AFFECTIVE AVATARS: EFFECTS OF AVATAR CUSTOMIZATION ON POSITIVE AND NEGATIVE EMOTIONS

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

Swati Pandita, MPS, MSc.

August 2022

AFFECTIVE AVATARS: EFFECTS OF AVATAR CUSTOMIZATION ON POSITIVE AND NEGATIVE EMOTIONS

Swati Pandita, Ph. D. MPS, MSc.

Cornell University 2022

Avatar customization and the use of self-similar avatars are two common strategies for increasing avatar identification in virtual health interventions. However, avatar customization interfaces can exclude the creation of minority identities, which further exacerbates inequities in representation along with poor customization experiences. An online study ($N = 82$) was conducted to investigate the effects of avatar customization, satisfaction with the customization experience, and avatar identification types (similar or wishful) on positive and negative affect with groups that are well-represented (White) and underrepresented (Asian American & Pacific Islanders) in avatar customization interfaces. Participants were assigned or instructed to create an avatar for a series of Cyberball games. Findings indicate that avatar customization does not significantly change positive or negative affect when compared to avatar assignment. However, differences in avatar customization satisfaction between AAPI and White individuals suggest that socially exclusive avatar creation interfaces can impact an individual's virtual experience.

BIOGRAPHICAL SKETCH

Swati Pandita is a doctoral candidate in the Department of Communication at Cornell University in Ithaca, NY. Her interest in communication began at Rhodes College in Memphis, TN, where she completed her Bachelor's of Science in Neuroscience, studying how the brain processes visual information and media representations of mental health (2015). Interested in applying her knowledge of the visual perception system, she pursued a Master's in Professional Sciences in Information Science, with a focus on Human Computer Interaction, at Cornell University (2016). During this time, she found a home for her interdisciplinary research interests in Communication Studies at Cornell University, where she completed a Master's of Science (2020) and Doctor of Philosophy (2022) in Communication.

Swati's primary research interests lie at the intersection of mental health, embodiment, and identity. Using the confluence of these three areas, she examines how new media, like virtual reality and its components (e.g., virtual environments, avatars, narrative structure, gaming reward mechanisms) can be effectively used to create self-reflective technologies. She employs both qualitative and quantitative methodologies to uncover and understand a person's experience and draws from this research to design and evaluate technologies for mental health.

ACKNOWLEDGEMENTS

Completing a dissertation takes a lot of time, energy, and focus, especially during a pandemic, where many sad realities entered our lives all at once. It was during this time that I was consistently reminded of the importance of studying the link between poor representation and mental health. Although I tried to shy away from this topic, scared that it was "too sensitive," "too much," or "not really a problem," I was fortunate to be surrounded by people who reminded me of my values when I lost sight of them. Thanks to the support of my doctoral committee, friends, and family, I persisted.

I would like to thank each of my committee members for supporting my research and ensuring it was not only well-executed, but true to my values as a scholar. Dr. Andrea Stevenson Won, thank you for taking me on as your first advisee, encouraging me to take on ambitious research projects, and challenging me to develop my coding skills; these experiences have opened many doors for me that would not have been possible without your guidance. Dr. Lee Humphreys, thank you for developing my skills as a qualitative scholar and for ensuring that I was engaging in the complexity and messiness of my research topics.

Dr. Natalie Bazarova, thank you for strengthening the experimental and theoretical rigor of my work; your excitement for my work was incredibly motivating. Dr. JoAnn Difede, thank you for sharing your experience in mental healthcare and deepening my understanding of both the patient and provider perspectives; thanks to you I am more aware of strawman arguments and how to communicate with more

compassion and grace in the mental healthcare space. Finally, Dr. Marlen Gonzalez, thank you for your big picture perspective, and for helping me find my way as an interdisciplinary scholar. While I could not have selected a tougher committee, thanks to your comments, criticisms, and critiques, I have become a confident scholar, and for that I will always be grateful.

I would also like to thank the "external committee" of friends and colleagues that brought me to Cornell and have shaped my work. Drs. Hajin Lim, Dawn Schrader, Robert Johnson, and Jason Haberman—I would not have even pursued a career in academe if it was not for your encouragement. I would also like to thank Drs. Robby Ratan and Nicholas Bowman for their initial feedback on my work, and for making the avatar psychology research space an inviting one.

I am very fortunate to have family and friends that will let me ramble about avatars, identity, and mental well-being. I would like to thank my family for giving me the opportunity to pursue research. Mom, dad, and Shruti, thank you for the countless sacrifices you made so I could pursue a higher education and live up to the meaning of our last name (in Sanskirt, although "little panda" is fitting too).

Mary and John, you have become my family during this time; thank you for always providing me a home away from home to rest and recharge. Celeste Whitlow, thank you for organizing our weekly pomodoro sessions and reviewing C# code (amongst many other things) with me. Amber Koberinski and Dinah Bowles, thank you for your unending support and friendship throughout the years; you two have been my north stars when imposter's syndrome gets the best of me.

Finally, I would like to thank members of the Communication Department,

Statistical Consulting Department, and Cornell Alumni Association for supporting my doctoral journey.

Our departmental staff is truly one of a kind and made my experience as a graduate student an exceptional one. Joanna Alario, thank you for checking in since day one; I did not think it was possible to have a graduate field coordinator as caring, compassionate, and helpful as you. Kelli Carr, thank you for your generosity and sharing your eye for detail with me. Irina, thank you for administering my countless SONA requests, and for warmly welcoming us into the department every day. I will miss you all so much.

As for data collection and analysis, I would also like to thank Stephen Parry for his statistical acumen and acknowledge that this work was funded in part by the Cornell Alumni Association.

To all the people that supported this work, from conversations to manuscript feedback—thank you.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
INTRODUCTION

Issues of emotional well-being, such as rates of anxiety and depression, are increasing each year (Cai et al., 2021). Scholars and practitioners from various disciplines, ranging from medicine to human computer interaction, have sought to meet this demand by designing digital mental health interventions. Gamified evidence-based therapies (EBTs), such as online cognitive behavioral therapies, offer unique forms of identification through avatars, or digital self-representations, that make interventions more engaging and enticing for participants.

Avatar identification, or the degree to which a user identifies with their avatar, is critical to the success of virtual health interventions. The more a participant identifies with their virtual avatar, the more likely an intervention will be successful. For example, users with better avatar identification were more likely to engage in healthy behaviors after a virtual reality (VR) health intervention (Kang & Kim, 2020). Additionally, Birk and Mandryk (2019) posit that avatar customization improves identification, which makes interventions more effective. In their online study, Birk and Mandryk found that participants who customized an avatar, compared to participants who were assigned an avatar, benefitted from an attention retraining module aimed at helping those with negative self-perceptions.

However, our current understanding of avatar *identification* and avatar *customization* within the context of emotional well-being research is limited. Avatar customization is often seen as a way for increasing avatar identification, and not evaluated as a separate activity with differential effects. That is, oftentimes the sole

purpose of studying avatar customization is to increase avatar identification. For example, debates on the use of self-similar avatars (i.e., shared physical resemblance with an avatar, often photorealistic) and whether self-similarity increases self-presence is framed with the intention of increasing avatar identification. However, there is a dearth of research in the opposite direction. Questions regarding the negative effects of avatar customization remain unanswered, such as: *Who benefits from avatar customization? How might avatar customization decrease identification?* Furthermore, studying avatar customization as a salient experience in and of itself also remains unanswered: *How might avatar customization work separately from identification to influence affect?*

Avatar creation can often exclude the existence of minority identities, such as Asian Americans and Pacific Islanders (AAPIs). Asian American and Pacific Islanders refers to individuals of Asian and Pacific Islander descent residing in the United States at the time of this study. This includes people with East Asian (i.e., China, Japan, South Korea), Southeast (e.g., Vietnam, Thailand, Phillipines), South Asian (e.g., Bangladesh, India, Pakistan), and Pacific Islander (e.g., Hawaii, Samoa, Fiji) descent. White refers to people of Western European descent (e.g., France, United Kingdom, Spain) residing in the United States at the time of the study. AAPIs were selected for their lack of representation in character (avatar) creation interfaces, whereas White participants were selected for their over-representation in such interfaces.

This dissertation study teased apart self-similar avatar identification and the experience of avatar customization to investigate their effects on positive and negative affect with individuals that identify as AAPI or White. The effects of self-similarity

and avatar customization on affect were evaluated under the pretext of a series of Cyberball games in an online study. Findings indicate that customizing one's avatar did not differentially impact positive or negative affect when compared to those assigned an avatar. That is, there was no main effect of avatar customization on positive or negative affect. However, amongst participants that customized their avatars, AAPIs were more likely to report lower satisfaction with customization scores than White participants, warranting the significance of self-similar avatars and their impact on virtual mental healthcare experiences.

This research makes three key contributions to the fields of digital mental health, avatar psychology, and identity representation. First, it demonstrates the importance of inclusive avatar customization in digital mental health interventions. It does this by showing how lack of racial representation in customization interfaces (i.e., limited avatar base options) can impact perceptions of one's avatar through the measure of customization satisfaction. Second, it engages with Asian Americans and Pacific Islanders (AAPIs), a group that is unrepresented in the mental health space and shows how their avatar customization experiences may differ in more nuanced ways (i.e., things that are not traditionally measured). Third, it provides an empirical link between avatar customization and increased feelings of agency, an important psychological need and outcome variable for emotional well-being interventions.

The dissertation is organized as follows. The second chapter provides background on the importance of self-similar avatars and the experimental hypotheses, where two patterns of avatar customization were predicted: (1) avatar customization as protective (i.e., generally positive, agentic experience) or (2) avatar customization as a

salience factor (i.e., increasing identification or negative affect). The third chapter describes the methods and materials used in the study and includes study design rationale and data analysis. The fourth chapter reports the findings from the study and includes the models for positive and negative affect, satisfaction with avatar customization, and self-similar avatar identification used to evaluate my hypotheses. Findings are discussed in the fifth and final chapter.

CHAPTER 2

SELF-SIMILAR AVATARS AND EMOTIONS

Avatars are salient self-representations. Identification with an avatar can improve digital health intervention outcomes by promoting self-relevance. However, how identification is achieved is still an issue of scholarly debate. I argue that one significant path of identification occurs with *self-avatars* (e.g., shared appearance) that engage with a person's self-concept through *avatar personalization*, a specific form of *avatar customization*. This chapter explicates the relationship between avatars, *self-presence*, and self-concept, and then introduces the difference between how *avatar identification* and *customization* (the experience of creating identification) can impact the user's emotions. At the end of this chapter, I introduce the hypotheses for my dissertation study which investigates appearance-based discrepancies in avatar identification and its effects on emotional well-being in virtual environments.

Avatars are digital self-representations in social virtual worlds used for work, play, and leisure (Nowak & Fox, 2018). Affordances such as embodiment, the ability to modify appearance, and control over movement (agency), make avatars uniquely positioned to promote self-relevance (Ratan & Dawson, 2016). These affordances have made avatars-based interactions appealing for health and education interventions. Clinical practitioners use avatar-based therapies to treat patients with post-traumatic stress disorder (Rizzo & Shilling, 2017), major depressive disorder (Fodor et al., 2018), social anxiety (Horigome et al., 2020; Aymerich-Franch & Bailenson, 2014), hemiparesis due to stroke (Laver et al., 2017), and pain management due to burns

(Hoffman et al., 2011). Educators have also investigated the utility of avatars in virtual classrooms and avatar effects on spatial presence in immersive learning environments (Mon, 2010; Hudson & Hurter, 2016; Ahn, Nowak, & Bailenson, 2022). Outside of the classroom, athletes can practice their plays (Stone et al., 2018, Huang, Churches, & Reilly, 2015) and employees can engage in skills training through simulation-based training (Zahabi & Razak, 2020; Liaw et al., 2020; Hsu, 2012). This brief overview shows that avatar-based interactions have many important social applications and can be effective mediums for promoting behavioral change.

Avatar-based interactions, or avatar effects, are powerful. For example, the *Proteus Effect* demonstrated that people will act in accordance with their perception of their avatar's identity (Yee & Bailenson, 2007; Yee, Bailenson, & Ducheneaut, 2009). In other words, a person embodied in a tall avatar who perceives tall people as confident and may then act more confidently during a negotiation task than a person in a short avatar (Yee & Bailenson, 2007). In another example, the *doppelgänger effect* showed that people will behave more like a virtual human (an avatar they cannot control) that looks like them, rather than a virtual other. Studies on the *doppelgänger effect* have found that people who watched their virtual doppelgänger (a virtual human made in their image) exercise, as compared to a virtual other (i.e., a generic gender and aged matched avatar), were more likely to engage in exercise after the experience (Fox & Bailenson, 2009). Although avatars have demonstrated the capacity to change human behavior, research on *why, when,* and *how* they are effective is still developing.

Bailenson and Segovia posit that the *doppelgänger effect* is successful because a virtual doppelgänger promotes self-identification (2010). The authors identify Rogers and colleagues' *self-referential encoding (SRE) effect* as an explanation for why virtual doppelgangers are effective at promoting behavioral change (1977). "The self-referential encoding (SRE) effect states that individuals learn and remember information better when it is related to the self" (Bailenson & Segovia, 2010, p. 178). The virtual doppelgänger is associated with the self, increasing its self-relevance. Therefore, when a person sees their virtual doppelgänger engaging in an activity, it is encoded almost as if they were engaging in that same activity. While the remaining literature review does not involve virtual humans, the *SRE effect* holds significant relevance to *avatar identification* and *self-presence*, two concepts that promote self-relevance and thus engagement in virtual worlds (i.e., virtual environments).

Related Concepts

Avatar-based interactions rely on *avatar identification* and *self-presence* to drive salient experiences (Li & Lwin; 2016). *Avatar identification* refers to the overlap between the self-concept and avatar representation (e.g., Fig. 2), whereas *self-presence* refers to how much of one's self-concept is engaged in the mediated environment. Further distinctions between *avatar identification* and *self-presence* lie within their sub-concepts and will be discussed below. While *avatar identification* and *self-presence* can work in many ways, I will focus on the social identity levels of each concept to link their role with affect.

Before discussing avatar identification, it is important to define how avatars are conceptualized in this research. Avatars are digital self-representations that afford interaction in virtual worlds (Nowak & Fox, 2018). For example, in order to play *Animal Crossing: New Horizons*, the player must create an avatar that represents them in the game's universe (e.g., Fig. 1b). Furthermore, avatars in this research are refined to controllable, full-bodied, human-looking (humanoid) entities that can vary in artistic style (cartoon vs photorealistic) and dimensionality (2D vs 3D). Avatars can also be classified by ways of embodiment. Avatars used in physically immersive settings with various degrees of body-tracking, such as virtual reality, are considered embodied interactions (e.g., Fig. 1a), whereas avatars without body-tracking (e.g., controlled by keypress or controller, see Fig. 1b) are not. It is important to note that foundational literature on avatar identification and its psychological effects draws from empirical work on both embodied and non-embodied avatar interactions. Virtual embodiment is known to have its own effects. For example, virtual embodiment can increase the experience of an interaction and can interact with other forms of identification to make it feel real (Bailey et al., 2016; Sah et al., 2021). The significance of this distinction will become clearer as the concepts of *avatar identification* and *self-presence* are introduced.

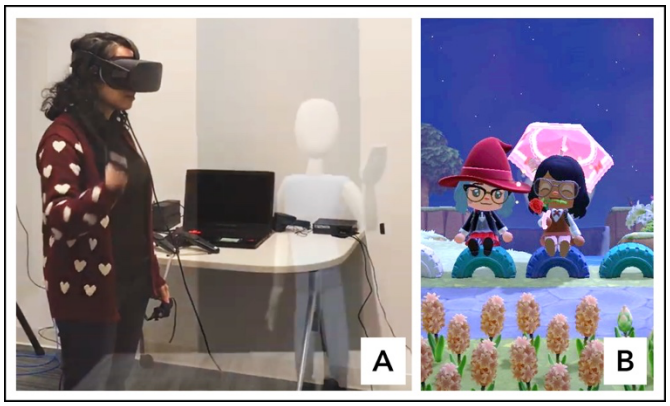


Figure 1. Embodied and non-embodied avatars. An example of an embodied avatar on the left (A) and non-embodied on the right (B). The avatars in 2B are from Nintendo's *Animal Crossing: New Horizons* and are controlled by a joystick (i.e., joycon) for most in-game interactions.

Avatar identification

Avatar identification is the act of identifying aspects of one's self-concept with an avatar. The process is often described as a temporary shift in one's self-concept that is prompted by a variety of identity cues. For example, Van Looy and colleagues identify three forms of avatar identification: *similarity*, *wishful*, and *embodied identification* (2009). Downs and colleagues (2019) refer to this construct as *player-avatar identification* and add other forms of identification such as *value homophily*, *perspective-taking*, and *liking*. The following paragraphs will contain a brief description of each concept and their application to avatar-similarity (self-relevance).

Van Looy and colleagues focus on appearance-driven identification with avatars. *Similarity identification* is when a person identifies with an avatar that represents their actual self (e.g., current appearance). *Wishful identification* occurs when a person identifies with an avatar that represents their ideal self (e.g., aspirational appearance). *Embodied identification* is when a person identifies with the

behavioral realism of their avatar (i.e., avatar moves when I move) as well the perception of having a body (i.e., because it moves, it is me).

Avatar creation is related to self-presentation and self-discrepancy (Vasalou et al., 2008; Vasalou & Joinson, 2009). First, as per Goffman's self-presentation framework (1959), avatar representations are seen as performative acts. Therefore, it is by virtue of this performance that people (actors) carefully consider their digital self-representation. These decisions are often mediated by choices that reflect the need for *similarity* and *wishful identification*. In short, *similarity identification* represents the "actual self" and *wishful identification* represents the "aspirational self ." Another key premise is that people create their avatars with the intention of minimizing self-discrepancy (Dunn & Guadagno, 2012; Mancini & Sibilla, 2017) or design avatars that are in line with their actual (Messinger et al., 2019) or ideal self (Ducheneaut et al., 2009). Together, these two assumptions allow for other forms of avatar identification.

Downs, Banks, and Bowman expand avatar identification to include *value homophily*, *perspective-taking*, and *liking* (2019). For this discussion, the following definitions will serve as a high-level understanding of each concept; a more detailed account of each concept can be found in Downs and colleagues work (2019). *Value homophily* refers to the avatar sharing the same attitudes and beliefs as the user (e.g., "the avatar has the same attitude toward [X] that I do" (Downs et al., 2019)). *Perspective-taking* is when the player (i.e., user) is able to take the perspective of their (or another) character, such that the player is able to understand the character's actions or feelings. For reference, the character refers to the avatar the user is playing with.

Finally, *liking* refers to the actions of characters over time. Players come to like characters that agree with their morals (i.e., actions that are "proper and correct" or agreeable to us in a given situation).

While *value homophily*, *perspective-taking*, and *liking*, are all important avenues for avatar identification, they are not within the scope of appearance-based self-congruence. What these concepts do demonstrate are the multiple entry-points for self-congruence (identification) that avatars have to offer. However, appearance-based identification can happen more instantaneously as compared to *value homophily*, *perspective-taking*, and *liking* occur over a series of multiple exposures. Furthermore, appearance-based similarities can signal value homophily in certain situations (Guegan et al., 2017).

Self-presence

Broadly defined, *self-presence* is "the extent to which the self is present or relevant during media use" (Ratan, 2013, p.323). *Self-presence* describes the different ways or "levels" in which people can connect with their avatars or virtual self-representations (Ratan, 2013, p.324). The concept of *self-presence* has three components that are derived from Damasio's framework of self-concept (consciousness) known as the three levels of self: *proto*, *core*, and *extended-self*. The *proto* and *core-self* are related to the experience of having a body and experiencing emotions at a physiological level, respectively. The *extended-self* is related to one's social identity; it is the "conscious idea of self, based on memories" of the self (Ratan, 2011, p.9).

Ratan (2012, p. 327) distinguishes the three types of *self-presence* by their duration or temporal aspects. *Proto self-presence* is engaged when a person is interacting in a virtual world with their avatar. Once a person stops using their avatar, *proto self-presence* is immediately disengaged, as the individual is no longer controlling the avatar's actions. *Core self-presence* functions in a similar temporal manner to *proto self-presence*, however, the effects of *core self-presence* may linger after avatar use. Ratan argues that people with high *self-presence* (overall) are more affected by what happens to their avatar (2012, p. 327), and that *core self-presence* might explain the impact of avatar experiences (what happens to my avatar affects me). Furthermore, *core self-presence* may also explain the longer-term effects (i.e., minutes, hours, days, weeks) of avatar-based health interventions.

In contrast to *proto* and *core self-presence, extended self-presence* involves longer lasting and more permanent effects related to identity and persistence of the identity representation (Treem & Leonardi, 2016). During avatar customization, people choose what aspects of their identity they want to represent. However, Ratan points out that customization often happens *before* avatar use and not after. This timing is critical, because it suggests that how a person customizes their avatar, especially in singular use cases, is more permanent because users may not go back and edit their avatar. Therefore, *extended self-presence* not only encapsulates aspects of social identity, but it also preserves them as avatars still exist even if they are not in use[1]. In summary, people engage in *proto* and *core self-presence* in most avatar

[1] It is important to note that when avatars are used in experimental settings, they are de-identified (renamed) and often destroyed to protect the participant's privacy in concordance with IRB regulations. However, this may not be the case in other settings where an IRB is not used.

experiences; they represent the shorter to longer-term effects of avatar use in experimental settings. However, not every avatar experience engages in similar levels of *extended self-presence*, where participants are asked to engage in self-presentation (i.e., think about how they want to represent themselves) and have the results of that experience (i.e., avatar) persist over time.

