant experiences. Including opportunities for more in-depth responses in this study could give a better understanding of how VR users perceive their virtual characters. Additionally, pursuing a deeper knowledge of embodiment, possibly in studies examining embodiment only, could further shine a light on the relationship between embodiment and character identification.

APPENDIX A

SURVEY AND QUESTIONNAIRE

CREATED BY SHANE BURRELL

Character Identification Scale

DEMOGRAPHICS

Directions: In the following spaces, please select or write the most appropriate response to each question. If there is a separate set of directions, please read those directions carefully and answer each question according to the directions for that section of the questionnaire.

DEM_1 AGE. What is your age? _____

DEM_2 SEX. What is your biological sex (select one)?

Male
Female
Other
No Response

DEM_3 GENDER. _____

DEM_4 USE. How much experience do you have using VR? (select one)

0-2 months
3-4 months
5-6 months
7+ months

MEASURES

Character Identification

Character Identification

Directions: I would like for you to remember the last virtual reality experience you had. Please circle the choice that most closely describes your experience based on the statements provided:

CHID_1 I feel I am my character when playing in VR.

Strongly Disagree | Disagree | Neither agree nor disagree | Agree | Strongly Agree

CHID_2 I feel hurt when my character is damaged in VR.

Strongly Disagree | Disagree | Neither agree nor disagree | Agree | Strongly Agree

CHID_3 I feel happy when I am playing my character in VR.

Strongly Disagree | Disagree | Neither agree nor disagree | Agree | Strongly Agree

CHID_4 I feel angry when I fail in VR.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

CHID_5 I can be myself in VR.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

CHID_6 When I play my character in VR I feel I am most myself.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

CHID_7 When my character in VR is upset, I become upset.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

CHID_8 When my character in VR completes a task, I feel accomplished.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

CHID_9 I believe I am my character while playing in VR.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

CHID_10 When experiencing a VR simulation, describe what your character looks like.

Free Response:

CHID_11 When experiencing a VR simulation, describe how your character moves in the simulation.

Free Response:

CHID_12 When experiencing a VR simulation, describe the abilities your character has.

Free Response:

Embodiment

Emotional Investment to Character

Directions: I would like for you to remember the last virtual reality (VR) experience you had. Please circle the choice that most closely describes your experiences based on the statements provided.

EIA_1 I feel happy when I play with my character in VR.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

EIA_2 I become stressed when my character in VR is distressed.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

EIA_3 I feel happy when my character in VR is happy.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

EIA_4 I feel sad when my character is sad.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

EIA_5 I feel hurt when my character in VR is damaged.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

EIA_6 I share the same emotions as my character in VR.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

Physical Investment to Character

Directions: I would like for you to remember the last virtual reality (VR) experience you had. Please circle the choice that most closely describes your experiences based on the statements provided.

PIA_1 I feel that the character I play in VR has the same physical features as myself.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

PIA_2 I feel that the character I play in VR strongly resembles myself.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

PIA_3 I have customized my character in VR to resemble me in the real world.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

PIA_4 My character in VR represents the way I want to look in the real world.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

PIA_5 My character in VR represents a part of my personality I cannot show in the real world.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

Inhabiting the Character

Directions: I would like for you to remember the last virtual reality (VR) experience you had. Please circle the choice that most closely describes your experiences based on the statements provided.

IA_1 I feel that the character I play in VR is an extension of myself.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

IA_2 I feel that the character I play in VR is a redefinition of myself.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

IA_3 I feel that the character I play in VR is myself in a different body.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

IA_4 I feel that as I play through the game in VR the character becomes more like myself.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

IA_5 I feel that the character I play in VR is a part of me.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

IA_6 I feel that the character I play in VR has the same attitudes I have in reality.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

Immersion

Temporal Dissociation

Directions: I would like for you to remember the last virtual reality experience you had. Please circle the choice that most closely describes your experience based on the statements provided:

TDS_1 While playing in VR, I lost track of time.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

TDS_2 To While playing in VR, I forget about the real-world.