Self-presence and avatar identification are correlated (Seo et al., 2017). In line with the *SRE effect*, people identify more with and report greater self-presence when their avatar looks like them (Seo et al., 2017). The link between avatar identification is unsurprising because avatar identification is a process in which the self is extended into a mediated environment; it is a form of self-extension. Therefore, *avatar identification* and *self-presence* carry parallel components. For example, the experience of *embodied identification* is similar to the feeling of *proto* and *core-self*. Both aspects relate to the experience of having a body and being able experience sensations (external and internal) with it. Similarly, the *extended-self* maps onto *similarity identification* in appearance based social identity cues.

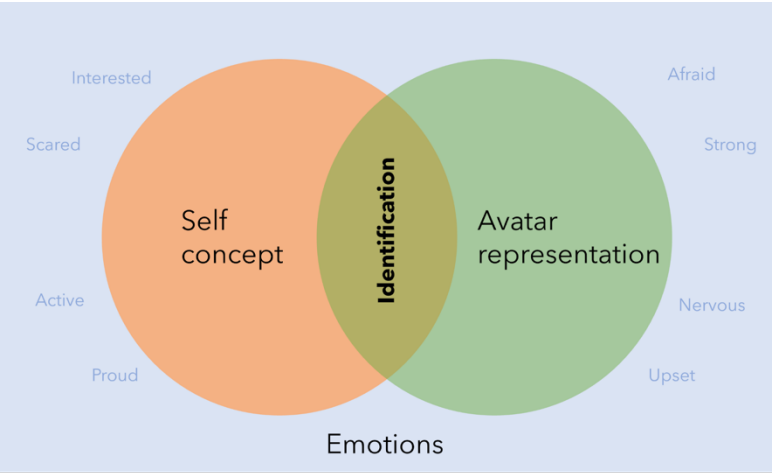


Figure 2. Self and avatar overlap. A visual representation of the self-similar (appearance based) avatar identification process. Identification occurs when there is an overlap between self-concept and the avatar representation. The identification process co-occurs with the emotions that are associated with the presence or absence of salient social identity cues.

Figure 2 visualizes the differences between *avatar identification* and *self-presence*. On the left, self-concept entails aspects of *self-presence*. That is, things that we refer to as "us." This can be the perception of having a body, the body's appearance, and the sensations felt with the body (e.g., physiological signals, like emotions and the five senses). Self-concept can also include values, attitudes, and beliefs which form the basis of social identity. These social identity cues can take shape in tangible objects and associations (e.g., traditional clothing, skin color, gender identification) (Peña et al., 2017, Yee et al., 2011, Lee & Park, 2011). Avatar representations, or the digital character serve as an extension of the self that can also exhibit social identity cues. Identification occurs when aspects of self-concept, like social identity cues, and the avatar representation are shared. This identification (or identification process) can co-occur with feelings (associated with positive or negative emotions) towards the social identity cues that are (or are not) available for people to choose from.

Avatars and self-recognition

When an avatar looks like you, it serves as an identity cue; it also engages the part of the brain implicated in self-referential processing (Gonzalez-Franco et al., 2016). In other words, avatar appearance alone is enough for the brain to recognize an avatar as a part of, or extension of, the self. However, "looking like you" can mean many different things. Scholars have long debated on whether to prioritize *avatar personalization* or *behavioral realism* when creating avatar-based experiences (Latoschik et al., 2017; Bailenson et al., 2006; Herrera et al., 2020). *Avatar personalization* is the act of making a physically self-similar avatar (Waltemate et al., 2018). A personalized avatar shares the user's physical appearance (e.g., body shape, hair style, skin color) (e.g., Fig. 3). *Behavioral realism* refers to the avatar moving like a human does in the physical word (the avatar operates under the same physics, e.g., gravity, as humans do in the physical world), and can also incorporate human-like qualities (e.g., blinking, facial expressions, etc).

Figure 3. Personalized Self-Avatar. An example of a personalized avatar (A) made in the physical likeness of the author (B). The avatar was made with ReadyPlayerMe, a free virtual reality avatar customization tool.

Other scholars have noted that *avatar personalization* may not be as important as *avatar customization*. While *avatar customization* can lead to *avatar*

personalization, the two concepts also have slightly different meanings. *Avatar customization* refers to the general act of creating an avatar and customizing it to one's preference(s) (McArthur, 2017). This can include making an avatar with a different gender, body type, or skin tone than one's own. However, *avatar personalization* refers to creating an avatar that physically resembles the user (Waltemate et al., 2018).

In the context of research, the goal of *personalization* is to improve self-similarity identification or matching a participant's avatar to their physical appearance (e.g., gender-matching, skin tone, hair style). Meanwhile, the goal of avatar *customization* is to give participants more choice over how they are represented in a virtual space; there is no explicit or predicted outcome with *customized* avatars, as there is with *personalized* avatars (e.g., an avatar that resembles your physical appearance). Furthermore, *avatar customization* is more often, but not always, done by the user, whereas*, avatar personalization* may be done by the user or another party (e.g., a researcher).

In short, personalized avatars can be customized through self-selection (e.g., selecting features or colors) or automatically generated with camera scanning technology where the resulting avatar looks like the participant. However, avatars can also be customized to not look like the participant at all (e.g., fantasy avatar). Personalized avatar refers to the end product, whereas customized refers to the action of creating an avatar and having more choice over what is created.

While both *avatar customization* and *personalization* enhance avatar identification through self-relevance (Turkay & Kinzer, 2014; Turkay & Kinzer, 2017; Koulouris et al., 2020; Waltemate et al., 2018), it is unclear as to how that happens.

One potential mechanism is through *agency*. Research within and outside the domains of avatar studies have found that the act of customization increases feelings of control, or *agency* (Sundar, 2008). This is important because having agency over an outcome can lead to positive affect or attitudes (Birk et al., 2016; Sundar & Marathe, 2010). However, another mechanism includes satisfaction with the avatar creation process, which also involves affective outcomes (Trepte & Reinecke, 2010).

The importance of agentic interactions has not gone unnoticed. The human computer interaction (HCI) community has called for the design of more agentic experiences to help improve emotional well-being (Thieme et al., 2015). *Self-determination theory* posits that *agency* is a basic psychological need (Ryan & Deci, 2000). Therefore, designing interactions that imbue a sense of agency can be intrinsically motivating for participants, which can increase user-engagement. Building upon this idea, Kalyanaraman and Wojdynski found that user customized content is perceived to have more value and relevance, regardless of the content form (i.e., characters/avatars or web content) (2015). This suggests that customization and agency also play an important role in the self-avatar creation process. In the next section, agency and satisfaction will be discussed in the context of affect and self-avatar customization.

Self-avatars and emotions

Avatar customization is a gamification strategy that can improve player autonomy and enjoyment (Cuthbert et al., 2019). Participants that customize their avatars, compared to those that do not, report a more positive experience with their

gameplay (Birk & Mandryk, 2016). Several studies have also found that participants who customized an avatar for a health intervention, compared to those assigned an avatar, had significantly higher rates of adopting healthy lifestyle changes (Kang & Kim, 2020; Kim & Sundar, 2012). Within the domain of mental health, participants who customized their avatars and reported low social connectedness showed improved attentional training against negative stressors (Birk & Mandryk, 2019).

Research has also shown that participants with *self-avatars* (i.e., more closely resembled the user) report positive attitudes towards their avatar and its use in virtual interactions **(**Suh et al., 2011**)**. Part of this may be explained by intrinsic motivation, or when an individual partakes in a behavior because it is satisfying (Ryan & Deci, 2000). For example, Birk and colleagues found that participants who showed greater identification with their avatar spent more time playing the game Infinite Runner, where intrinsic motivation (i.e., motivated behavior) was operationalized as the time spent playing the game (2016). Koulouris et al., also reasoned that shared avatar resemblance may have fostered intrinsic identification (by providing intrinsic motivation) between the user and avatar, which resulted in increased exergame performance (2020). However, the performance effect of intrinsic identification broke when participant's avatars resembled idealized characteristics (that were made to increase wishful identification). A similar exergame study found that customizing self-relevant avatars were particularly helpful in motivating people with low health ideals to exercise (Waddell et al., 2015). These studies suggest that both avatar appearance (self-similar/relevant) *and* customizability are independent concepts that work together to drive avatar effects in virtual environments.

Drivers of avatar customization preferences

When it comes to creating a self-avatar, context drives many customization decisions. Although early avatar research concluded that people make avatars that reflect their ideal self (Bessière et al., 2007; Jin, 2012), recent work has shown that people often make a hybrid of their idea and actual selves (Messinger et al., 2019). Furthermore, salient social identity cues (i.e., "core identity traits") such as sex, body type, and skin color remain consistent regardless of context (e.g., professional or casual), or the interactants (e.g., social closeness, such as close friend vs stranger) (Messinger et al., 2019; Triberti et al., 2017). Triberti and colleagues also found that women were more likely than men to change their avatar body if they were aware of meeting a stranger offline (as opposed to an acquaintance) (2017). What does change in these settings is how people accessorize (e.g., formal wear for professional contexts) (Messinger et al., 2019; Triberti et al., 2017). However, it is important to note that early work studied gaming experiences (e.g., MMORPGs) as opposed to casual socialization (i.e., avatar-based chat). The different overarching goals of these virtual worlds also factors into the type of avatar a user chooses to create.

Perceived competitiveness of a game, life satisfaction, and avatar similarity can also determine what type of avatar a player creates (see Trepte & Reinecke, 2010 for a review). These measures can indicate what a person values (i.e., type of reward) in a given context and relate that to their avatar customization choices (e.g., equipping avatar with best gear if winning is important) (Peng, 2021). In this way, perceived competitiveness and life satisfaction are linked to extrinsic motivation because they are predicated by receiving an external reward (i.e., accomplishment). Many games

focus on extrinsic motivation through their reward structure (Reid, 2012). However, extrinsic motivation may not be the most helpful type of motivation for health interventions, where the reward lasts as long as the behavior that supports it (Koulouris et al., 2020).

People may wish to create avatars that embody an identity different from their own. Two formative concepts within this realm are *identity exploration* and *identity tourism*. While an individual is exploring another identity (e.g., male playing with a female avatar) in both cases, *identity tourism* refers to a specific pretense in these motivations. That pretense is the *intentional* practice of passing as a member of a marginalized group often for capital gain (Nakamura, 1995, p.181-193). The distinction between the two lies within intentionality and purpose. *Identity tourism* is characterized by self-gain (greed) or extrinsic motivation (i.e., voyeurism, cultural appropriation, etc), whereas *identity exploration* is driven by a gentle curiosity or intrinsic motivation for the purposes of self-exploration. While *identity exploration* is more in line with the goal for positive emotions, it is important to draw an ethical distinction between these motivations for creating avatars. This is because the perception of identity tourism can draw harm to marginalized groups in lieu of fostering stereotypical attitudes, which marginalized groups try to avoid (Lee, 2009; Lee, 2014; Kafai, 2010).

While research on avoiding stereotype threat, as well as its effects on individual performance are well-studied (Ratan & Sah, 2015; Chang et al., 2019), limited work has investigated the effects of poor self-avatar representation on emotional well-being. Current research suggests that poor avatar personalization can

signal social harms like identity threat due to the perceived dominance of majority identities in virtual worlds (Kafai et al., 2010; Dietrich, 2013). However, to the author's knowledge, no work has provided a holistic account for identity representation in virtual environments that includes perception(s) of stereotype threat (e.g., White dominance), satisfaction with the avatar customization process, and identification with self-similar avatars in the context of emotional well-being (positive and negative identity related emotional experiences).

The next section briefly details current problems with avatar customization interfaces and their implications for emotional well-being.

Current problems with avatar customization

When creating a physically self-similar avatar, people often create a blend of their idealized and actual self for formal (e.g. business) and informal (e.g. friends) social situations (Messinger et al., 2019; Triberti et al., 2017). However, the avatar customization process is not without its flaws. Despite improvements in option availability, identity representation through avatar customization is still not equitable for all races, genders, and body types (Lee & Park, 2011; Nakamura, 2002; Pace et al., 2009; Pandita et al., 2021).

Most avatar customization experiences begin with a selection of a template or base avatar. Oftentimes, especially in the case of creating a human-like (humanoid) avatar, the initial template is a White male or female (e.g., Fig 4). These templates rarely vary in age, race, or fitness, often portraying young Caucasian (<40 years of age), fit, and able-bodied individuals (McArthur & Jensen, 2014). The choice

limitations in CCIs are often attributed to their beginnings in fantasy games, which readily offered hypersexualized fantastical Eurocentric avatars (Pace et al., 2009; Consalvo & Harper, 2009).

Since the 2010s, scholars have called for the design of inclusive CCIs (McArthur, 2015; Hayes & Johnson, 2019). These calls have been met with CCIs like *ReadyPlayerMe*, which offers users with a larger selection of template avatars. For example, CCIs have begun incorporating cultural elements into avatar design, such as the hijab (headscarf) and inclusive hairstyle design (e.g., braids, curly hair, etc.). However, these new options are often not a part of the initial templates offered to the user as they enter the avatar customization phase. This introduces a new problem of multiple choice, where users that cannot find a representative template end up having to spend more effort into creating a self-avatar they can identify with, thereby maintaining the issue of inequitable representation (Pandita, Humphreys, & Won, 2021). Therefore, standard avatar representations may negatively impact the effectiveness of online mental health interventions for older or AAPI patients.

Representation and mental health

Representation plays an important role in our daily lives. Those that are represented in political spaces get more say, resources, and needs met; they have a better quality of life. However, many marginalized groups, who often lack representation in key social spaces such as mental healthcare (Evans et al., 2012), have embraced invisibility, or not voicing their needs, in exchange for existing. Asian Americans and Pacific Islanders (AAPIs) are one such group that are referred to as the

"model minority" due to their *perceived* ability to assimilate quietly and harmoniously in the United States (Lee et al., 2009).

However, the perceived ability of AAPIs to successfully assimilate in the United States is a deeply harmful misperception. The model minority myth blankets any perception of harm done to AAPIs, which further minimizes awareness of greater problems. AAPIs also face racial discrimination, have poorer mental health, and significantly underutilize mental healthcare resources (Wu et al., 2021). Yet, it was not until the recent uptick in AAPI hate crimes that more attention has been brought to existing inequities in AAPI quality of life, and even underscoring the anxieties of being and being identified as AAPI (Tessler et al., 2020).

How people are represented in media affects how they are perceived by the greater public (Litam, 2020). Issues of representation not only affect a marginalized group's sense of identity on a personal level (i.e., minimizing needs, like seeking mental healthcare), but also influence the ways in which they are perceived and treated by others (dominant groups) at a societal level (i.e., model minority myth).

The focus on overt racial discrimination (e.g., slurs or physical harm) has led many to overlook the additive effects of *covert* racial discrimination on AAPI's mental health. AAPIs are more likely to face covert discrimination, such as microaggressions of being the perpetual foreigner, which is a form of social ostracism (Ong et al., 2013). Studies have also shown that the cumulative effects of microaggressions can result in deleterious mental health outcomes for people of color (Nadal et al., 2014; Ong et al., 2013).

While issues of racial discrimination, such as microaggressions, and their toll on mental health are not new, the continued promise of a race-less, and thus discriminatory-less, internet during the dot-comm boom led many to believe that these were problems of the past (Nakamura, 2000). However, AAPIs are more susceptible to covert forms of microaggressions, such as the perpetual foreigner (Ong et al., 2013). Considering this research, it is not unreasonable to suggest that the inability to create an avatar that physically resembles oneself in a virtual world for a group that is historically underrepresented in media (DuCros et al., 2018) is a microaggression. When people of color perceive it difficult to create an avatar of the same race, it reinforces the status quo of "White habitus" (Dietrich, 2013) or dominance. Furthermore, even if people of color have the option to design non-White avatars, if the perception of White habitus holds, they are more likely to design White-passing avatars (Kafai et al., 2010).

Digital spaces are the new frontier of mental healthcare and can help improve issues of accessibility for AAPIs. During the Covid-19 pandemic many turned to video games to help cope with feelings of stress, anxiety, and depression (Pearce et al., 2021; Wang et al., 2020). Furthermore, results from a 2019 consumer survey by SuperData, and analyzed by the Nielsen Company, found that "Asian American households own more video game related products than the total US population" (Nielson, 2020), which implies better adoption of avatar-based health interventions due to familiarity. While gaming tends to focus on individuals below the age of 35, avatar-based therapies can also be accessible to non-gamers and older adults. Avatar

self-representation can make an intervention appear and potentially feel more relevant to the participant.

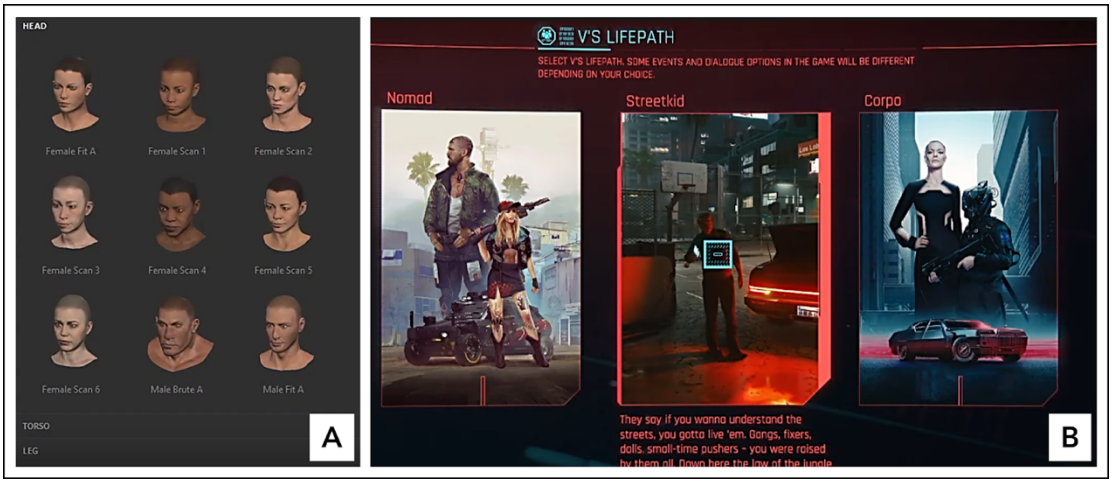


Figure 4. Examples of common layouts for character creation interfaces (CCIs). (A) displays Adobe Fuse. (B) is a screen capture of "Cyberpunk: 2077." Both interfaces are known for the endless customization options they offer users. However, the experience in both cases begins with moving past a Eurocentric avatar that is presented first.

Avatar customization offers a unique opportunity to engage in positive self-referential processes, where users can select which aspects of their identity they want represented in the virtual world (Vasalou et al., 2007). However, there are many aspects that can interfere with or impact similarity-based identification and subsequent affective outcomes. Therefore, it is important to tease apart avatar customization and identification as it relates to satisfaction (or contentment) either with the process (customization) or appearance (identification) within the spirit of representational equity in digital spaces. To this end, the following study is guided by the following research questions: *(1) How might avatar customization and identification impact emotional well-being? (2) What factors influence avatar customization effects on identification? (3) Is avatar customization an equitable experience for everyone?*

The purpose of this study is to bridge knowledge on avatar customization, identification, and affect with feelings of identity representation to further our understanding of avatar customization effects in health contexts. Participants either customized or were randomly assigned an avatar matched for gender and race and then underwent a negative mood induction task. This study evaluates the effect of avatar customization on positive and negative affect at three levels: the process itself, the role of avatar identification, and the role of avatar. The final section will detail the study's hypotheses.

Hypotheses

The following hypotheses are part of an embargoed pre-registration (osf.io/rcpe8). The first hypothesis serves as a confirmatory test of Birk and Mandryk's (2019; 2016) results, which also investigated the influence of avatar customization on positive and negative affect. Participants in my study will be grouped based on condition, customized or assigned, with a gender matched avatar, similar to Birk & Mandryk's experimental design (2019). In line with Birk and Mandryk's findings (2019; 2016), it is hypothesized that avatar customization will increase positive affect and decrease in negative affect from time at baseline (Birk & Mandryk, 2016). That is, the experience of avatar customization will be perceived more positively and less negatively than the experience of avatar assignment, leading to the following hypothesis:

Hypothesis 1: Positive affect (PA) will increase, and negative affect (NA) will decrease after avatar customization, but not avatar assignment.

The effects of avatar customization on positive and negative affect may also be explained by satisfaction with the avatar customization experience. In an interview study where participants were instructed to create self-similar avatars for a dream job interview, participants were satisfied with an avatar that did not physically resemble them (Pandita, Humphreys, & Won, 2021). This implies that satisfaction with the customization process itself, along with context of use and perceived possibility of personalizing an avatar, is also important to understanding when customization, over personalization, is beneficial, potentially resulting in increased identification and positive affect. The following hypotheses predict opposing patterns in positive and negative affect in the satisfied customizers as opposed to the dissatisfied customizers:

Hypothesis 2: Individuals satisfied with the avatar customization process will report higher positive affect and lower negative affect compared to those dissatisfied with the avatar customization process.

However, in the same study (Pandita, Humphreys, & Won, 2021) AAPI participants reported feeling less like themselves, the more they had to edit their avatar. AAPI participants also remarked that if they had more time, maybe their avatar could look more like them, implying more effort was needed on their part to create a self-similar avatar. This experience, laid in stark contrast with White participants, where one participant felt that the customization experience was seamless, noting the customization interface offered his hairstyle and a t-shirt he owns. Therefore, satisfaction may be dependent on those with better representation in avatar customization interfaces, such as cis-White males (Waddell et al., 2014):

Hypothesis 3: White individuals will report higher positive affect, lower negative affect, and higher satisfaction with avatar customization after the initial avatar customization task compared to AAPIs.

The ability to create self-similar avatars can influence a person's perception(s) of inclusion in a virtual environment, and ultimately their experience (Kafai et al., 2010). Kafai and colleagues found that Black teens felt the virtual world of *Whyville* was socially exclusive because of the perceived difficulty in creating Black avatars (2010). Black participants not only reported more difficulty in creating Black avatars, but also noted there were many options for creating White, but not Black, appearances.

If avatar customization acts as a positive experience, such that it promotes the perception of choice (Sundar, 2008), then the avatar customization process itself may act as a buffer against negative mood induction tasks. To test this hypothesis, participants will undergo the Cyberball exclusion task after avatar customization or assignment. The Cyberball exclusion paradigm is a classic method for inducing feelings of social exclusion in social psychology research (Williams & Jarvis, 2006). The paradigm has been shown to decrease positive affect and increase negative affect, particularly feelings related to anger, making it a well-suited for this study (Seidel et al., 2013). The buffer or protective hypothesis, which posits that avatar customization is a generally positive experience that protects against negative experiences, is as follows:

Hypothesis 4: Individuals that customized their avatars will report higher PA and lower NA compared to those who were assigned avatars *after* the Cyberball exclusion task.

However, avatar customization may also have adverse effects. An alternative hypothesis, whereby avatar customization *increases* avatar identification could be indicative of a saliency or intensification effect of subsequent avatar-based interactions. Increased avatar identification may intensify feelings of ostracism yielded by social ostracism. For example, participants who customized their avatars and *did not receive* an attentional retraining experience prior to a negative event reported more negative affect than those who customized avatars and received training (Birk & Mandryk, 2019). The authors suggest this may be due to avatar customization increasing avatar identification which in turn increases the saliency of subsequent events. The following alternative hypothesis, coined the saliency hypothesis, accounts for such an effect:

Hypothesis 5: After the Cyberball exclusion task, individuals that customized their avatars will report lower PA, higher NA, and higher avatar identification compared to those who were assigned avatars.

However, dissatisfaction with avatar customization may also stem from perceptions of social exclusion given by the avatar customization experience. "White habitus" refers to the idea that avatars are largely derived from videogames which default to Whiteness as a social norm (Dietrich, 2013). In other words, videogame experiences, like avatar customization, focus on White players' representational needs, which often means that it is easier to create a White-looking avatar than a non-White

avatar (Kafai et al., 2010; Pandita et al., 2021). Furthermore, if an environment is perceived as White dominant, there is a greater chance that a non-White individual will create a White-passing avatar (Kafai et al., 2010). Therefore, dissatisfaction may exacerbate ostracism effects even when avatar identification is lower:

Hypothesis 6: Individuals dissatisfied with the avatar customization process will report higher NA, lower PA, and lower avatar identification than those satisfied with the avatar customization process.

Conversely, dissatisfaction with the avatar customization process could also have an indirect protective effect in which the salience of ostracism is reduced. Antithetical to *hypothesis 5* which proposes that increased avatar identification could amplify negative affect after the exclusion task, individuals that are dissatisfied with and *do not* identify with their avatar could feel doubly removed from those outcomes. In this scenario, participants may be "saved" from subsequent negative events that occur in the social virtual environment as follows because they do not identify with the avatar:

Hypothesis 7: After the Cyberball exclusion task, individuals dissatisfied with their avatar customization process will report lower avatar identification, higher PA, and lower NA than those satisfied with the avatar customization process.

Thus far, two patterns of avatar customization effects are predicted. First, if avatar customization is broadly conceptualized as a protective positive experience, then individuals that customized their avatars will report higher PA and lower NA across all conditions after baseline. However, if avatar customization hinges on the avatar identification process, then two sub-patterns are predicted: (1) increased avatar

identification and satisfaction will report lower PA and higher NA after the exclusion task, or (2), individuals that show decreased avatar identification and satisfaction will report higher PA and lower NA after the exclusion task. The latter pattern indicates a quasi-protective effect of avatar customization.

Finally, avatar customization can improve feelings of agency (Sundar, 2008; Turkay and Kinzer, 2014), self-efficacy (Behm-Morawitz, Lewallen, and Choi, 2016), overgeneralization of negative beliefs towards the self (Kang and Kim, 2020). All of which are affected by depressive episodes (Slaby, Paskaleva, and Stephan, 2013; Milanovic et al., 2018; Beck, 1970; Beck and Bredemeier, 2016). The final set of hypotheses are exploratory and investigate the relationship between affect, customization satisfaction, avatar identification, race, agency, and overgeneralization:

Hypothesis 8: Positive and negative affect will be predicted by feelings of satisfaction with avatar customization, agency, overgeneralization, and avatar identification.

Hypothesis 9: Individuals who customize their avatars will report higher levels of agency as compared to individuals who do not customize their avatars.

Hypothesis 10: White individuals who customize their avatars will report higher levels of avatar identification as compared to AAPI individuals who customize their avatars.

Findings from these hypotheses may begin to explain how avatar customization affects, or is affected by, other aspects of psychological well-being, such as the basic need for agency, or cognitive distortions like overgeneralization.

Conclusion

Avatars are a form of *self-representation* that encompass *self-concept* and *avatar identification*. *Self-concept* consists of the values and beliefs one holds about themselves and may be signaled by an avatar's appearance or way in which a person identifies with their avatar. *Avatar identification* refers to the differing ways (self-similar, wishful, or embodied aspects of self-concept) a person can connect with their *self-representation* and is often described by levels or intensity of *self-presence*. *Self-presence*, or how much an avatar representation feels like the user, refers to the depth in which a person identifies with their avatar representation, and in what way (e.g., proto, core, or extended-self; i.e., sense of having a body, ability to feel sensations, extensions of the self in virtual environments, like a social media profile).

Furthermore, the creation of an avatar can engage *self-referential* (self-relevant) activity, such as thinking about *how to* or *what aspect of* the self to present in an avatar. For example, those that choose to personalize their avatars might tap into self-similar identification (physical resemblance). Customizing (creating an avatar of your choice) and personalizing (creating a self-similar avatar of your choice) an avatar can imbue a sense of agency over an outcome; this in turn can not only strengthen avatar identification but can also improve psychological well-being or positive affect. However, there are many cases, particularly within the domain of digital mental health treatments, where people do not get to choose their self-representation (virtual avatar). In these cases, identification through self-similar avatars is often relied upon.

Research suggests that self-similar avatars enhance *avatar identification*, which is a key mechanism for improving intervention efficacy. Therefore, when

people chose to personalize their avatars (a type of avatar customization that results in self-similar avatar), or create self-similar avatars, it can be assumed that those with self-similar avatars report higher levels of positive and lower levels of negative affect after avatar creation. However, peoples previous experience with avatar customization and personalization may also affect their expectations of what is possible in avatar creation. Feelings towards the customization process (i.e., perceptions and attitudes of social exclusion and limited identity representation) and whether an individual chooses to personalize their avatar when given the option further complicate the relationship between avatar customization and affect.

The effects of avatar customization and self-similarity (in some cases, personalization) have not been independently evaluated. This study seeks (1) to examine the relationships between avatar customization, satisfaction, and identification with positive and negative affect, and (2) to investigate avatar customization as an inclusive identification mechanism for avatar-based virtual health interventions. The following chapter will detail methods and materials for a study investigating avatar customization effects on negative virtual experiences.

CHAPTER 3

MATERIALS & METHODS

An online experiment that investigated the effects of avatar customization and race (i.e., shared physical resemblance) on avatar identification, satisfaction, and affect was conducted from February to May 2022. The study was advertised as "Games for Virtual Reality" on a participant recruitment website at a midsized university located within the northeastern half of the US. Participants played the Cyberball games (Williams & Jarvis, 2006) under the guise of a user evaluation study to conceal the study's hypotheses and reduce demand effects. Participants completed a series of three game-related tasks and four surveys. After completing the 45-minute study, participants were debriefed on the study's purpose and re-consented to participate in the study. The following section details the materials and methods used in the study.

Participants

146 adults, 18+ years of age (35 male, 107 female, 4 non-binary) were recruited to participate in an online study and compensated 1 SONA credit or $15/hour. Participants' age ranged from 18-31 years (M = 20.4, SD = 1.72; where eight chose not to report age). 57 participants identified as White (39%), 56 as Asian or Pacific Islander (38%), 13 as Black (9%), and 16 as multiracial (11%). Two participants did not report race.

Immigrant generation identification was also collected to capture potential differences in attitudes towards avatar identification. Regarding immigrant generation identification, 22 participants were first generation (immigrated to the US as an adult),

24 were 1.5 generation (immigrated as a child), 44 as second generation (at least one parent was born in the US), and 52 as third generation (at least one parent and grandparent was born in the US). This meant that roughly 15% of the sample identified as first generation, 16% 1.5 generation, 30% as second generation, and 35% as third generation. Four participants chose not to disclose their immigrant generation. Immigrant generation classifications were implemented from Ong and colleagues' study on Asian American well-being (Ong et al., 2013).

White and Asian American and Pacific Islander (AAPI) participants, the two largest demographics in the sample size, were selected for analysis and thus 33 respondents were removed (including those that did not disclose their race and ethnicity). Participants were also removed if they were of mixed race (n = 9), even if they identified as both White and Asian (n = 2). One participant that reported being of mixed race, East Asian and Pacific Islander, was included as AAPI. Of these participants, 22 participants were removed due to improper survey completion; this left the sample with 52 participants (27 AAPI, 25 White) in the customized condition and 30 (18 AAPI, 12 White) in the assigned condition.

Sample Size

The sample size estimate was provided by a preliminary power analysis conducted in *G*Power*. The pilot study sample included 11 participants (6 White, 5 Asian) and analyses accounted for unequal variance due to an unbalanced design (e.g., 1 out of 6 participants identified as Asian in the customization condition). Therefore, the resulting sample size estimates are conservative in that they favor Type II error

(i.e., incorrectly accepting the null hypothesis) to reduce Type I error (i.e., falsely rejecting null hypothesis).

The pilot analysis indicated that 15 participants were required for between-subjects comparisons (e.g., differences in negative affect between assigned and customized groups) using independent t-tests for 80% power and a medium to large effect size (*Cohen's d* = 0.50 - 0.80) at 0.01 significance. Similar parameters were used for identifying the sample size of 20 participants for within-subjects comparisons (e.g., differences in avatar related agency, a repeated measure, for those in the customization condition) using paired t-tests. Effect sizes were based on studies with a similar experimental design (Birk & Mandryk, 2019). Therefore, the final sample size was found to be sufficient for the study.

Study Design

A mixed-design study was conducted to investigate between and within subject group differences. The first factor consisted of avatar generation with two-levels (customization and assignment). The second factor of race also had two-levels (White and Asian). Avatar generation was treated as a between-subjects factor, whereas race was treated as a within-subjects factor (e.g., comparing means within the broader customization group/condition). The main outcomes of interest were positive and negative affect, avatar customization satisfaction, avatar identification, and avatar related agency. Affect and avatar related agency were repeated measures. A schematic of the study procedure can be found in Figure 5.

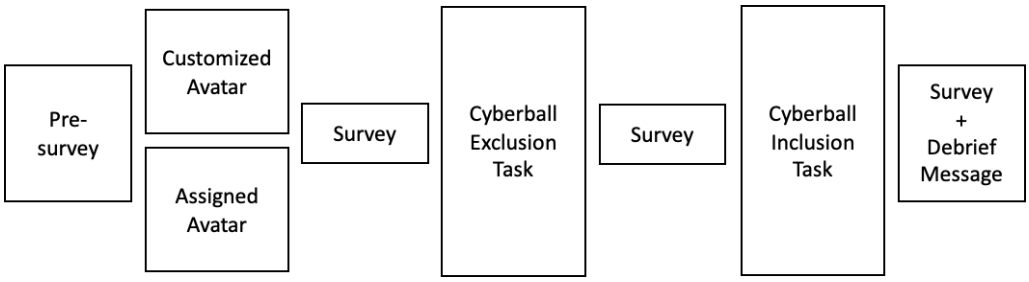


Fig 5. Schematic of experimental design. Participants were assigned to either the customized or assigned avatar condition prior to filling out the pre-survey. After completing the first avatar task, participants filled out another survey. This process was repeated twice more until participants

Study Procedure

After signing up for the online study, participants were given a survey link that also contained a link to the virtual environment (hosted on an external website). Participants were randomly assigned to the "customized" or "assigned" condition, where the condition name referred to the mode of avatar generation. Due to variance in game loading time (e.g., <2 minutes for high speed internet or <10 minutes for moderate internet speed), all participants were instructed to load their environment prior to consenting. After consenting to the experiment, participants filled out a pre-survey which collected information on gender identification, baseline affect, mental health history (e.g., depression or anxiety), cognitive patterns (e.g., overgeneralization and agency) and coping style.

After completing the pre-survey, participants either customized their avatars for five minutes, or were assigned a gender-matched avatar. Participants in the "assigned" condition were instructed to acquaint themselves with their avatar for five minutes in lieu of the avatar creation time (e.g., zoom or pan). Example avatars can be found in figure 6. After customizing or meeting their avatar, participants were instructed to return to the survey window for the post-task (second) survey. The

second survey consisted of affect measures, avatar identification (e.g., similarity measures), perceived limitations with the avatar's physical features (e.g., shape, size, color) and satisfaction with avatar customization or satisfaction with their assigned avatar.

Upon completion of the second survey, participants read a mentalization prompt in preparation for the Cyberball games. Participants were asked to think of the other players (in the Cyberball game) as real people. This protocol was adapted from Kassner and colleagues (2012) who used this prompt to amplify the effects of the exclusion and inclusion activities (tasks) in a VR version of the Cyberball game. More information about the mentalization prompt can be found in the materials section. After reading the mentalization prompt, participants were instructed to return to the virtual environment where they began the first round of Cyberball games.

Participants played the exclusion version of the game for three minutes and answered the corresponding post-activity (third) survey. In the third survey, participants reported feelings of exclusion and inclusion which were used as mood manipulation checks. In the inclusion version of the game, which always came after the third survey, participants played the inclusion game and answered the finals survey in which they reported feelings of exclusion and inclusion. The final survey also collected information regarding participants' immigrant generation (e.g., second-generation American), perception of diversity in their hometown, body image perception, avatar creation and gaming history. This demographic information will be used for future exploratory analyses. After completing the study, participants were

debriefed about the purpose of the study and the mood manipulation (via the Cyberball task) was disclosed. Participants were then re-consented.

Materials

The online study consisted of three WebGL environments created in Unity 3D. Each environment included a character creation interface or random avatar generator and two games that were based on Kipling and Jarvis' Cyberball paradigm (2006). Participants responded to an online survey between tasks. Details on the design of these environments and the survey are provided below.

Avatars. Every participant had an avatar that remained consistent amongst the three tasks. Participants in the customization condition customized their avatar with the UMA CCI, whereas participants in the assigned condition were randomly assigned a gender-matched avatar generated by the UMA random avatar generator. Participants in the assigned condition that identified as third gender or non-binary were assigned a female avatar (n = 4). The virtual environment also included two other players which were also generated by the UMA random avatar generator; these avatars also remained consistent throughout the games. All avatars were based on the same male and female base models (UMA stock models). The following subsections detail the UMA character creation interface and random avatar generator.

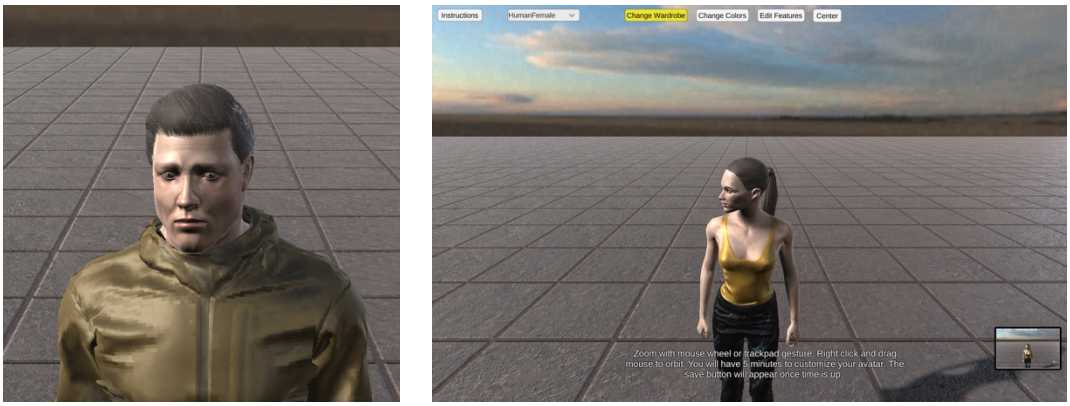


Figure 6. Default UMA avatars. The image on the left displays the default "male human" avatar from UMA. The image on the right displays the default "female human" avatar from UMA. Both images are cropped screenshots of the character creation interface used in the study.

Character Creation Interface. Unity Multipurpose Avatar (UMA) is an open-source game building asset with a premade character creation interface (CCI) that reflects modern CCIs (as seen in Fig. 4, chapter 2). The UMA CCI, known as the character creator, allows users to build their own avatars from stock avatars that range in type and style. Some stock examples include humanoid, fantasy (e.g., werewolf, zombie), and toon characters (avatars). Users can edit their avatar's body features such as size, shape, and color (e.g., head size, nose bridge, skin color) as well as accessories (e.g., clothing or shoes). For the purposes of this study, which is to create a self-avatar, the base avatars were limited to the humanoid avatars. More information about the CCI modifications can be found in the figure below.

Figure 7. Default UMA character creation interface (CCI). The default UMA CCI is pictured above, showing the original template option menu (i.e., Elf Female, etc.). The "Change DNA" button was replaced with an "Edit features" button. The "randomize" and "create in code" buttons were also removed.

Random Character Generator. Two variations of the random avatar generator were created for this study: (1) random male avatar generator and (2) random female avatar generator. These avatars were based on either a male or female stock model and varied in shape, size, and color (i.e., within natural human colors, e.g., brown skin as opposed to blue skin). Due to the high variance in skin color and body type within a given race, randomly assigned avatars were not matched for skin color or body type. Furthermore, in order to conceal the purposes of the study and focus on the effects of personalized customization, photos of participants were not collected. Examples of randomly generated avatars can be found in figures 8 and 9.

Figure 8. Cyberball Interface. Participants had a third-person view of their avatar and their partner's avatars. Participants can choose who they pass the ball to by selecting the "pass to right" or "left" button(s).

Cyberball exclusion task. The Cyberball exclusion task is a three (or more) player ball-tossing game designed to experimentally induce negative mood through feelings of social exclusion (Williams & Jarvis, 2006; Le et al., 2020). The game creates feelings of exclusion by manipulating the amount of tosses the participant receives, such that the participant is excluded during most of the game (e.g., 90% of all passes exclude the participant).

Once the game loaded, participants were instructed to play catch with two other players for three minutes in the virtual environment. Participants could initiate passes through button click (e.g., to throw the ball to the player on the left, click the "left" button). The exclusion task was designed such that for every pass initiated by the participant, eleven passes occurred between the other two players before the ball

was thrown back to the participant. Once time was up, the "next" button appeared to the right of the screen and led the participants to the external post-survey (survey 3). The post-survey included manipulation checks for ostracism and inclusion, which were shown to work (see section on manipulation checks).

Figure 9. Landing page for experimental virtual environments. Once the virtual environment loaded, participants saw a landing page with three avatars. The screenshot above is from the assigned condition. In the "customized condition, the start button reads "customize your journey."

Cyberball inclusion task. The Cyberball inclusion task is a variation of the Cyberball exclusion task that is designed to induce feelings of belonging (Williams & Jarvis, 2006). In the Cyberball inclusion task, at least three players are playing a ball toss game, where each player receives an equal number of throws per game.

In this study, the inclusion game, like the exclusion game, was designed to be three minutes long. The inclusion game always came after the exclusion game as a way to increase positive affect after a negative social experience (see Fig. 6). In other words, while the Cyberball inclusion task is typically utilized as a control condition,

the purpose of the Cyberball inclusion task in this study was to mitigate negative feelings of ostracism that may arise after the Cyberball exclusion task (Simard & Dandeneau, 2018).

Mental visualization task. Prior to each game, a mental visualization prompt was provided to the participant in the previous survey (surveys 2 and 3). The mental visualization prompt was used to improve ostracism and inclusion effects of the Cyberball tasks and is described on the following page (Kassner et al., 2012). The prompt, from Kassner and colleagues, is as follows:

> Take note of the landscape: What color is the grass? What is the weather like? Is it sunny or cloudy? Try to mentally visualize actually being in this environment. Also, pay very close attention to the other individuals in the virtual world. While you are playing the game, try to mentally visualize their behaviors as if they were real people. What do they look like? What are they doing? Are they happy or sad? Are they having fun? Are they bored?

Measures

Measures were split into three main categories: repeated, single, and covariates. The two remaining categories of measures include exploratory (demographic) measures and manipulation checks. All measures listed in the three main categories were used in building the models for hypothesis testing.

Repeated Measures

PANAS. The positive and negative affect schedule (PANAS) is a 20-item survey in which respondents report their affect. The PANAS has been used in studies as a proxy for mental well-being to measure changes in affect (Kingston et al., 2007; Mitchell et al., 2009; Taylor et al., 2020; Watson et al., 1988). The schedule is broken

down into two subsets: positive and negative affect. Questions regarding positive affect ask respondents to indicate their feelings of "interest, excitement, enthusiasm, pride, etc." Similarly, questions measuring negative affect asked participants to indicate their feelings of "distress, upset, guilty, etc." Feelings are rated on a five-point Likert scale, where a rating of one indicates "very slightly or none at all" and five denotes "extremely."