.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

TDS_3 While playing in VR, I forget about my daily concerns.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

TDS_4 While playing in VR, I believe I am in the game.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

TDS_5 While playing in VR, I felt that the event happening was happening in the real world.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

Transportation to a Different Place

Directions: I would like for you to remember the last virtual reality experience you had. Please circle the choice that most closely describes your experience based on the statements provided:

TDP_1 While playing in VR, I felt I could interact with the environment.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

TDP_2 While playing in VR, I felt that the environment was real.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree

TDP_3 While playing in VR, I feel that my senses are heightened.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

TDP_4 While playing in VR, I often forget I am using controllers.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

TDP_5 While playing in VR, I feel that I move at my own will.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

Emotional Investment

Directions: I would like for you to remember the last virtual reality experience you had. Please circle the choice that most closely describes your experience based on the statements provided:

EI_1 While playing in VR, I become emotional.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

EI_2 While playing in VR, I want to know everything that will happen.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

EI_3 While playing in VR, I am happy when I win

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

EI_4 While playing in VR, I am sad when I lose.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

EI_5 While playing in VR, I speak to the game.

Strongly Disagree Disagree Neither agree nor disagree Agree Strongly Agree

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

April 15, 2021

CSUSB INSTITUTIONAL REVIEW BOARD
Administrative/Exempt Review Determination
Status: Determined Exempt
IRB-FY2021-184

Prof. Mihaela Popescu and Mr. Shane Burrell
CAL - Communications
California State University, San Bernardino
5500 University Parkway
San Bernardino, California 92407

Dear Prof. Popescu and Mr. Burrell:

Your application to use human subjects, titled ""Did That Just Happen?": Embodiment & Immersion's influence on Character Identification's Effects on Virtual Reality Users" has been reviewed and determined exempt by the Chair of the Institutional Review Board (IRB) of CSU, San Bernardino. An exempt determination means your study had met the federal requirements for exempt status under 45 CFR 46.104. The CSUSB IRB has not evaluated your proposal for scientific merit, except to weigh the risk and benefits of the study to ensure the protection of human participants. Important Note: This approval notice does not replace any departmental or additional campus approvals which may be required including access to CSUSB campus facilities and affiliate campuses due to the COVID-19 pandemic. Visit the Office of Academic Research website for more information at https://www.csusb.edu/academic-research.

You are required to notify the IRB of the following as mandated by the Office of Human Research Protections (OHRP) federal regulations 45 CFR 46 and CSUSB IRB policy. The forms (modification, renewal, unanticipated/adverse event, study closure) are located in the Cayuse IRB System with instructions provided on the IRB Applications, Forms, and Submission webpage. Failure to notify the IRB of the following requirements may result in disciplinary action. The Cayuse IRB system will notify you when your protocol is due for renewal. Ensure you file your protocol renewal and continuing review form through the Cayuse IRB system to keep your protocol current and active unless you have completed your study.

Important Notice: For all in-person research following IRB approval all research activities must be approved through the Office of Academic

Research by filling out the Project Restart and Continuity Plan.

- **Ensure your CITI Human Subjects Training is kept up-to-date and current throughout the study.**
- **Submit a protocol modification (change) if any changes (no matter how minor) are proposed in your study for review and approval by the IRB before being implemented in your study.**
- **Notify the IRB within 5 days of any unanticipated or adverse events are experienced by subjects during your research.**
- **Submit a study closure through the Cayuse IRB submission system once your study has ended.**

If you have any questions regarding the IRB decision, please contact Michael Gillespie, the Research Compliance Officer. Mr. Michael Gillespie can be reached by phone at (909) 537-7588, by fax at (909) 537-7028, or by email at mgillesp@csusb.edu. Please include your application approval number IRB-FY2021-184 in all correspondence. Any complaints you receive from participants and/or others related to your research may be directed to Mr. Gillespie.

Best of luck with your research.

Sincerely,

Nicole Dabbs

Nicole Dabbs, Ph.D., IRB Chair

CSUSB Institutional Review Board.

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