Positive and negative affect scores are calculated independently of one another, with higher scores indicating greater positive or negative affect. Scores range from 10-50, where the mean score of positive affect was 33.3 (*SD* = 7.2) and negative affect was 17.2 (*SD* = 6.2) with a reliability of 0.88 for the positive affect scale and 0.87 for the negative affect scale (Watson et al., 1988). The mean baseline score of positive affect in this study was 28.7 (*SD* = 8.0) and negative affect was 20.0 (*SD* = 8.4), with a reliability of 0.89 for positive affect and 0.93 for negative affect.

Agency over avatar. The agency over avatar measure is from the Player-Avatar Interaction (PAX) scale (Banks & Bowman, 2016). Under the PAX scale, agency is conceptualized as "sense of control" and is measured by two statements: "this avatar does what I want" and "I control this avatar." Responses were measured on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree). The agency over avatar measure was used to help with identifying differences between agency over the self, versus avatar. In this study, people that customized their avatars reported a mean of 3.75 (*SD* ± 1.7) for "this avatar does what I want" and 4.08 (*SD* = 1.1) for "I control this avatar." People that were assigned an avatar reported a mean of 2.5 (*SD* = 1.4) for "this avatar does what I want" and 3.2 (*SD* = 1.4) for "I control this avatar."

Single outcome measures

Satisfaction with avatar customization. An overall measure of avatar satisfaction was created to differentiate satisfaction with appearance versus experience, such as physical resemblance and customization affordances (e.g., a person's avatar could not look like them, but they are still satisfied with the experience of customization). Questions regarding physical likeness included a modified version of Lee and Park's (2011) perceived limitations and difficulties in avatar customization measure, which asked participants to rate their avatar's physical resemblance to themselves on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree). Participants were also asked to rate the most limiting customization features on a seven-point Likert scale (e.g., "How limited did you feel when you customized the following aspects of your avatar?").

The questions regarding satisfaction with avatar customization were also on a seven-point Likert scale and asked, "how satisfied were you with the ability to customize your avatar?" in the customized condition (M = 3.52, SD = 0.92) and "how satisfied were you with your avatar?" in the assigned condition (M = 2.64, SD = 0.87).

Avatar identification. Avatar identification was measured with an adapted version of Van Looy and colleague's similarity identification, wishful identification, and embodied presence subscales (2012). The player identification scale asks participants to rate their agreement on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree) with example statements such as "my [avatar] is an extension of myself" and "when I am playing it feels as if I am my [avatar]" (Van

Looy et al., 2012). The player identification measure was also used by Birk and Mandryk (2019) and will serve as another way to differentiate avatar identification from satisfaction.

People that customized their avatars reported a mean similarity identification score of 10.6 (*SD* = 9.3) and wishful identification score of 7.15 (*SD* = 6.7). People that were assigned an avatar reported a mean similarity identification score of 3.96 (*SD* = 6.2) and wishful identification score of 3.22 (*SD* = 5.0). The similarity identification scale had a cronbach's alpha of 0.85 for the customization condition, and 0.93 for the assigned condition. Wishful identification had a cronbach's alpha of 0.86 for the customization condition, and 0.88 for the assigned condition.

Covariates

Avatar and videogame history. New experiences, or novelty, can increase positive affect (Fierro-Suero et al., 2020). In order to ensure effects are not driven by novelty, participants answered questions regarding videogame play and experience with avatar customization. Sample questions include "have you customized an avatar before? What types of experiences have you customized an avatar for (options: videogames, VR chat, Bitmoji)? What kinds of avatars have you made? (options: photorealistic, low poly, fantastical, etc.)." 44 participants reported having videogame experience (38 reported not). However, 76 participants reported having created an avatar (6 reported none).

BDI-II. The Beck Depression Inventory is a 21-item survey that evaluates depression severity on a zero (none) to three-point (severe) scale (Beck et al., 1961).

Statements ask participants to rate how sad, discouraged, and guilty they are feeling. Responses are then tabulated into a total score, which is then categorized into one of six brackets. Higher scores, such as those above 21 points, indicate greater depression severity. Since depression can affect how individuals process social exclusion (Le et al., 2020), the BDI-II will be used as a covariate for predicting changes in positive and negative affect after the Cyberball exclusion task.

GAD-7. The generalized anxiety disorder scale (GAD-7) is a seven-item questionnaire used to screen individuals with generalized anxiety disorder (Spitzer et al., 2006). It is a 21-point self-report measure that classifies scores of ten or less with having no to mild anxiety, and scores above ten as moderate to severe. Generalized anxiety disorder is often comorbid with subclinical depression (Eysenck & Fajkowska, 2018). It can also be an important covariate to control for with the Cyberball exclusion task (Le et al., 2020). The GAD-7 has also been implicated in picking up other anxiety disorders, like social anxiety disorder (Williams, 2014), which is another important covariate to consider for measuring positive and negative affect after the Cyberball Exclusion Task.

Body image disturbance. Individuals with depression are known to have poor body and self-image (Paxton et al., 2006). Therefore, it is important to consider differences in body image disturbance when exploring meaningful differences in avatar customization satisfaction. Body dissatisfaction was measured with the Body Shape Satisfaction Scale (Pingitore et al., 1997). Participants rated ten aspects of their body shape and parts (e.g. height, weight, body shape, waist, body build, and shoulders) on a five-point Likert scale (1=very satisfied; 5= very dissatisfied). The

Body Shape Satisfaction Scale is a reliable (α = .88) for body image disturbance (Pingitore et al., 1997). In this study, body image disturbance was used as a covariate for analyses that predict avatar satisfaction.

Exploratory measures

SoA. The sense of Agency (SoA) scale is a self-report measure of general agency, or one's general belief in their ability to control an outcome (Tapal et al., 2017). Agency is often low in individuals with poorer emotional well-being, such as those with depression (Slaby et al., 2013). The SoA is a thirteen-item scale where participants rate statements regarding agency on a seven-point Likert scale (1= strongly disagree; 7=strongly agree). Examples include "I am in full control of what I do. Nothing I do is actually voluntary." The SoA measurement contains positive and negative subscales. Positive SoA (SoPA), which consists of five items, measures 'feelings of control' and negative SoA (SoNA), which consists of six items, may be a "variant of helplessness" (Tapal et al., 2017). This measure was not analyzed in the current study, but will be used to see whether general feelings of agency can predict avatar satisfaction in future studies.

Overgeneralization. The overgeneralization measure is a four-item subscale taken from the Attitudes Towards Self (ATS) scale (Carver, 2013). Overgeneralization refers to an individual's ability to generalize negative beliefs about the self (e.g. "when even one thing goes wrong, I begin to wonder if I can do well at anything at all"). Participants rated statements with a five-point Likert scale (1 = I agree a lot; 5= I disagree a lot). This measure was included because individuals with poorer mental

well-being report a higher likelihood of overgeneralizing negative outcomes to the self and world (Beck & Haigh, 2014), which may affect perceptions of the exclusive and inclusive tasks and how participants report positive and negative affect.

Brief COPE. The Brief COPE (B-COPE) is a self-report inventory that assesses the frequency in which a person uses different coping styles (e.g. self-distraction, humor, self-blame) amidst stressful events (Carver, 1997). For example, participants were asked how often they utilize the following strategies for coping with stress: "I've been criticizing myself; I've been getting help and advice from other people." The B-COPE can be modified to fit both general and specific contexts (Kato, 2015). In this study participants were asked to report their coping strategies during stressful situations or hardships. However, these items were not used for analysis.

The B-COPE consists of 28 items that group into 14 subscales (e.g., self-distraction, active coping, acceptance) and measures responses on a four-point Likert scale (1 = "I haven't been doing this at all"; 4 = "I've been doing this a lot"). The 11 of the 14 subscales in the B-COPE report moderate internal consistency with Croanbach's alpha ranging from = .070 to alpha = .90 (Carver, 1997). The venting, denial, and acceptance subscales show limited internal consistency with Cronbach's alpha = .50, .54, .57, respectively (Carver, 1997). Work by Dias and colleagues (2012) has divided the scale into three factors or coping styles: problem-focused coping, emotion-focused coping, and avoidant coping.

Manipulation Checks

There were four manipulations involved in this study. Manipulations included condition assignment (assigned or customized avatar) and mood induction (exclusion and inclusion games). At the beginning of each survey, participants were asked to summarize each task; this was done to confirm task completion and corresponding survey results. Example responses include: *"I dressed and customized my avatar. There were a lot of features that you could adjust, especially facial dimension*" for the customization condition, and *"I first passed the ball to the right girl because I usually feel more connected to girls. They kept passing the ball to each other"* for the exclusion task. More details regarding exclusion due to failed manipulation checks can be found in the data cleaning section.

Exclusion and inclusion mood manipulations elicited by the Cyberball games were checked with questions about the group activity (e.g., "*what did you see and do in the virtual environment?*") A paired t-test was used to check if the social exclusion and inclusion scenarios induced feelings of ostracism and belongingness, respectively. Means and standard deviations ($M_{exclusion}$= 6.41, $SD_{exclusion}$= 2.03; $M_{inclusion}$= 6.85, $SD_{inclusion}$= 1.96) of each task were trending significance (t = -1.86, df = 287, p = 0.06).

Analysis

A mixed model analysis, which is a type of linear regression analysis, was used to investigate predictors of positive and negative affect and avatar identification. The mixed model analysis was chosen due to the hierarchical nature of the data, where repeated measures were nested within individuals, and the goal of examining variation

between groups (customization vs. assigned condition) and within groups (i.e., positive affect over time, and differences between White and AAPI within the same condition). This resulted in the development and evaluation of three mixed models (i.e., positive affect, negative affect, and avatar identification). All analyses were conducted with R using the lme4 package.

Rationale. The current study has a nested data structure which means the assumption of independence is not met (i.e., repeated, or multiple measures of positive and negative affect for each participant means the data is highly clustered or correlated). This violates the assumption of ANOVA and linear regression analyses, both of which assume data independence (e.g., positive affect at baseline will not be related to subsequent positive affect measures for the same individual). Linear mixed model analysis (i.e., multilevel analysis), on the other hand, can account for non-independent data. Furthermore, linear mixed effect models are also better equipped at handling missing data and account for multiple contributors to variance such as fixed effects (e.g., condition, race, and time) and the random effect of the participant (e.g., random variability in participant response). Furthermore, linear mixed effect models have also been shown to be more robust even when distributional assumptions are violated (Schielzeth et al., 2020).

Data cleaning. Survey data was collected on Qualtrics and checked for normality and missing values throughout each stage of the data cleaning process. Cells that were missing data were replaced with NA and kept in analysis if inclusion criteria were met. Data was excluded if the following criteria were not met: (1) participant did not follow instructions (n = 3), (2) participant missed or incorrectly answered any of

the three attention checks (n = 42), (3) the overall survey completion rate was less than 80%, (4) the participant was familiar with the Cyberball tasks or study hypotheses, or (5) did not identify as AAPI or White (n = 26)[2], or did not report race (n = 3). After data cleaning, the remaining sample size used for hypothesis testing was 82 participants (52 customized, 30 assigned).

Linear models. Four linear mixed effects models were created to test each hypothesis. The four models are described in detail in the results section. In summary, each model predicts changes in the outcome variable (i.e., positive, or negative affect and avatar identification) that can be explained with fixed effects of condition (customized vs assigned), time, and BDI, and a random effect of the participant. Each model was modified in a stepwise fashion to assess the significance of each predictor; where models were chosen based on their AIC scores (i.e., where variance was best explained by the least number of predictors). The significance of each predictor was evaluated if p was less than or equal to .05. Exploratory hypotheses included demographic factors to predict positive and negative affect and their relationship to avatar customization. These demographic factors included race, BDI, overall agency, and overgeneralization. The significance of each exploratory predictor was also evaluated if p was less than or equal to .05.

[2] Participants were excluded if they did not identify strictly as AAPI or White. This meant that participants who reported being *both* AAPI and White (n = 2) were not included in the final analysis.

Conclusion

In this chapter the methods and materials for creating an online study that investigated the effects of avatar customization on positive and negative affect were discussed. Three variations of a virtual environment entitled the "Cyberball games" were built. The next chapter will present results and briefly discuss whether they support or disprove the hypotheses presented in chapter 2

CHAPTER 4

RESULTS

This chapter presents results from a study that investigated the effects of avatar customization on positive and negative affect in emotionally evocative situations (i.e., social exclusion and inclusion). In summary, the hypothesized main effect of condition, or avatar customization was not supported. That is, people who customized their avatars did not differ in their positive or negative affect levels when compared to those who were assigned an avatar. However, comparisons within the customization condition found that people dissatisfied with their avatar had lower avatar identification. Furthermore, AAPIs were more likely to be dissatisfied with their avatar when compared to White participants, although this difference was found to be trending.

The chapter first describes the specifications for the analyses, data validity, and survey incompletion rates. Then it presents the findings for each hypothesis. Finally, it ends with a section on the models developed for hypothesis testing and a description of how each model was constructed.

Analyses Specifications

Six linear mixed models were created to evaluate the relationship between affect and avatar customization. The first two models predicted positive affect between conditions (customization and assigned) and within the customization condition. The next two models were for negative affect; these models evaluated predictors of negative affect between conditions and within avatar customization. The

fifth model evaluated predictors of avatar similarity identification, and the sixth model evaluated predictors of satisfaction with avatar customization.

Positive or negative affect baseline measures (PANAS items) were kept as fixed effects in every model. The decision to keep baseline PANAS as a fixed effect, rather than a random effect, was due to the study's design. This is because baseline PANAS measures are strong and consistent predictors of subsequent (repeated) PANAS measures. In other words, baseline PANAS as a fixed effect has more explanatory power than as a random effect of the participant. While baseline PANAS measures will vary randomly between participants, it is better to account for variability that will have a larger effect on the outcome variables. Therefore, using baseline PANAS as a fixed effect increases the explanatory power of the models by accounting for non-independence of repeated measures. Furthermore, random effects are typically categorical variables and not continuous, which is another reason for keeping baseline PANAS, a continuous variable, as a fixed effect (Barr et al., 2013).

It is important to note that one could isolate baseline PANAS measures and keep it separate from subsequent PANAS measures (i.e., after avatar customization/assignment, exclusion task, and inclusion task). However, this would still yield similar results as a *lmer* test where time (i.e., baseline, after customization/assignment, etc.) is treated as a factor variable, which is how the analyses was conducted.

All data analyses were performed with R (R Core Team, 2021) using RStudio (RStudio Team, 2021). The mixed model analyses were conducted with the *lmer* function from the *lme4* package (Bates et al., 2015). Assumptions of linearity, constant

variance, independence of errors, and normality were met which indicated proper use of such tests. Beta coefficients, standard error, and significance levels are reported for all mixed models. Pairwise comparisons are also reported to help evaluate support for or against hypotheses.

The following sections discuss data validity, and which factors and covariates were selected for each model and the process of model selection. The second half of the chapter introduces the six models and outcomes from hypothesis testing.

Data Validity

In a second round of data-cleaning, 22 participants were removed from the dataset due to survey incompletion after preliminary[3] inclusion criteria were met. The second round of data-cleaning removed participants that either missed the baseline survey or they did not answer the corresponding survey after a virtual task (e.g., taking the baseline survey *after* avatar assignment). While linear mixed effects models are robust in the event of missing data, and were chosen for this specific purpose, it is equally important to confirm that the surveys were taken at the right time points; this is discussed in more detail in the next section on survey incompletion.

A Chi-Square Goodness of Fit test was performed to determine whether the proportion of incomplete data between the assigned and customized conditions was equal between the two groups. Results indicate that the proportion of incomplete data did not differ by condition, $X^2 = (1, N = 82)$, $p = 0.157$, and the remaining sample was used for data analysis. A breakdown of the incompletion rates is shown in Table 1, and

[3] Preliminary inclusion criteria refer to the survey being marked complete by Qualtrics (80% completion rate) and participants identified as AAPI or White).

a breakdown of the sample size used for analysis can be found in Table 2. The "useable" column in Table 1 is further split into racial categories, AAPI and White, to provide a demographic breakdown in Table 2.

Table 1. *Sample size drop-out per condition and exclusion criteria.*

	Raw (exclusion criteria not applied)	**Race** (AAPI & White with responses marked complete by Qualtrics)	**Useable** (responses that include baseline)
Assigned	71	39	30
Customized	75	65	52

Table 2. *Sample size per condition used in analysis.*

	Assigned	**Customized**
AAPI	18	27
White	12	25

Survey Incompletion

Notably, more participants were removed from the assigned condition for incomplete data (n = 32, see Table 1)[4]. Incomplete data was marked as missing baseline or post-avatar surveys (n = 15, includes both conditions) or answering the wrong survey (n = 17, includes both conditions). One potential explanation for the drop-out rates could be boredom or lack of interest during the avatar assignment phase. As seen in figure 11, positive affect decreases over time in both the

[4] Note this value also includes non-AAPI, White, or mixed race (e.g. AAPI and White) identifying participants that were removed at this stage.

customization and assigned conditions; furthermore, this drop may be even more salient for those in the assigned condition who might have found themselves waiting for the next set of instructions to appear.

The positive affect scores of incomplete responses that were taken at the right time, post-exclusion and inclusion surveys, (confirmed with free response manipulation check that asked participants to describe the activity), were first compared to those that completed the assigned condition, and then compared to those that completed the customized condition.

Measures of positive affect from the post-exclusion and post-inclusion were compared with those who completed all surveys (M_{exc} = 14.2, SD_{exc} = 6.01; M_{inc} = 17.3, SD_{inc} = 9.63) and those who did not (M_{exc} = 15.8, SD_{exc} = 5.86; M_{inc} = 17.6, SD_{inc} = 7.25) in the assigned condition. There was no significant difference in positive affect scores at exclusion and inclusion (t_{exc} = 0.92, df_{exc} = 39, p_{exc} = 0.37; t_{inc} = 0.14, df_{inc} = 45, p_{inc} = 0.89) between complete and incomplete responses in the assigned condition.

Boredom was also explored with the individual PANAS item of "interest" between those that completed the surveys (M_{exc} = 1.87, SD_{exc} = 0.90; M_{inc} = 2.13, SD_{inc} = 0.90) and those that did not (M_{exc} = 1.79, SD_{exc} = 0.92; M_{inc} = 2.05, SD_{inc} = 0.90) in the assigned condition. There was no significant difference in interest scores at exclusion and inclusion (t_{exc} = -0.29, df_{exc} = 37, p_{exc} = 0.77; t_{inc} = -0.26, df_{inc} = 43.4, p_{inc} = 0.79) between complete and incomplete responses in the assigned condition.

The same comparison was run between incomplete responses in the assigned condition and completed responses in the customized condition. There was no

significant difference between the two groups at exclusion (t = 0.15, df = 29, p = 0.89) or inclusion (t = 0.59, df = 29, p = 0.56).

While the current analysis cannot explicitly evaluate whether participants were more bored in the assigned condition as compared to those in the customized condition, the fact that interest scores were relatively similar in both conditions for the exclusion and inclusion suggest the avatar assignment window felt too long for participants, which may explain why they skipped ahead. Other explanations for incompletion rates may be related to the drop in positive affect seen in both conditions. How this might relate to survey retention are further discussed in the limitations section of the next chapter.

Hypotheses testing

Customizing an avatar, as compared to being assigned an avatar, did not change peoples' affect. People who customized their avatar did not report significantly higher or lower positive *or* negative affect when compared to those who were assigned an avatar. However, significant changes in positive affect were found within groups (i.e., condition over timepoints) rather than between groups. Within each condition, both positive and negative affect did change over time. Furthermore, people that customized their avatar and were dissatisfied with the customization experience were more likely to report lower avatar identification. Finally, AAPIs were found to be less satisfied with their avatar customization experience than White participants. The following paragraphs will describe these findings within the context of hypothesis testing.

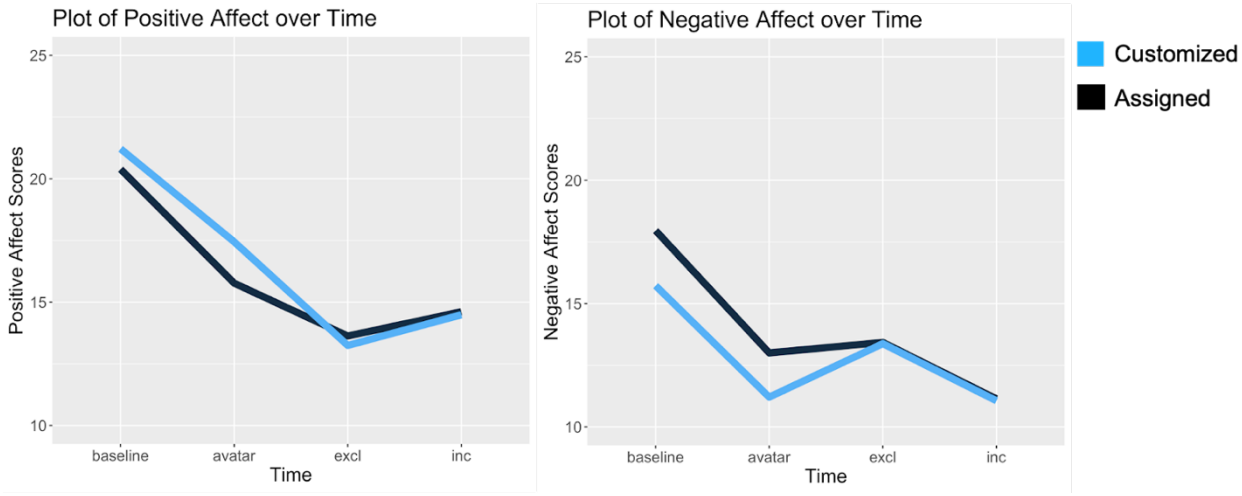


Figure 10. Changes in positive and negative affect over time per condition. The figure on the left shows the mean change in positive affect between four experimental time points (baseline, avatar, etc.) per condition (customized or assigned avatar). The figure on the right shows the mean change in negative affect between the time points. Note, the lowest possible total score for positive or negative affect at a given time is 10.

In *hypothesis 1*, a main effect of avatar customization on positive and negative affect was predicted, such that positive affect would increase, and negative affect would decrease after a participant customized their avatar when compared to the *assigned* condition. While avatar customization significantly predicted positive affect ($B = 4.04$, $t = 2.16$, $p = .05$), it did not predict negative affect ($B = -0.60$, $t = -0.42$, $p = 0.67$). Furthermore, the effect of avatar customization on positive affect was in the opposite direction of what was predicted in *hypothesis 1*.

Two pairwise t-tests with a Bonferroni correction to adjust for multiple comparisons were conducted to evaluate the significance of change in positive and negative affect scores between baseline and avatar time points for both conditions. Positive affect significantly decreased, instead of increased, after avatar customization ($M_{baseline} = 30.1$, $SD_{baseline} = 7.26$; $M_{avatar} = 22.7$, $SD_{avatar} = 9.30$; $t = 7.96$, $df = 51$, $p < .001$). Negative affect also significantly decreased, as predicted, after avatar customization

($M_{baseline}$= 19.8, $SD_{baseline}$= 8.95; M_{avatar}= 12.8, SD_{avatar}= 5.96; t = 6.21, df = 51, p < .001). In the *assigned* condition, both positive ($M_{baseline}$= 26.4, $SD_{baseline}$= 8.70; M_{avatar}= 19.1, SD_{avatar}= 9.66; t = 4.23, df = 29, p < .001) and negative affect ($M_{baseline}$= 20.3, $SD_{baseline}$= 7.40; M_{avatar}= 14.0, SD_{avatar}= 5.89; t = 5.60, df = 29, p < .001) significantly decreased after avatar assignment.

The difference in positive and negative affect scores between baseline and avatar assignment for each condition was computed into a change score per participant (i.e., positive affect score at baseline - positive affect score at avatar assignment). The difference in positive affect change scores between participants in the *customized* (M_{change_pos}= 8.08, SD_{change_pos}= 5.36) and *assigned* (M_{change_pos}= 8.97, SD_{change_pos}= 8.01) conditions were not statistically different (t = -0.54, df = 44, p = 0.59). Similarly, the difference in negative affect change scores between the *customized* (M_{change_neg}= 7.69, SD_{change_neg}= 7.38) and *assigned* conditions (M_{change_neg}=7.30, SD_{change_neg}= 4.89) were also not statistically significant (t = 0.29, df = 78, p = 0.77).

In summary, *hypothesis 1* was unsupported. Participants within each condition reported significantly lower positive and negative affect scores from baseline to avatar assignment. However, the change in these scores was not significantly different between conditions (i.e., the difference between baseline and avatar assignment was not greater in the customization condition as compared to the assigned condition).

In *hypothesis 2,* individuals satisfied with the avatar customization process were predicted to report greater positive affect and lower negative affect as compared to those dissatisfied with the avatar customization process. Answers to "*how satisfied were you with the ability to customize your avatar?*" were used to create a categorical

variable out of satisfaction responses (i.e., mean split at 3.5, where responses <3.5 were categorized as dissatisfied and responses >3.5 were categorized as satisfied). A linear model predicting customization satisfaction (see Table 8) with positive and negative affect after avatar customization was run to evaluate *hypothesis 2*. Customization satisfaction was predicted by positive affect (B = 0.04, t = 3.39, p = .001), but not negative affect (B = 0.01, t = 0.51, p = 0.62). Participants with higher customization satisfaction scores reported higher positive affect (M = 26.6, SD = 10.1*;* t = 3.59, df = 44*,* p < .001) as compared to those with lower satisfaction scores (M = 18.5, SD = 5.91). However, there was no relationship between negative affect and customization satisfaction. Therefore, participants with higher customization satisfaction scores did not report significantly lower negative affect scores (M = 13.3, SD = 6.64; t = 0.66, df = 49, p = 0.51) than those with lower customization satisfaction scores (M = 12.2, SD = 5.13).

Two models, each predicting positive and negative affect respectively (see Tables 3 and 5), were also used to evaluate *hypothesis 2*. Both models included customization satisfaction as a predictor of positive or negative affect. Customization satisfaction was found to be a strong predictor of positive affect (B = 4.71, t = 2.57, p < 0.01), but not negative affect (B = 1.14, t = -1.01, p = 0.31).

Pairwise comparisons with a Bonferroni correction between each time point indicate that individuals satisfied with their avatar customization experience reported higher positive affect at baseline ($M_{baseline}$ = 33.5*,* $SD_{baseline}$ = 6.27), after avatar customization (M_{avatar} = 26.6*,* SD_{avatar} = 10.1), after the exclusion (M_{exc} = 18.0*,* SD_{exc} = 10.6), and inclusion task (M_{inc} = 22.0*,* SD_{inc} = 11.4) as compared to their dissatisfied

counterparts ($M_{baseline}$ = 26.0, $SD_{baseline}$ = 6.23; M_{avatar} = 18.5, SD_{avatar} = 5.91; M_{exc} = 14.4, SD_{exc} = 6.32; M_{inc} = 16.5, SD_{inc} = 7.03). However, as in the previous model, negative affect scores did not significantly differ between satisfied and dissatisfied groups (B = 1.14, t = 0.89, p =0.31). Therefore, *hypotheses 2* is partially supported, such that higher satisfaction predicted higher positive affect scores, but lower customization satisfaction scores did not predict higher negative affect scores.

Hypothesis 3 predicted that White individuals would report higher PA, lower NA, and higher customization satisfaction as compared to AAPIs after customizing an avatar. *Hypothesis 3* was evaluated with the positive affect, negative affect, and satisfaction models (see Table 4, 6, and 8) and independent t-tests.

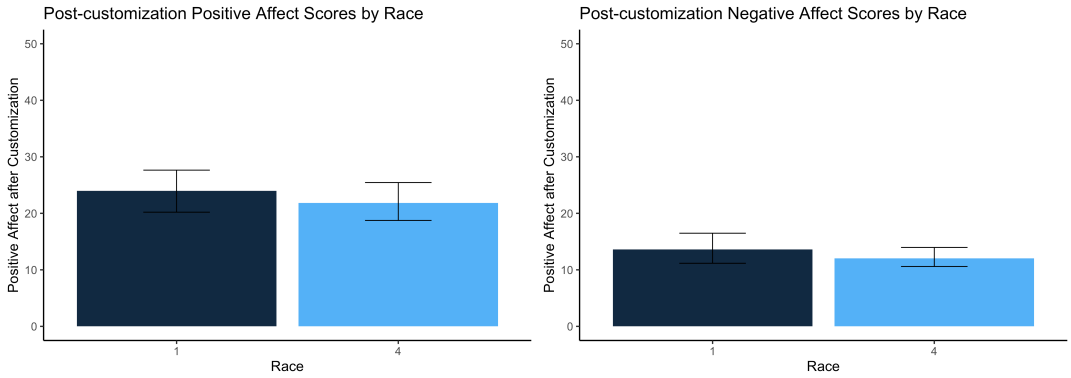


Figure 11. Post-customization affect scores by race. The bar chart on the left shows the means of positive affect scores in White (1) and AAPI (4) participants after avatar customization. The bar chart on the right shows the mean of negative affect scores after avatar customization. Note, the lowest possible total score for positive or negative affect at a given time is 10.

White participants (M = 24.0, SD = 9.76) did not report higher (t = 0.811, df = 49, p = 0.421; also see Fig 11) positive affect scores after avatar customization, as compared to AAPI participants (M = 21.9, SD = 8.91, see figure 11). Similarly, White

participants (M = 13.6; SD = 7.19) did not report lower negative affect scores (t = 0.93, df = 39, p = 0.36), as compared to AAPI participants (M = 12.0; SD = 4.54). However, a significant relationship between race (AAPI) and customization satisfaction was found in a model that predicted customization satisfaction (see Table 8). Race was found to be a predictor of customization satisfaction (B = -0.40, t = -3.71, p < .01), and AAPIs (M = 3.30, SD = 0.91) were more likely to report lower customization satisfaction scores (t = 1.87, df = 50, p = 0.07), as compared to White participants (M= 3.76, SD= 0.88, see figure 12).

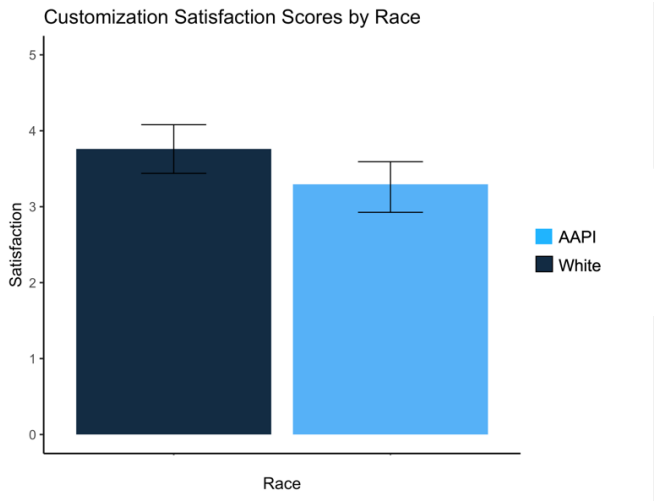


Figure 12. Customization satisfaction scores by race. The bar chart above shows the means of satisfaction with the avatar customization experience by race.

In summary, *hypothesis 3* was partially supported. While White participants did not have significantly higher positive affect or lower negative affect after avatar customization, White participants did report higher (trending) customization satisfaction scores as compared to AAPIs.

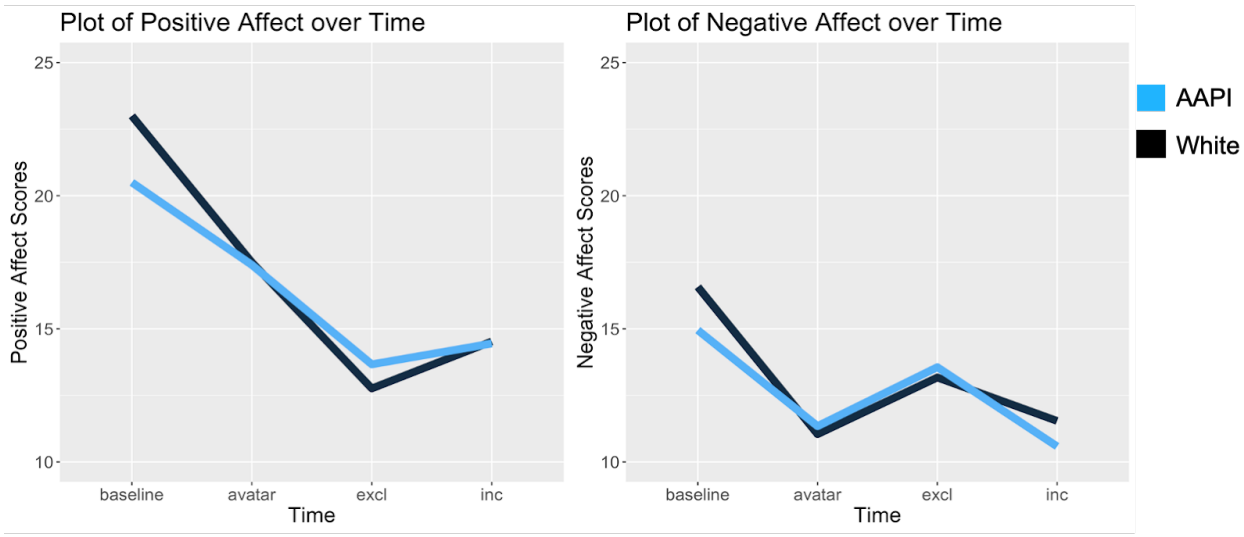


Figure 13. Changes in positive and negative affect, grouped by race. The figure on the left shows the mean change in positive affect between four experimental time points (baseline, avatar, etc.) grouped by race (AAPI or White). The figure on the right shows the mean change in negative affect between time points. Note, the lowest possible total score for positive or negative affect at a given time is 10.

In *hypothesis 4*, participants that customized their avatars, as opposed to those assigned an avatar, were predicted to report greater positive and lower negative affect after a social exclusion task. *Hypothesis 4* was evaluated with independent t-tests and models of positive (see Table 3) and negative affect (see Table 5) that compared for conditions.

Participants that customized their avatars (M = 19.4, SD = 9.92) did not report significantly higher positive affect scores (t = 0.96, df = 62, p = 0.34) as compared to those who were assigned an avatar after the social exclusion task (M = 17.3, SD = 9.63). Participants that customized their avatars (M =*12.2; SD* = 5.47) reported higher, rather than lower, negative affect scores (M = 11.7; SD = 7.50) when compared to those assigned an avatar after the social exclusion task, but the difference was not significant (t = 0.45, df = 66, p = 0.65). Change scores for positive (t = 0.80,

df = 55, *p* = 0.43) and negative (*t* = -1.05, *df* = 45, *p* = 0.30) affect scores were also non-significant.

Additional analysis found that positive affect significantly decreased (from time at avatar) after the exclusion task in both the *customized* condition (t_{paired} = 6.35, *df* = 51, $p < .005$; M_{avatar} = 22.9, SD_{avatar} = 9.30; M_{exc} = 16.3, SD_{exc} = 8.97) and *assigned* condition (M_{avatar} = 19.1, SD_{avatar} = 9.30; M_{exc} = 14.2, SD_{exc} = 8.97; t_{paired} = -3.28, *df* = 29, $p <$ .01). Negative affect significantly increased between the avatar assignment (*M* = 12.79, *SD* = 5.95) and exclusion (*M* = 14.71, *SD* = 5.65) in the *customized* condition (t_{paired} = -2.95, *df* = 51, $p < .05$). However, negative affect did not significantly increase after the exclusion task (M_{avatar} = 14.0, SD_{avatar} = 5.89; M_{exc} = 15.7, SD_{exc} = 7.50) in the *assigned* condition (t_{paired} = -1.29, *df* = 29, $p <$ .21).

In summary, these results indicate that *hypothesis 4* was not supported, as participants that customized their avatars did not report significantly higher positive or lower negative affect, when compared to those assigned an avatar.

In *hypothesis 5*, which tests the saliency effect, participants that customized their avatar were predicted to report lower positive affect, higher negative affect, and higher avatar identification after the social exclusion task, when compared to those assigned an avatar.

As reported in the findings for *hypothesis 4*, participants that customized their avatars reported higher positive affect scores (*M* = 19.4, *SD* = 9.92) as compared to those assigned an avatar (*M* = 17.3, *SD* = 9.63), but these differences were insignificant (*t* = 0.96, *df* = 62, *p* = 0.34). The same pattern followed for negative affect, where participants in the customized condition reported higher negative affect

(M =*12.2; SD* = 5.47) than those in the assigned condition (M = 11.7; SD = 7.50); however, these differences were also not statistically significant (t = 0.45*,* df = 66*,* p = 0.65).

Participants in the customized condition reported higher similarity (M= 16.7, SD = 5.63) and wishful identification (M = 11.3, SD = 4.88) as compared to those in the assigned condition (M_{sim} = 10.8*,* SD_{sim} = 5.45; M_{wish} = 8.8*,* SD_{wish} = 4.42); these differences were found to be statistically significant (t_{sim} = 4.65*,* df_{sim} = *62,* p_{sim} < .01; t_{wish} = 2.35, df_{wish} = 65.6, p_{wish} = 0.02). It is important to note that similarity and wishful identification were single measures taken after avatar creation or assignment.

In summary, *hypothesis 5* was partially supported in that participants in the customized condition reported significantly higher scores on similarity and wishful identification with their avatar as compared to those in the assigned condition. Similarly, participants reported higher negative affect after a social exclusion task if they customized their avatar, as compared to those assigned an avatar, however this difference was found to be insignificant. However, predictions on lower positive affect were unsupported, such that participants that customized their avatar reported higher positive affect (after a social exclusion task) than those who were assigned an avatar; further analyses revealed this was an insignificant difference.

In *hypothesis 6*, participants that were dissatisfied with the avatar customization process were predicted to report higher negative affect, lower positive affect, and lower avatar identification than those satisfied with the avatar customization process. To examine this hypothesis, affect after customization and exclusion were compared for dissatisfied and satisfied participants.

Participants that were dissatisfied with their customization experience did not report higher negative affect after customization (M = 12.2, SD = 5.13) or social exclusion (*M = 14.7, SD = 6.34*) when compared to participants that were satisfied with the customization experience (M = 13.3, SD = 6.64; t = 0.004, df = 44, $p > .05$). While those dissatisfied with the customization experience reported lower levels of positive affect (M = 14.4, SD = 6.32) as compared to those satisfied with the experience (M = 18.0, SD = 10.7), this difference was not found to be statistically significant (t = 1.53, df = 45, $p > .05$). Individuals dissatisfied with the customization experience did report lower similarity (M = 14.8, SD = 5.27) and wishful identification (M = 9.92, SD = 4.00) when compared to their satisfied counterparts (M_{sim} = 18.4, SD_{sim} = 5.47; M_{wish} = 12.4, SD_{wish} = 5.32); this difference was found to be statistically significant for similarity identification (t = 2.44, df = 49, p = .02) and trending for wishful identification (t = 1.94, df = 49, p = .06).

In summary, *hypothesis 6* was partially supported, such that individuals dissatisfied with their avatar customization experience reported lower levels of similarity (significant) and wishful identification (trending significance). However, individuals dissatisfied with their avatar customization experience did not report higher levels of negative affect and lower levels of positive affect. Rather, negative affect was similar for both groups, and those satisfied with the customization experience reported higher levels of positive affect (did not reach significance).

In *hypothesis 7*, which tests for the quasi-protective effects of limited identification, participants dissatisfied with their avatar customization experience were

predicted to report lower avatar identification, higher positive affect, and lower negative affect than those who felt satisfied.

Participants dissatisfied with the avatar customization experience reported lower levels of similarity and wishful identification when compared to their satisfied counterparts. As reported in *hypothesis 6's* findings, satisfied participants did report higher positive affect levels, but not lower negative affect levels when compared to their counterparts.

The remaining findings are for exploratory hypotheses which look into other predictors of positive and negative affect such as agency, overgeneralization, and an interaction between race and avatar identification.

In *hypothesis 8*, avatar customization satisfaction, agency, overgeneralization, and avatar identification were predicted to be strong predictors of positive and negative affect. Customization satisfaction ($B = 4.71$, $t = 2.57$, $p < .01$) and agency ($B_{PAX\text{-}1} = -6.67$, $t_{PAX\text{-}1} = -2.19$, $p_{PAX\text{-}1} < .05$; $B_{PAX\text{-}2} = 5.47$, $t_{PAX\text{-}2} = 1.75$, $p_{PAX\text{-}2} > .05$) were found to be predictors of positive affect (see Table 4). Overgeneralization was not added to the positive affect model as it is used as a measure for overgeneralizing negative thoughts about the self (Carver, 2013). Similarity identification ($B = -0.22$, $t = -0.81$, $p > .05$) did not predict positive affect. Customization satisfaction ($B = 1.14$, $t = 0.89$, $p > .05$), agency ($B_{PAX\text{-}1} = -2.94$, $t_{PAX\text{-}1} = -1.38$, $p_{PAX\text{-}1} > .05$; $B_{PAX\text{-}2} = 2.32$, $t_{PAX\text{-}2} = 1.05$, $p_{PAX\text{-}2} > .05$), overgeneralization ($B = 0.18$, $t = 0.37$, $p > .05$), and similarity identification ($B = 0.03$, $t = 0.16$, $p > .05$) were not found to be predictors of negative affect (see Table 6).

In *hypothesis 9*, which investigated the relationship between agency and customization, participants that customized their avatars were predicted to report higher levels of agency when compared to those assigned an avatar. Differences in agency were explored with independent and paired t-tests. Individuals in the customized condition reported higher levels of avatar related agency than those in the assigned condition after avatar assignment (M_{custom} = 7.83, SD_{custom} = 2.14; M_{assign} = 5.70, SD_{assign} = 2.58; t = 3.83, df = *52*, p < .001); these measures include "*this avatar does what I want*" (PAX1; M_{custom} = 3.75, SD_{custom} = 1.17; M_{assign} = 2.50, SD_{assign} = 1.38; t = 4.16, df = *52*, p < .001) and "*I control this avatar*" (PAX2; M_{custom} = 3.75, SD_{custom} = 1.17; M_{assign} = 2.50, SD_{assign} = 1.38; t = 2.89, df = *47*, p < .01). These differences continue after the exclusion task, where individuals in the customized condition reported higher (M_{custom} = 4.06, SD_{custom} = 0.94) levels of agency as compared to those in the assigned condition (M_{assign}= 3.27, SD_{assign} = 1.44; t = 2.70, df = 43, p < .01).

Differences between general feelings of control "*I am in control of my life*" (M_{custom} = 6.77, SD_{custom} = 1.84; M_{assign} = 5.79, SD_{assign} = 2.10) were also significant between conditions after a social exclusion task (t = 2.10, df = 52, p = .04). However, there were no significant differences between conditions after the inclusion task (M_{custom} = 7.20, SD_{custom} = 1.58; M_{assign} = 6.70, SD_{assign} = 1.93; t = 1.20, df = 52, p = .23). Finally, the change in general feelings of control were more significant in the customized condition (t_{paired} = -3.68, df = 51, p < 0.001) than in the assigned condition (t_{paired} = -1.80, df = 29, p = 0.08). Therefore, *hypothesis 9* was supported.

Finally, in *hypothesis 10,* it was predicted that White individuals who customized their avatars would report higher levels of avatar identification as

compared to their AAPI counterparts. However, no differences in the similarity or wishful identification scores of White (M_{sim} = 17.7, SD_{sim} = 6.04 ; M_{wish} = 12.4 , SD_{wish} = 5.32) and AAPI (M_{sim} = 15.8, SD_{sim} = 5.17; M_{wish} = 10.2, SD_{wish} = 4.25) individuals were found (t = 1.24, df = 47, p = 0.22 for similarity identification; t = 1.62, df = 46, p = 0.11 for wishful identification). Therefore, *hypothesis 10* was not supported.

Fixed factor and covariate selection for affect and satisfaction models

Most participants had video game experience (n = 75), with eight reporting daily gaming (i.e., gaming at least once a day), 16 reporting weekly gaming, 22 reporting monthly gaming, and 12 reporting yearly gaming. Most participants also reported having avatar customization experience (n = 94), out of which 29 reported having made a photorealistic avatar, 19 fantasy human or creature (e.g., World of Warcraft), 41 cartoon or anime, and five others (i.e., all of the above, Animal Crossing, Bitmoji). Avatar history was included in initial iterations of positive and negative affect models but was later removed as it was not a strong predictor of either variable.

The average BDI and GAD-7 scores in the *assigned* and *customized* conditions were moderate. Participants in the *assigned* condition reported moderate levels of anxiety (M_{anx} = 12.2, SD_{anx} = 5.37) as did participants in the *customized* condition (M_{anx} = 11.4, SD_{anx} = 5.27). BDI scores were also at moderate levels for the *assigned* (M_{BDI} = 32.3, SD_{BDI} = 11.3) and *customized* (M_{BDI} = 32.0, SD_{BDI} = 9.36) conditions respectively. BDI and GAD-7 were kept as covariates on positive and negative affect models due to

their known correlation with positive and negative affect (Tarlow & Haaga, 1996). However, they also proved to be weak predictors of positive and negative affect.

Other demographic factors such as age, body image concern, race, and gender were also evaluated as predictors of affect and included in all six models. Age, race, and body image concern were not found to be significant predictors of positive or negative affect (see Tables 3-6). However, gender was found to be a significant predictor of positive (B = 5.20, t = 3.13, p = 0.002) and negative affect (B = -4.45, t = -2.12, p = 0.04), but not for avatar identification or satisfaction.

Avatar-related agency was also included as a covariate for the second set of positive and negative affect models. Individuals that customized their avatars (M=7.46, SD=2.36) reported higher levels of avatar-related agency than those assigned an avatar (M=3.80, SD=3.40). The difference between the two groups was found to be significant (t = -6.9103, df = 102.14, p < .001), which is why they were separated for the second positive and negative affect models.

Checking and evaluating regression models

Before introducing the models, it is important to note that the correlation between predictors was checked with a *variance inflation factor* test for each model. Another important assumption of linear regression is that the predictors in the model do not correlate with each other (i.e., multicollinearity). Issues of multicollinearity can obfuscate the relationship between the outcome variable and predictors. To this end, the *mctest* package in R was used to examine variance inflation factors. The variance inflation factor never went above 1.5 for any given predictor. A variance inflation

factor above five is considered problematic (i.e., high chance of multicollinearity). Therefore, all variables for analyses could be included in the following models as they did not increase the risk of multicollinearity.

Once predictors were checked for multicollinearity, several models were created to predict positive and negative affect, avatar identification, and satisfaction with avatar customization. Models were compared using AIC criterion (Yu & Yau, 2012). The AIC criterion can help determine model quality by reporting the model that best explains sources of variance. AIC, like BIC, is known to penalize the addition of extra predictors (i.e., to avoid overfitting a model). However, AIC is recommended over BIC when a "true model" (for comparison) does not exist or is "too complex to model parametrically" (Vrieze, 2012). The models with the lowest AIC values, which is an estimation of prediction error, are reported below.

The following sections provide summarize each model of positive affect, negative affect, customization satisfaction, and avatar identification. Positive and negative affect have two models (Tables 3-4; Tables 5-6); the first model predicts positive affect between conditions (customization and assigned) and the second model predicts positive affect *within* the customization condition. The models reported below had the lowest AIC scores.

Positive Affect

Two mixed effects models were developed to examine the effects of condition (i.e., avatar customization or assignment) on positive affect. The first model (see Table 3) has condition, age, gender, and time as fixed effects and participant ID as a random

effect. This model also included an interaction term (i.e., an effect of condition and time as a significant predictor of positive affect) and had an AIC value of 2280 (*df* =12). Avatar customization significantly predicted positive affect (B = 4.04, t = 2.16, p = .05). Time at baseline (B = 7.48, t = 5.35, p < .001) and exclusion (B = -4.91, t = -3.70, p < .001) also predicted positive affect. However, time at inclusion did not predict positive affect (B = -2.14, t = -1.61, p = 0.11). There was no significant interaction effect found between condition and time at exclusion (B = -1.82, t = -1.01, p = 0.20) or inclusion (B = -1.57, t = -0.92, p = 0.36) in the same model. Age (B = 0.06, t = 0.13, p = 0.90) and gender (B = -0.50, t = -0.30, p = 0.77) were also not found to be predictors of positive affect.

Table 3. *Predictors of Positive Affect*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Positive affect						
Model:	Condition*time + age + gender						
Random Effect:	Participant	Intercept	41.8				
Fixed Effects:	Intercept			17.9	9.05	1.98	0.05
	Condition (customized)			4.04	1.87	2.16	*
	Age			0.06	0.43	0.13	0.90
	Gender (female)			-0.50	1.64	-0.30	0.77
	Time 1 (baseline)			7.48	1.40	5.35	***
	Time 3 (exclusion)			-4.91	1.33	-3.70	***
	Time 4 (inclusion)			-2.14	1.33	-1.61	0.11
	Custom*baseline			-0.26	1.76	-0.15	0.88
	Custom*exclusion			-1.82	1.71	-1.01	0.29
	Custom*inclusion			-1.57	1.71	-0.92	0.36

Notes. *** p < .001, ** p < .01, * p<.05
Number of obs: 342, groups: id, 93

The second model (see Table 4) builds upon the first, adding satisfaction with avatar customization, similarity identification, avatar-related agency, race, BDI scores, anxiety scores, and body satisfaction scores as predictors for positive affect. The independent variables were used as fixed effects in model 2; the random effect of participant was kept the same. The second model has an AIC score at 1002 (*df* = 15).

This model excluded the interaction term of condition and time to demonstrate the relationship between affect, customization, and demographic factors. In this model, avatar customization satisfaction (B = 4.71, t = 2.57, p < .01), agency ("this avatar does what I want") (B = -6.67, t = -2.19, p < .05), and time at baseline, exclusion, and inclusion were significant predictors of positive affect (see Table 4).

An exploratory mixed model was created to determine which specific positive affect items were driving changes in positive affect. Results from this model, which had time, condition, and three positive affect items as fixed effects, with a random effect of participant, can be found in the supplementary materials. In summary, changes in feeling enthusiastic (B = 1.93, t = 2.59, p < .01) and inspired (B = 3.09, t = 2.81, p < .01) were the strongest predictors of positive affect.

Table 4. *Predictors of Positive Affect in Avatar Customization*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Positive affect						
Model:	time + satis + av_agency1 + av_agency2 + race + gender + similarity_ident + bdi + gad7 + body_concern_impair						
Random Effect:	Participant	Intercept	48.3				
Fixed Effects:	Intercept			22.3	13.3	1.69	0.10
	Time 1 (baseline)			7.54	1.04	7.22	***
	Time 3 (exclusion)			-6.03	1.04	-5.77	***
	Time 4 (inclusion)			-3.28	1.04	-3.14	**
	Customization Satisfaction			4.71	1.83	2.57	**
	Avatar agency (PAX1)			-6.67	3.04	-2.19	*
	Avatar agency (PAX2)			5.47	3.12	1.75	0.09
	Race (AAPI)			-0.85	2.71	-0.313	0.76
	Gender (female)			-3.35	2.84	-1.18	0.25
	Similarity Identification			-0.22	0.27	-0.81	0.42
	BDI-II			-0.14	0.42	-0.35	0.73
	Anxiety (GAD-7)			-0.22	0.56	-0.40	0.69
	Body Dissatisfaction			0.13	1.38	0.09	0.92

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 156, groups: id, 39

Negative Affect

Two mixed effects models were developed to examine the effects of condition (i.e., avatar customization or assignment) on negative affect. The first model (see Table 5) had condition, age, gender, and time as fixed effects and subject as a random effect. This model also included an interaction term of condition and time (i.e., an effect of condition and time as a significant predictor of negative affect). The first model has an AIC value of 2445 (df =12). Time at baseline and inclusion were found to significantly predict negative affect. Specifically, time at baseline (B = 6.97, t = 5.72, $p < .000$) and time at inclusion task (B = -2.42, t = -2.10, $p < .05$) were significant predictors of negative affect. Finally, there was no significant interaction effect of time with condition (customization) was found (see Table 5).

Table 5. *Predictors of Negative Affect*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Negative affect						
Model:	Condition*time + age + gender						
Random Effect:	Participant	Intercept	17.1				
Fixed Effects:	Intercept			19.4	6.26	3.10	**
	Condition (custom)			-0.60	1.41	-0.42	0.67
	Age			-0.25	0.29	-0.84	0.41
	Gender			-1.14	1.13	-1.01	0.31
	Time 1 (baseline)			6.97	1.22	5.72	***
	Time 3 (exclusion)			1.27	1.15	1.08	0.28
	Time 4 (inclusion)			-2.42	1.15	-2.10	*
	Custom*baseline			0.08	1.54	0.05	0.96
	Custom*exclusion			0.78	1.49	0.52	0.60
	Custom*inclusion			1.85	1.49	1.24	0.22

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 342, groups: id, 93

The second model (see Table 6) builds upon the first, adding satisfaction with avatar customization, similarity identification, avatar-related agency, race, BDI scores, anxiety scores, overgeneralization, and body satisfaction scores as predictors for negative affect. The independent variables were used as fixed effects in model 2; the

random effect of participant was kept the same. The second model has an AIC score at 990 ($df = 16$). This model excluded the interaction term of condition and time to demonstrate the relationship between negative affect, customization, and demographic factors. Finally, overgeneralization was added to this model as an exploratory factor. In this model, only gender and time at baseline were found to be predictive of negative affect (see Table 6).

An exploratory mixed model was created to determine which specific negative affect items were driving changes in negative affect. Results from this model, which had time, condition, and three positive affect items as fixed effects, with a random effect of participant, can be found in the supplementary materials. In summary, changes in feeling scared ($B = 2.33$, $t = 6.01$, $p < .001$) or hostile ($B = 2.28$, $t = 4.36$, $p < .001$) were the strongest predictors of negative affect

Table 6. *Predictors of Negative Affect in Avatar Customization*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Negative affect						
Model:	time + cus_satis+ av_agency1 + av_gency2 + race + similarity_ident + bdi + gad7 + body_concern_impair + overgen						
Random Effect:	Participant	Intercept	20.31				
Fixed Effects:	Intercept			6.43	10.5	0.61	0.55
	Time (baseline)			7.28	1.08	6.74	***
	Time 3 (exclusion)			1.85	1.08	1.71	0.08
	Time 4 (inclusion)			-0.49	1.08	-0.451	0.60
	Customization Satisfaction			1.14	1.28	0.89	0.38
	Avatar agency (PAX1)			-2.94	2.13	-1.38	0.20
	Avatar agency (PAX2)			2.32	2.20	1.05	0.30
	Race			-1.68	1.90	-0.90	0.38
	Gender			-4.45	2.10	-2.12	*
	Similarity Identification			0.03	0.17	0.16	0.96
	BDI-II			0.15	0.22	0.71	0.92
	Anxiety (GAD-7)			-0.02	0.33	-0.05	0.71
	Body Dissatisfaction			1.36	0.93	1.47	0.08
	Overgeneralization			0.18	0.49	0.37	0.71

Notes. *** p < .000, ** p < .01, * p < .05,
Number of obs: 156, groups: id, 39

Avatar similarity identification

A mixed effects model of avatar similarity identification was developed to investigate how participants might think about self-similarity in the context of avatar customization. This model included fixed effects of self-resemblance, wishful identification, race, gender, BDI, and body dissatisfaction with a random effect of participant. The identification model has an AIC of -1658. Avatar similarity identification was predicted by self-resemblance, wishful identification, and race (see Table 7).

A frequency table of what features participants customized the most can be found in the supplementary materials (see Table 9).

Table 7. *Predictors of Avatar Similarity Identification in Avatar Customization*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Similarity identification						
Model:	Self-resemble + wishful_ident + race + gender + bdi + body dissatisfaction						
Random Effect:	Participant	Intercept	3.22				
Fixed Effects:	Intercept			8.09	1.94	4.18	***
	Self-resemblance (physical)			2.50	0.33	7.54	***
	Wishful identification			0.28	0.07	3.90	***
	Race (AAPI)			2.20	0.63	3.51	**
	Gender (Female)			0.05	0.70	0.07	0.95
	BDI-II			-0.06	0.04	-1.40	0.17
	Body Dissatisfaction			-0.38	0.34	-1.11	0.28

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 148, groups: id, 37

Satisfaction with avatar customization

A sixth, and final, linear mixed model was developed to better understand the predictors of satisfaction with avatar customization (henceforth satisfaction). The satisfaction model included fixed effects of self-resemblance, similarity identification, wishful identification, race, gender, BDI, and body dissatisfaction with a random effect of subject. The satisfaction model has an AIC value of -3190. Satisfaction with

avatar customization was predicted by wishful identification, race, and body dissatisfaction (see Table 8).

In a post hoc analysis, fixed effects of avatar-related agency were added to the satisfaction model in Table 8. In this model, satisfaction with avatar customization was significantly predicted by feelings of control over the avatar (B = 0.28, t = 1.98, p = .06; B = -0.34, t = -2.17, p <.05). Wishful identification (B = 0.07, t = 4.94, p = .06), race (B = -0.37, t = -3.24, p = .06), and body dissatisfaction (B = -0.15, t = -2.53, p = .06) were also predictors in this model.

Table 8. *Predictors of Customization Satisfaction*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Customization satisfaction						
Model:	similarity_ident + wishful_ident + race + gender + bdi + body dissatisfaction						
Random Effect:	Participant	Intercept	0.10				
Fixed Effects:	Intercept			3.41	0.34	10.2	***
	Similarity Identification			-0.01	0.01	-1.01	0.32
	Wishful Identification			0.08	0.01	6.23	***
	Race (AAPI)			-0.40	0.11	-3.71	**
	Gender (Female)			-0.01	0.11	-0.11	0.91
	BDI-II			-0.01	0.01	-1.10	0.28
	Body Dissatisfaction			-0.14	0.06	-2.33	*

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 156, groups: id, 39

Conclusion

Results from a study investigating the effects of avatar customization on positive and negative affect, identification, and customization satisfaction were presented in a series of hypothesis tests and through a description of linear models. Overall, avatar customization did not significantly change positive or negative affect when compared to those assigned an avatar. However, findings also indicate that while avatar customization improves feelings of agency, it also can drive differential customization satisfaction experiences for AAPIs.

The next and final chapter will discuss these results within the two predicted patterns of avatar customization effects (i.e., protective and saliency/intensification), the significance of avatar customization for marginalized groups, limitations with the current study, and future work.

CHAPTER 5

DISCUSSION

This study investigated the relationship between avatar customization and affect. More specifically, it examined several aspects of avatar customization, such as shared physical self-resemblance, avatar identification, and customization satisfaction, and how these experiences are related to positive and negative affect. The study also examined how individuals of different racial identities, AAPI and White, might identify with their avatar or experience customization satisfaction differently. In order to investigate these relationships, an online mixed-design study was conducted to analyze the effects of avatar customization on positive and negative affect, satisfaction, and identification. Participants were randomly assigned an avatar or told to customize an avatar for a series of three virtual tasks. After each task, participants completed a short survey about their experience, which included measures of positive and negative affect, customization satisfaction, and avatar identification. Several groups of participants were analyzed for the study. First, participants were split by condition (customized and assigned avatar). Second, participants were split by race (AAPI and White) for within subjects comparisons in the customized condition. The findings from this study are discussed below.

Avatar customization and affect

Positive and negative affect significantly decreased after avatar customization ($t_{pos} = 7.96$, $df_{pos} = 51$, $p_{pos} < .001$; $t_{neg} = 6.21$, $df_{neg} = 51$, $p_{neg} < .001$). Although avatar customization was predicted to be a positive experience in *hypothesis 1*, such that

feelings of agency or control over an outcome, would transfer to greater positive affect, this was not the case (Sundar & Marathe, 2010; Kalyanaraman & Sundar, 2006). Positive affect may have decreased because the customization experience did not encompass feelings of enthusiasm or inspiration, which were the main drivers of change in positive affect within this experiment (B_{enthus} = 1.93, t_{enthus} = 2.59, p_{enthus} < .01; B_{inspo} = 3.09, t_{inspo} = 2.81, p_{inspo} < .01). Although avatar customization may not be seen as a positive emotional experience that broadens and builds, these results do indicate that the experience of avatar customization can decrease negative affect (i.e., feeling scared or hostile) that maintains low mood states.

The insignificant change in positive affect could also be due to issues in measurement granularity. A more sensitive measure of affect may be needed to detect increases in positive and negative affect. The PANAS scale, which captured differences in positive and negative affect in this study, may not include the specific type of positive emotion(s) that avatar customization may elicit, such as contentment, creativity, and self-compassion. For example, the PANAS lacks the measurement of low arousal states, such as contentment, which could be more indicative of positive affect in the context of self-similar avatar creation (Diener et al., 2009). In another example, avatar customization can be seen as a chance to experience creativity (Harrell et al., 2017), which is also not measured by the PANAS. Finally, given the relationship between avatar customization, identification, and self-perception (Pimentel & Kalyanaraman, 2020), future research should also look into measuring emotionally positive self-attitudes, such as self-compassion, in the context of avatar

customization to better understand how self-avatar customization can influence positive affect (Neff, 2010).

Despite insignificant changes in positive affect, the significant decrease in negative affect in the customization condition may signal enjoyment (Wang et al., 2017). In a study with a similar pre and post design, participants that customized an ideal self and actual self avatar both reported lower negative affect, which the authors posit is due to the game (intervention) itself. However, unlike the current study, it is unclear as to whether the authors took the post positive and negative affect measurements after customization or after the game. Therefore, it may be that avatar customization itself lowers negative affect, especially when negative affect significantly increased after the social exclusion task.

Avatar customization intensifies affective experiences and promotes agency

Based on previous literature (Birk & Mandryk, 2019; 2016), I had predicted that there would be significant differences in positive and negative affect between conditions. One pattern, named the protective effect, predicted that avatar customization would act as a buffer against negative emotional experiences (i.e., social exclusion). In other words, individuals who customized their avatars would have higher positive affect and lower negative affect compared to those in the assigned condition, after a social exclusion task. However, it was found that the intensification or saliency effect was partially supported instead. This was evidenced by the significant increase in negative affect in the *customized* (t_{paired} = -2.95, df = 51, $p < .05$) condition, but not in the *assigned* (t_{paired} = -1.29, df = 29, $p < .21$) condition

While not the focus of this study, it is important to note that the Cyberball exclusion and inclusion paradigms did significantly impact positive and negative affect regardless of condition. Results from this study support previous research that claims the Cyberball paradigm is an effective paradigm for imbuing feelings of social exclusion and inclusion that impact positive and negative affect. Furthermore, the current findings are consistent with previous studies that have found avatar customization increases the intensity of a social experience (Dechant et al., 2021).

Positive and negative affect only differed *within* each condition, and not between conditions at each time point (see fig 10, chapter 4). However, differences between conditions may have reached significance if the study had more power (i.e., a larger sample size); this is particularly evident in affect score measures right after avatar customization or assignment (see figure 10).

The lack of significant differences in positive and negative affect between conditions does not imply there are no important differences between each condition. For example, an independent t-test which compared changes in avatar related agency ("*this avatar does what I want*"; "*I control this avatar*") found that participants in the customized condition reported higher levels of agency when compared to those in the control condition. Furthermore, agency ("*this avatar does what I want*") was found to be a predictor of positive affect (see Table 5; $B = -6.67$, $t = -2.19$, $p < .05$). Similarly, the change in a general feeling of control was more significant in the customized condition ($t_{\text{paired}} = -3.68$, $df = 51$, $p < 0.001$). In fact, a study by Kao found that avatar identification improved needs satisfaction (i.e., the player experience of need

satisfaction, that includes needs for autonomy, competence, relatedness, etc), which suggests a nuanced relationship between avatar identification, satisfaction, and affect.

Recent discourse in the field suggests a theoretical link between affective processing and sense of agency (Kaiser et al., 2021). Future research would benefit from differentiating the type of agentic experiences that can occur in a virtual experience and examining its relationship with positive and negative affect. It may be that avatar customization allows for feelings of choice (with avatar customization) and outcome agency (the customized avatar), whereas the Cyberball games only affect outcome agency (ball passing).

Identification and Affect

Similarity identification did not predict positive or negative affect, which was predicted by *hypothesis 4*. This finding partially differs from previous research on similarity identification and affect. Birk and Mandryk (2016) found that similarity identification predicted positive affect, but not negative affect. However, the authors also found that wishful identification predicted positive affect, but this was not supported by the current findings. This may be because the customization interface Birk and Mandryk (2016) included character attributes, such as "*stamina, willpower, and intelligence*" and personality traits, such as "*I see my avatar as someone that is sociable*" (which participants rated on a five-point Likert scale). Therefore, the focus on shared physical resemblance between avatar and participant (instead of attributes) in the current study may explain why similarity and wishful identification were not predictive of positive affect.

While there was no significant relationship between similarity identification and affect, similarity identification was predicted by self-resemblance, wishful identification, and race. Self-resemblance and race as predictors of similarity identification complement existing literature due to them being salient identity cues that participants often consider presenting in virtual environments (Lee and Park, 2011; Lee, 2014). However, the relationship between similarity and wishful identification is perplexing, as the two are considered independent factors (Van Looy et al., 2012**)**. Wishful identification is often conceptualized as an avatar being dissimilar from one's self concept, but also being desirable (i.e., the ought or aspirational self).

However, if the aspirational self is viewed as part of one's broader self-concept, then wishful identification as a predictor of similarity identification also makes sense as similarity identification includes questions such as, "*my avatar is an extension of myself*" or "*my avatar is like me in many ways*." These statements may encapsulate the aspirational self, which can be interpreted as another form of similarity identification (Hoffner & Buchanan, 2005).

Satisfaction with avatar customization and affect

This study developed the construct of avatar customization satisfaction as a way of differentiating affect related to avatar identification from the experience of choice (with avatar customization). In a linear mixed model that predicted satisfaction with avatar customization, wishful identification, race, and body dissatisfaction were the strongest predictors of satisfaction scores. Participants with higher wishful

identification scores also reported higher satisfaction scores. However, AAPIs had slightly lower satisfaction scores when compared to their White counterparts (B = -0.40, t = -3.71, p < .01). A follow-up t-test to compare the means between groups found this difference was trending in significance (t = -1.87, df = 49, p = 0.07). Similarly, body dissatisfaction was also trending in significance as a predictor (B = -0.14, t = -2.23, p < .05).

If satisfaction was related to physical resemblance, then self-similarity and self-resemblance would have been significant predictors of satisfaction. However, this might also suggest differences in expectations of shared avatar and self-resemblance that could be explained by avatar history. For example, differences in avatar history (i.e., experience creating avatars) might influence satisfaction scores, such that those without previous avatar customization experience will report lower satisfaction due to limited experience (see Table 11 in supplementary material). Such differences in avatar customization history might also explain the trending differences in AAPI and White satisfaction scores.

A trend in which individuals with lower body dissatisfaction scores (of their own body, not their avatar's body) reported higher avatar customization satisfaction scores was also found. Such findings make sense in that individuals with lower body dissatisfaction scores would be less concerned or preoccupied with their avatar's body. Therefore, this finding serves as a preliminary confirmation that one's own body perception can influence how they perceive avatar customization satisfaction.

This finding also confirms the importance of body perception when building a self-avatar. Individuals that are more concerned with their bodily appearance or are

prone to have more body dissatisfaction (e.g., individuals with depression or body dysmorphia) might be at greater risk of experiencing negative affect with an avatar customization experience. Conversely, the experience of controlling one's body image might also be satisfying. However, future research should consider how individuals with body image concerns (dissatisfaction) are affected by avatar customization experiences.

Satisfaction with avatar customization was also found to be a significant predictor of positive affect, but not negative affect. These findings make sense in light of the previous discussion of the PANAS measurement. Satisfaction with the avatar customization experience may be more similar to the positive affect scale because both require participants to report hedonic states (e.g., pleasurable emotions). Furthermore, dissatisfaction might not be associated with negative affect, in that it is a low arousal negative experience rather than a high one (e.g., feeling hostile).

Race-based differences in affect and customization satisfaction

Previous research indicated that AAPIs with self-similar avatars (photogenerated by research assistants) had lower self-presence ratings than their White counterparts (Sun et al., 2018). An interview study on avatar customization experiences, from the same research group, found that AAPI individuals engaged in race minimizing strategies when creating an avatar for a job interview to reduce stereotype threat (Pandita et al., 2021). In this study, *hypotheses 3* and *10* investigated the effects of poor representation by predicting differences in positive and negative affect, similarity identification, and customization satisfaction between AAPI and

White individuals. Findings indicate that AAPI participants had no differences in positive or negative affect, and similarity identification. However, AAPI participants reported lower customization satisfaction scores than White participants ($t = 1.87$, $df = 50$, $p = 0.07$).

The finding of lower satisfaction scores, or greater dissatisfaction with the avatar customization process, captures the importance of evaluating the impact of a poor avatar customization experience. Although AAPI and White participants did not differ in the amount they identified with their avatar (i.e., similarity or wishful identification), measuring dissatisfaction provides evidence that participants are discontent with the process.

It is important to note that customization dissatisfaction was not only associated with race; people who were dissatisfied with the customization process (which included both AAPI and White participants), were also more likely to report lower similarity and wishful identification with their avatar. Although the study design cannot test for longitudinal implications, it provides a starting point for capturing negative avatar customization experiences that underrepresented groups (i.e., racial minorities, overweight, older adults) face when trying to use tools, or in this case access virtual worlds, that were not designed for their representational needs.

Broaden and Build theory

The *broaden and build theory* posits that positive emotions, such as joy and interest, can expand our "momentary thought-action repertoires" (Fredrickson, 2001). The theory presumes that the experience of persistent negative emotions, bereft of

positive emotions, limit a person's thought-action repertoire (i.e., mindset) (Fredrickson, 2004). This narrowing of options then promotes the selection of maladaptive thought processes (e.g., cognitive distortions, rumination) that can keep people stuck in low mood states (i.e., narrow mindsets associated with poor emotional well-being) (Velten et al., 2021; Vanderlind et al., 2020; Faulk et al., 2013). The *broaden and build theory* proposes that by engaging in more positive emotional experiences, a person's thought-action repertoire expands. This expansion (or *broadening*) means that there are more adaptive cognitive strategies and actions to choose from. As a person engages in more activities, they *build* more personal resources (e.g., social and psychological) which can promote emotional well-being. This process ultimately leads to a person developing a "broadened mindset" and the experience of "spiraling upward."

The broadened mindset is often achieved through play or exploration (or similar activities). Positive emotions such as interest or curiosity are associated with play and exploration (Gallagher & Lopez, 2007). It is through these initial positive emotions that individuals can continue to engage in "discovery of novel and creative actions, ideas, and social bonds" (Fredrickson, 2004). These discoveries help *build* a person's psychosocial resources (and reserves), which are critical in maintaining emotional well-being (i.e., coping in stressful situations). In summary, if we use the spotlight analogy for visual attention (Treisman, 1982), positive emotional experiences help to *broaden* our mind's spotlight and allow us to discover and *build* psychosocial resources for emotional coping (e.g., Fig. 4).

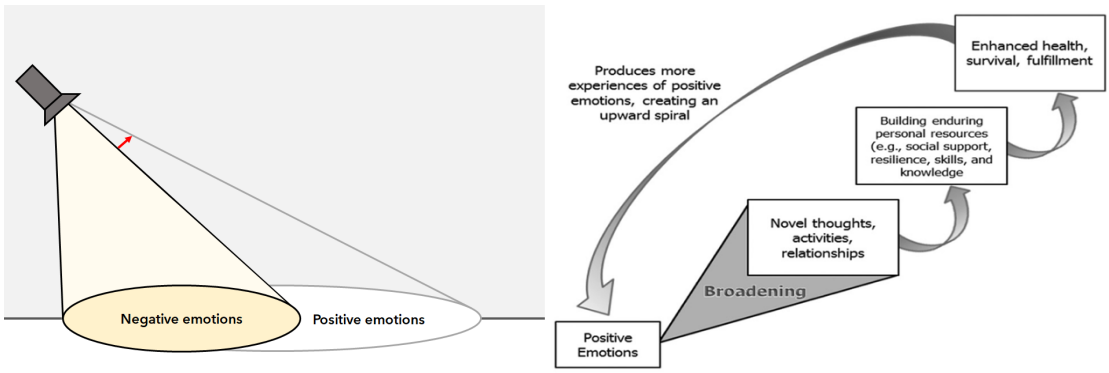


Figure 14. The broaden and build theory. The *broaden and build theory* presumes that negative emotions limit one's attentional scope (or spotlight). However, experiencing positive emotions can help broaden one's attentional scope (as demonstrated by the red arrow) and allow a person to obtain more resources to improve (or maintain) their emotional well-being. Broadening one's scope does not mean getting rid of negative emotions, but rather make room for the experience of positive emotions that can help individuals cope with negative emotions (as seen in the schematic on the right, from Cohn & Fredrickson, 2010).

Positive emotions are said to have an "undoing effect" in the face of negative stressors. Fredrickson and colleagues found that participants who viewed movie clips that induced positive emotions of contentment and amusement, respectively, recovered faster from a speech preparation task, used to induce cardiovascular anxiety, than those who viewed sad or neutral film clips (2000). Furthermore, the findings suggest the undoing effect of contentment and amusement is a universal phenomenon; the study found that these findings held true for group comparisons between men and women, and European and African Americans. Such research has led to further testing of positive emotions' undoing effect **(**Cohn & Fredrickson, 2010; Tugade et al., 2004; Ong & Allaire, 2005**).**

Gaming experiences are designed to include positive emotional experiences such as interest and engagement **(**Trepte & Reinecke, 2010). These experiences share similar features to Cohn and Fredrickson's conceptualization of *interest*, which is described as "[a] sense of possibility or mystery, fascination, feeling open and alive"

and is followed by exploration (2010). Similarly, many interactions are evaluated by user satisfaction, which parallels *contentment* or a feeling that everything is alright (Cohn & Fredrickson, 2010). For example, Kang and Watt found that participants with anthropomorphic avatars were more likely to report higher communication satisfaction (2013). In other words, avatar-based experiences can contain positive emotional experiences that abate negative emotional experiences. Furthermore, self-avatars may serve as more powerful mediums due to their capacity to enhance self-relevance.

Avatar customization is a prominent way in which games can foster positive emotions. Customizing one's avatar can also be an agentic experience and have direct implications for health outcomes (Kim, 2010; Marathe & Sundar, 2011; Sundar, 2008). However, interest and satisfaction are often driven by a user's preferences. In order to help practitioners evaluate the implications of avatars in their work, I have put together a set of design considerations for customized or personalized avatar use.

Design considerations for avatars in virtual health experiences

When using self-similar avatars for avatar-based health interventions, practitioners may consider the following principles related to feasibility and scale.

First, consider the duration of your avatar-based experience. Is it a one-time exposure (e.g., use as needed), or will it be part of a series of experiences (e.g., exposure therapies)? If it is a multi-series experience, how much time will occur between each experience?

Avatar customization is well-known for improving avatar identification. Previous work has found that playing with an avatar over an extended period (i.e., weeks or months) can also improve avatar identification (Turkay & Kinzer, 2014). However, depending on the duration of the experience, customizing a self-similar avatar may be a more efficient way to improve identification. For example, in this study, participants had significantly greater avatar identification when they customized their avatar for five minutes or less.

Second, consider what aspects of the self you want the patient (or participant) to access during the study.

Although participants assigned an avatar did not differ in their change in affect, as compared to those in the customized condition, during the social exclusion and inclusion tasks, it is important to note that they did differ in their level of identification with the avatar. Participants assigned an avatar reported lower levels of self-similar and wishful identification when compared to those who customized their avatar. Embodied identification will be particularly important for those designing more physically interactive avatar-based mental health experiences.

Third, if participants need to make self-similar avatars, customization interfaces need more racially representative options that are easily accessible. (This is not to be conflated with offering more customization options for body features.)

People of color are often underrepresented in avatar customization interfaces (Pandita et al., 2021; McArthur et al., 2015; Kafai et al., 2010). While this may not directly affect avatar identification, it can affect perceptions of what identities can be created in a space (Kafai et al., 2010; Lee et al., 2014). Furthermore, my results show

that AAPIs were more dissatisfied with the customization process, in part because there were no Asian base templates available. Race-based differences in customization satisfaction suggest that the customization experience is not an equally as satisfying experience for marginalized groups.

Fourth, offer more options for larger social identity cues, such as hair style, color, and clothing.

In the supplementary analysis, participants felt most limited by the hair style, hair color, and clothing options. Offering broader choices, rather than micro-level choices (e.g., changing the size of an avatar's nose bridge) and more racially diverse templates can offload the burden of creating a self-similar avatar on marginalized groups.

Fifth, take body image, and other conditions that might affect body image, into account.

How a person perceives their body may affect how they think about their avatar representation. Participants with higher body dissatisfaction scores were more likely to report lower customization satisfaction scores. Mental health conditions, such as depression, can also affect how a person perceives their body. For example, individuals diagnosed with depression are more likely to report body image disturbances (Paxton et al., 2006).

Considering these factors will help practitioners evaluate their motivations for and assumptions regarding avatar use, identify the patient's perspective on avatar-use, and its implications for the virtual health experience. In the next section I will discuss the limitations of the current work.

Limitations

There were several limitations in this study related to the materials and study design. First, the use of the UMA character creation tool as the customization interface limited the use of racially diverse avatars. The base version of the UMA character creation tool came with two humanoid characters that presented as a White male and female, respectively (see Figure 13).

Figure 15. o3n Male and Female Races. Promotional photo for free UMA races on Unity Engine's asset store.

Although a third-party avatar template (asset) was available for purchase, the template name was not readily modifiable (e.g., participant would see an option for "o3n_MaleBrown" instead of a more neutral name "Template Male A"). This meant an extensive amount of time would be spent re-scripting the whole environment, and while this was attempted by the first author, it had to be abandoned due to limited capacity (two-person development team). Furthermore, using the unmodified template names would have introduced bias (see previous example) that could prime participants behavior or clue them into the purpose of the study. Finally, it is also

important to note that the best available asset pack at the time (o3n characters) only offered two adult "brown" characters that were modified from the original UMA male and female avatars, which were based on White humanoid models. These factors not only demonstrate how difficult it is to achieve equitable racial representation in self-similar avatars but also perfectly set the stage for the current study.

Another limitation with the study is that avatars in the customization condition were not randomly generated. In other words, participants always saw "HumanMale" first. Avatars in the customized condition were not randomized because we wanted all participants to start from the same base model in order to make comparisons about the customization experience. Future work with a much larger sample size might look into creating a change score between the ground truth base template and a randomly assigned (customizable) template to test for template order effects.

Other concerns with ordering may be that the task order remained the same in each trial. This is because we did not want some participants to end with the social exclusion task, which would result in a higher negative affect state. Therefore, the inclusion task was strategically placed as the last task to ensure an increase that would get the participant within the range of their baseline affective state (or a more positive state overall). In addition to this concern, the task order was kept consistent to allow for equal comparisons with individuals in the assigned condition. This was done to test the robustness of the hypothesized protective and intensification effects.

Internet access might have been another limiting factor for participants that did have access to high-speed internet (e.g., quarantining at their residence and unable to use high speed internet available on campus). Participants needed a high-speed

internet connection to load the environments quickly (≤ 3 minutes). However, participants in rural or remote locations with moderately high-speed internet would need at least 10 minutes for the environments to load. While this discrepancy was accommodated by building in the load time into the survey, such that participants were instructed to read through the consent form while loading the environment in the background, it is unclear as to how many participants were affected by loading times (there were no reports of slow loading time of those that completed the experiment, nor was the first author contacted by participants to help with troubleshoot loading the environments). However, access difficulties may partially explain why participants in both conditions had (although predominantly the assigned condition) answered surveys at the wrong time point and had to be dropped from analysis.

Finally, since this experiment did not target upregulating or down regulating specific positive and negative emotions, future work should incorporate such measures. Empirical work by Fredrickson and Branigan (2005) suggests that amusement and contentment should be evaluated for positive emotions and anger and anxiety for negative emotions. However, what the current work does provide is evidence that avatar customization can influence positive and negative emotions and provides justification for further investigation.

Conclusion: Implications & Future Work

Avatar-based interventions are an effective way to treat physical and mental health concerns. Scholars have found that avatar identification plays a crucial role in intervention efficacy and has led to the discovery of various identification forms (i.e.,

similar, wishful, embodied) while highlighting the importance of avatar customization in health interventions. However, little work has explored the effects of avatar customization outside of increasing identification. In other words, *how might avatar customization be helpful and/or harmful, and to who?*

The current study sought to answer these aims and examined the relationship between avatar customization, avatar identification, and satisfaction with positive and negative affect. Results suggest that avatar customization can lower negative affect, although the effect is not robust enough to protect individuals from virtual harm (i.e., social exclusion task). Furthermore, satisfaction with the customization of a self-similar avatar may be dependent on an individual's racial identity and whether an avatar of the same race is readily available to them. However, future research with a sample that includes a well-powered and broader racial demographic will be needed to increase generalizability.

Subsequent research should continue to explore how gaming mechanisms like avatar customization can imbue positive emotions that work to broaden and build a person's thought-action repertoire. Therefore, feasible next steps in this line of research include incorporating the measurement of low arousal positive affect, such as contentment or creativity.

Future research should also investigate the processes that drive avatar customization and its relationship with avatar identification and affect. For example, a moderated mediation analysis where affect is predicted by avatar customization, which is mediated by customization satisfaction, and the relationship between customization and satisfaction is moderated by identity (i.e., race; see Fig. 14). Second, the current

data set has not been fully analyzed for its contextual information. For example, future work can explore the relationship between perceived limitations in customization and satisfaction scores. Other important information to obtain from this dataset includes perceptions of racial diversity during childhood and how these perceptions may influence customization satisfaction and customization outcomes (i.e., what features were (de)prioritized for customized).

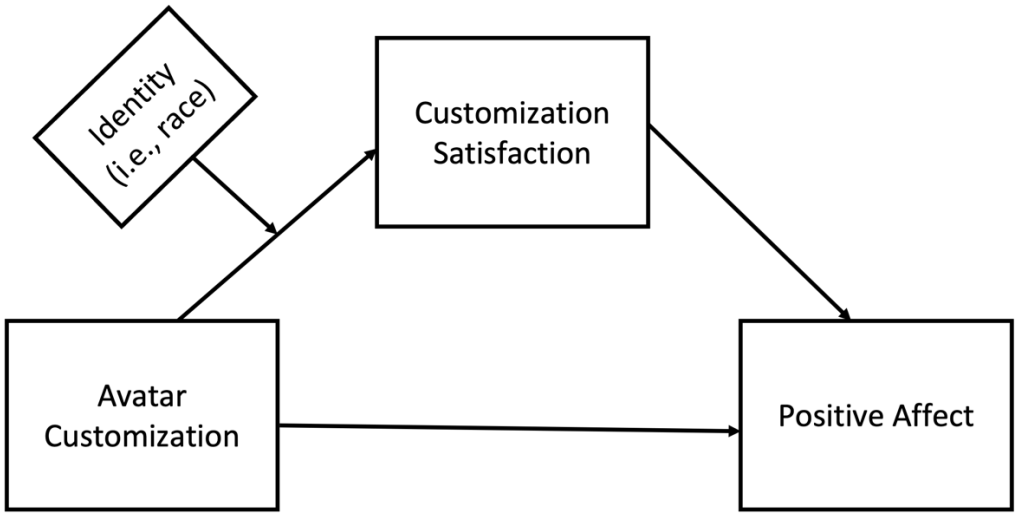


Figure 16. Moderated mediation analysis. A schematic of a future moderated mediation analysis in which affect (positive or negative) is predicted by avatar customization, where the relationship between customization and affect is mediated by customization satisfaction, and customization and customization are moderated by social identity (i.e., race).

Creating "anxiety avatars" or avatars that embody or represent a person's anxiety have been shown to reduce state anxiety (Pimentel & Kalyanaraman, 2020). However, research on the long-term effects of self-avatar identification for emotional well-being is still in its nascency. The current dataset also collected mental health history information (voluntarily reported) and brief cope scores. Forthcoming work will explore associations between mental health history, coping mechanisms, avatar customization, and avatar identification to help evaluate the efficacy of such

interventions for individuals with varying self-perceptions (that could affect the way in which they see their avatar as an extension of self).

APPENDIX A: ADDITIONAL ANALYSES

This appendix contains supplementary tables for the analysis of results in chapter 4. Table 9 refers to the customized avatar features, tables 10 and 11 refer to the additional models run for identifying scale items that predicted positive and negative affect, and table 12 is an exploratory model of customization satisfaction that includes avatar-related agency.

Table 9. *Customized avatar features*

Item	***N* = 126**
Hair style	66 (52%)
Hair color	50 (40%)
Eye Shape	7 (6%)
Eye Color	41 (33%)
Skin Color	42 (33%)
Facial Hair	9 (7%)
Clothing	6 (5%)
Accessories (e.g., glasses, shoes, headwear)	14 (11%)
Gender	54 (43%)
Other	3 (2%)

Customization priorities

Hair style, hair color, eye color, and gender were the most customized aspects of participant avatars (see Table 7). Participants felt most limited by clothing (n=25, M=2.23, SD=1.26).

Table 10. *Predictors of Positive Affect (Individual Scale Items)*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Positive affect						
Model:	Condition + time + enthusiastic + inspired						
Random Effect:	Participant	Intercept	17.1				
Fixed Effects:	Intercept			19.4	6.26	3.10	**
	Condition (custom)			-0.60	1.41	-0.42	0.67
	Enthusiastic			-0.25	0.29	-0.84	0.41
	Inspired			-1.14	1.13	-1.01	0.31
	Time 1 (baseline)			6.97	1.22	5.72	***
	Time 3 (exclusion)			1.27	1.15	1.08	0.28
	Time 4 (inclusion)			-2.42	1.15	-2.10	*

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 342, groups: id, 93

Table 11. *Predictors of Negative Affect (Individual Scale Items)*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Negative affect						
Model:	Condition + time + scared + hostile						
Random Effect:	Participant	Intercept	17.1				
Fixed Effects:	Intercept			19.4	6.26	3.10	**
	Condition (custom)			-0.60	1.41	-0.42	0.67
	Scared			-0.25	0.29	-0.84	0.41
	Hostile			-1.14	1.13	-1.01	0.31
	Time 1 (baseline)			6.97	1.22	5.72	***
	Time 3 (exclusion)			1.27	1.15	1.08	0.28
	Time 4 (inclusion)			-2.42	1.15	-2.10	*

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 342, groups: id, 93

Table 12. *Predictors of Customization Satisfaction (Model 2)*

			s^2	*b*	*SE*	*t*	*p*
Outcome:	Customization satisfaction						
Model:	similarity_ident + wishful_ident + race + gender + av_history + bdi + body dissatisfaction						
Random Effect:	Participant	Intercept	0.74				
Fixed Effects:	Intercept			3.99	0.30	13.2	***
	Similarity Identification			-0.02	0.01	-1.51	0.14
	Wishful Identification			0.06	0.01	5.47	***
	Race (AAPI)			-0.40	0.11	-4.21	**
	Gender (Female)			-0.27	0.11	-2.65	0.12
	Avatar history			-2.20	0.31	-7.14	***
	BDI-II			-0.02	0.01	-2.77	**
	Body Dissatisfaction			-0.04	0.05	-0.71	0.48

Notes. *** p < .000, ** p < .01, * p<.05
Number of obs: 156, groups: id, 39

APPENDIX B: SURVEY ITEMS

The Brief Cope identifies various coping activities people use during periods of stress. The measure was developed for patients dealing with chronic illness and has been widely adapted for various chronic conditions. Participants rate the following statements based on how much or little they have used the listed coping strategy (1= I haven't been doing this at all; I've been doing this a lot).

1. I've been turning to work or other activities to take my mind off things.
2. I've been concentrating my efforts on doing something about the situation I'm in.
3. I've been saying to myself "this isn't real.".
4. I've been using alcohol or other drugs to make myself feel better.
5. I've been getting emotional support from others.
6. I've been giving up trying to deal with it.
7. I've been taking action to try to make the situation better.
8. I've been refusing to believe that it has happened.
9. I've been saying things to let my unpleasant feelings escape.
10. I've been getting help and advice from other people.
11. I've been using alcohol or other drugs to help me get through it.
12. I've been trying to see it in a different light, to make it seem more positive.
13. I've been criticizing myself.
14. I've been trying to come up with a strategy about what to do.
15. I've been getting comfort and understanding from someone.
16. I've been giving up the attempt to cope.
17. I've been looking for something good in what is happening.
18. I've been making jokes about it.
19. I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.
20. I've been accepting the reality of the fact that it has happened.
21. I've been expressing my negative feelings.
22. I've been trying to find comfort in my religion or spiritual beliefs.
23. I've been trying to get advice or help from other people about what to do.
24. I've been learning to live with it.
25. I've been thinking hard about what steps to take.
26. I've been blaming myself for things that happened.
27. I've been praying or meditating.
28. I've been making fun of the situation.

The Generalized Anxiety Disorder Questionnaire (GAD-7) was used to measure anxiety, and often co-occurs with depressive symptoms. The questionnaire asks participants to rate (0= not at all; 3 = nearly every day) seven statements with the following prompt: "Over the last 2 weeks, how often have you been bothered by any of the following problems?"

1. Feeling nervous, anxious or on edge?
2. Not being able to stop or control worrying?
3. Worrying too much about different things?
4. Trouble relaxing?
5. Being so restless that it is hard to sit still?
6. Becoming easily annoyed or irritable?
7. Feeling afraid as if something awful might happen?

The Beck Depression Inventory (BDI-II) measures depression symptom severity in the past two-weeks, including today (0=none; 3=extremely). Participants were instructed to read each group of statements and then pick out the one that describes them the best:

1. Sadness
    a. I do not feel sad.
    b. I feel sad much of the time.
    c. I am sad all the time.
    d. I am so sad or unhappy I can't stand it.
2. Pessimism
3. Past Failure
4. Loss of Pleasure
5. Guilty Feelings
6. Punishment Feelings
7. Self-dislike
8. Self-criticalness
9. Suicidal thoughts or wishes
10. Crying
11. Agitation
12. Loss of Interest
13. Indecisiveness
14. Worthlessness
15. Loss of energy
16. Changes in sleeping pattern
17. Irritability
18. Changes in appetite
19. Concentration Difficulty
20. Tiredness or Fatigue
21. Loss of Interest of Sex

The Positive and Negative Affect Scale (PANAS) was used as a repeated measure (Watson, Clark, & Tellegen 1988). The first instance of the PANAS will serve as a baseline, asking participants to rate their affect over the past few *hours*. Subsequent measures will occur after viewing the virtual environment (meeting avatar, exclusion, inclusion), in which the unit of measurement will change to *minutes*. The question will be phrased as follows: "Indicate the extent you have felt this way over the past few hours/minutes (1= Very slightly, not at all; 5 = Extremely)."

1. Interested
2. Distressed
3. Excited
4. Upset
5. Strong
6. Guilty
7. Scared
8. Hostile
9. Enthusiastic
10. Proud
11. Irritable
12. Ashamed
13. Inspired
14. Nervous
15. Determined
16. Attentive
17. Jittery
18. Active
19. Afraid

Satisfaction with avatar customization was measured with the following questions:

1. What aspects of your avatar did you customize? (Select all that apply):
    a. Hair style
    b. Hair color
    c. Eye shape
    d. Eye color
    e. Skin color
    f. Facial hair
    g. Clothing
    h. Accessories
    i. Gender
    j. Other
2. How satisfied were you with the avatar customization process? (1=extremely dissatisfied; 5=extremely satisfied)
3. On a scale of 1-4 (1= not at all limited, vs. 5 = extremely limited), how limited did you feel when you customized an avatar on the following aspects (adapted from Lee & Park, 2011)?

    a. Modification: I did not customize this feature (value of 0)
4. Did your avatar physically resemble you? (1=not at all; 5=very much so)

The ostracism manipulations (exclusion and inclusion) were checked with responses to the following statements (adapted from Kipling et al., 2006). The intensity of ostracism will be measured by two 9-point questions (1=not at all; 9 = very much so).

1. "To what extent did you feel that you were *being ignored* or excluded by the other participants?"
2. "To what extent did you feel that you were *being noticed* or included by the other participants?"

The Basic Needs Scale, adapted from Kipling, (2009) and used in Kassner et al., (2012) will measure how needs were threatened in the exclusive and inclusive conditions. Participants will respond to the following statements regarding their needs being threatened after the exclusive and inclusive tasks, respectively (1 =not at all; 9 =very much).

1. *Belongingness:* How much do you feel you belonged to the group
2. *Meaningful existence:* How true is the statement: 'Life is meaningless'?
3. *Control:* How true is the statement: 'I am in control of my life'?
4. *Self-esteem:* To what extent do you think the other participants value you as a person?

Avatar Identification: The player identification scale (Van Looy et al., 2012) asks participants to rate their agreement with the following (1=strongly disagree; 5=strongly agree):

- Similarity identification
    - My avatar is similar to me
    - I resemble my avatar
    - My avatar resembles me
    - I identify with my avatar
    - My avatar is like me in many ways
    - My avatar is an extension of myself

- Wishful identification
    - I would like to be more like my avatar
    - If I could become like my avatar, I would
    - My avatar is an example to me
    - My avatar is a better me
    - My avatar has characteristics that I would like to have

- Embodiment
    - In the game, it is as if I become one with my avatar
    - I feel like I am inside my avatar when playing

- When I am playing, it feels as if I am my avatar
- When I am playing, I am transported into my avatar
- When playing, it feels as if my avatar's body becomes my own
- In the game, it is as if I act directly through my avatar

The agency over avatar measure is from the Player-Avatar Interaction (PAX) scale (Banks & Bowman, 2016). Under the PAX scale, agency is conceptualized as "sense of control" and is measured by two statements: "this avatar does what I want" and "I control this avatar." Responses are measured on a seven-point Likert scale (1=strongly disagree; 7=strongly agree). The agency over avatar measure will help us identify differences in self versus avatar-related agency.

Avatar history as a co-variate: Sample questions include "have you customized an avatar before? What types of experiences (options: videogames, VR chat, Bitmoji) have you customized an avatar for? What kinds (options: photorealistic, low poly, fantastical, etc.) of avatars have you made?"

- Do you play video games? Or have experience playing video games? (Yes/No)
- How frequently do you play video games?
  - 1-3x daily
  - 1-3x weekly
  - 1-3x monthly
  - 1-3x yearly
- How much time (minutes or hours) do you spend per gaming session? (Free response)
- Do you play mobile games? (Yes/No)
- How frequently do you play mobile games?
  - 1-3x daily
  - 1-3x weekly
  - 1-3x monthly
  - 1-3x yearly
- How much time (minutes or hours) do you spend per gaming session? (Free response)
- When do you play mobile games? (e.g. waiting in line, commute, etc.)
- Have you customized an avatar before? (Yes/No)
- What kind of avatar was it? If you are unsure of the avatar type, use 'other' to name the platform (e.g. game or app) you used to create it.
  - Photorealistic human
  - Fantasy human (e.g. World of Warcraft)
  - Cartoon or anime (e.g. Animal Crossing)
  - Other (name of platform, game, and/or style)
- What types of event(s) did you customize an avatar for? (Select all that apply)
  - Conference
  - Game
  - Messaging

- Social hangout
- Steaming
- Video call
- Work meeting
- Other

Sense of agency (Tapal et al., 2017) is one's general belief in their ability to control an outcome. Agency is often low in individuals with depression and those with poorer emotional well-being, and thus another important co-variate for measuring avatar effects. This measure will be reverse coded. Participants will rate the following statements (1= strongly disagree; 7=strongly agree):

1. I am in full control of what I do. (POS)
2. I am just an instrument in the hands of somebody or something else. (NEG)
3. My actions just happen without my intention. (NEG)
4. My movements are automatic--my body simply makes them. (NEG)
5. The outcomes of my actions generally surprise me. (NEG)
6. Things I do are subject only to my free will. (POS)
7. The decision whether and when to act is within my hands. (POS)
8. Nothing I do is actually voluntary. (NEG)
9. While I am in action, I feel like I am a remote-controlled robot. (NEG)
10. My behavior is planned by me from the very beginning to the very end. (POS)
11. I am completely responsible for everything that results from my actions. (POS)

Generalization is a sub-scale on the attitudes towards self-measure developed by Carver (2013). Individuals with depressive symptoms may over-generalize more than those without depressive symptoms, and an important covariate for assessing the appraisal of positive and negative virtual experiences. Generalization is measured with the following prompt: "To what extent do you agree with the following statements?" (1=strongly disagree; 5=strongly agree)

1. When even one thing goes wrong, I begin to wonder if I can do well at anything at all.
2. I hardly ever let unhappiness over one bad time influence my feelings about other parts of my life.
3. If I notice one fault of mine, it makes me think about my other faults.
4. A single failure can change me from feeling OK to seeing only the bad in myself.

The Body Shape Satisfaction Questionnaire: Participants will rate ten aspects of their body shape and parts on a five-point Likert scale (1=very satisfied; 5= very dissatisfied).

1. Height
2. Weight
3. Shoulders

4. Body Build
5. Waist
6. Stomach
7. Thighs
8. Face
9. Body Shape
10. Hips

Body Image Disturbance Questionnaire (Cash et al., 2004).

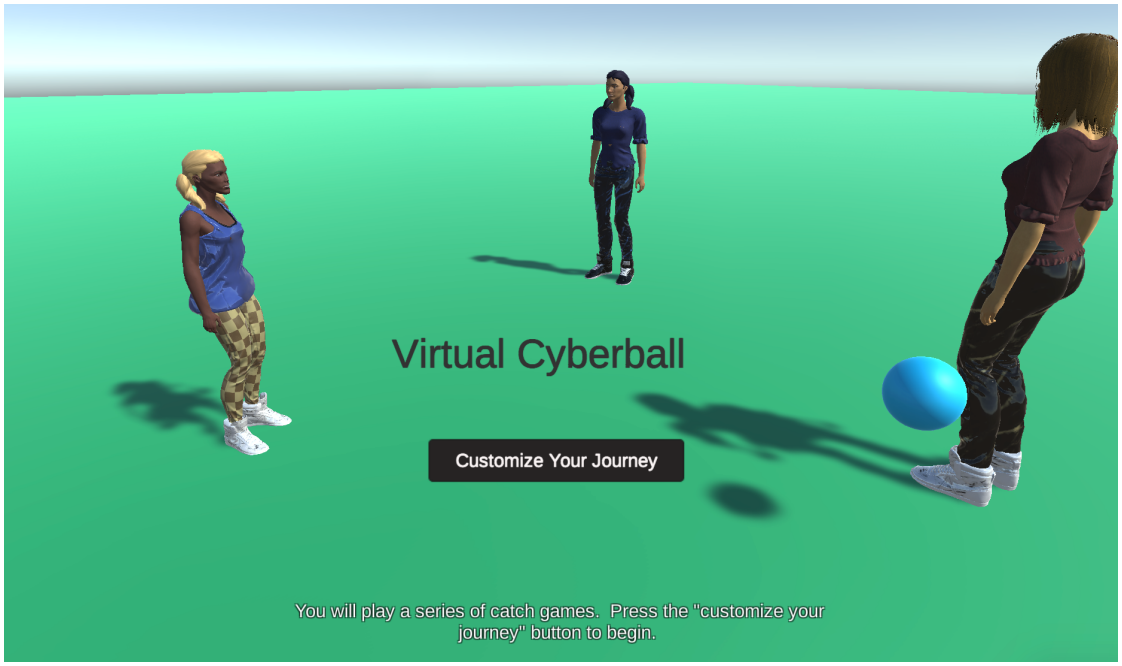
1. Are you concerned about the appearance of some part(s) of your body, which you consider especially unattractive? (1=Not at all concerned; 5=Extremely concerned)
2. If you are at least somewhat concerned, do these concerns preoccupy you? That is, you think about them a lot and they're hard to stop thinking about? (1=Not at all preoccupied; 5=Extremely preoccupied)
3. *Have your concerns about these body parts** often caused you a lot of distress, torment, or pain? How much? (1=no distress; 5= extreme and disabling) ***modified*
4. *Have your concerns about these body parts** often caused you impairment in social, occupational or other important areas of functioning? How much? (1=no limitation; 5= extreme and incapacitating) ****modified*

APPENDIX C: RECRUITMENT MATERIAL

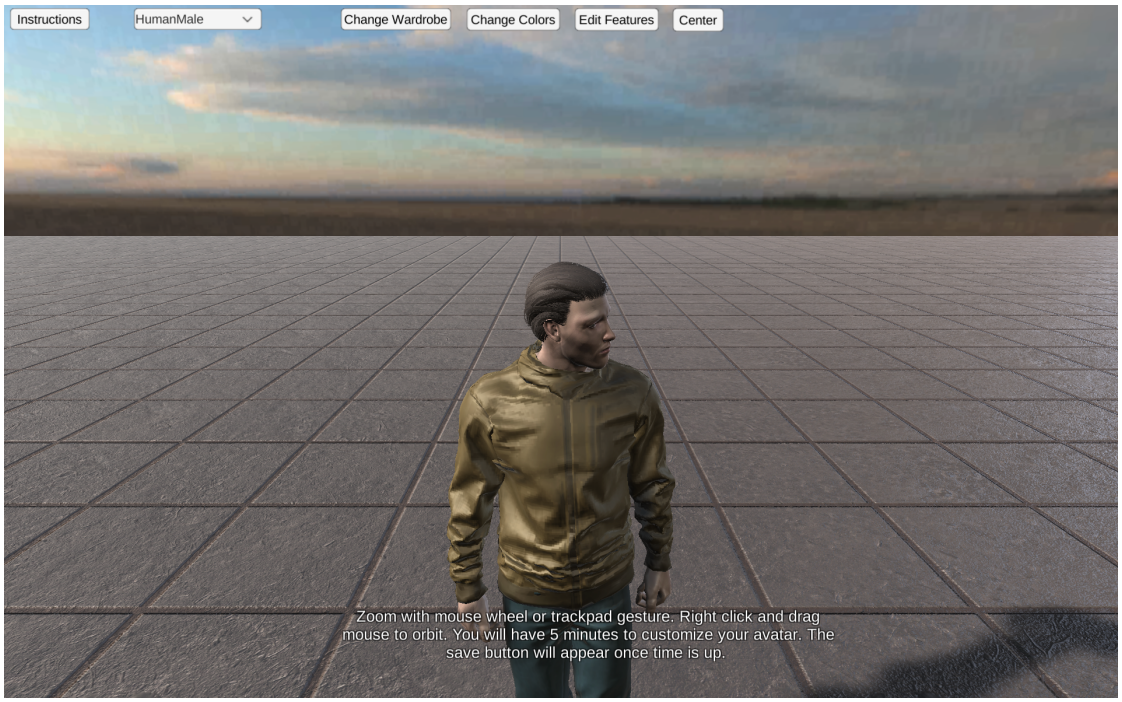
Study Description: We are looking for adults (18+ years) to help us evaluate games for emotional well-being. Participants will view a web-based virtual environment and answer short surveys regarding their experiences. Please note this is a credit-only, online study. Participants will receive 1 credit or $15 for their participation.

APPENDIX D: VIRTUAL ENVIRONMENT INSTRUCTIONS

You will play a series of catch games. Press the “customize your journey” button to begin.

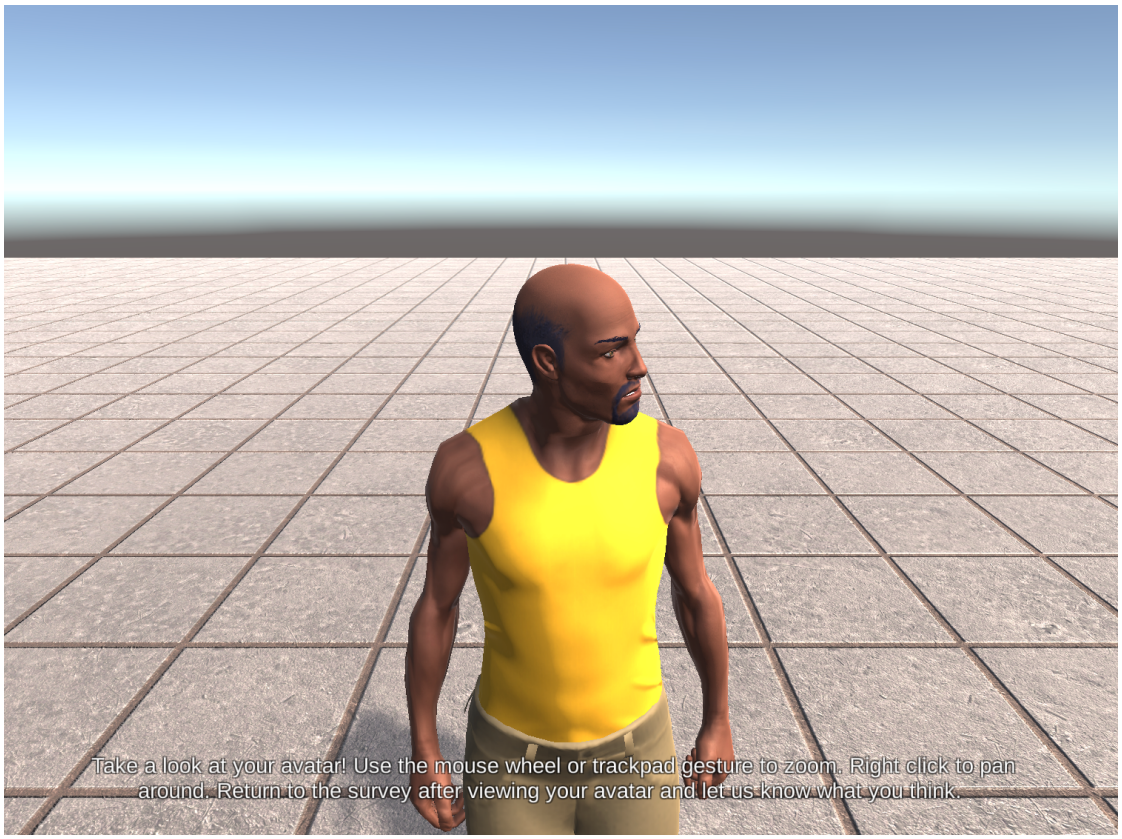


Instructions in customized avatar environment (initial overlay): Zoom with mouse wheel or trackpad gesture. Right click and drag mouse to orbit. You will have 5 minutes to customize your avatar. The save button appear once time is up.



Instructions in customized avatar environment (accessed via Instructions button, top left corner): To enter the game you will first need to create an avatar. You can create an avatar by selecting an avatar type, changing its wardrobe, colors, and features. You will have up to 5 minutes to complete this task. Zoom with mouse wheel or trackpad gestures. Right click and drag mouse to orbit. Once complete, hit the "save & continue" button. The save button will appear after 5 minutes are up.

Instructions in assigned avatar environment: Take a look at your avatar! Use the mouse wheel or trackpad gesture to zoom. Right click to pan around. Return to the survey after viewing your avatar and let us know what you think.


Take a look at your avatar! Use the mouse wheel or trackpad gesture to zoom. Right click to pan around. Return to the survey after viewing your avatar and let us know what you think.

REFERENCES

Ahn, S. J. G., Nowak, K. L., & Bailenson, J. N. (2022). Unintended consequences of spatial presence on learning in virtual reality. *Computers & Education*, 104532.

Aymerich-Franch, L., & Bailenson, J. (2014). The use of doppelgangers in virtual reality to treat public speaking anxiety: a gender comparison. In Proceedings of the International Society for Presence Research Annual Conference (pp. 173-186).

Bailey, J. O., Bailenson, J. N., & Casasanto, D. (2016). When does virtual embodiment change our minds?. *Presence*, *25*(3), 222-233.

Bailenson, J.N., Segovia, K.Y. (2010). Virtual Doppelgangers: Psychological effects of avatars who ignore their owners. In: Bainbridge, W. (eds) Online Worlds: Convergence of the Real and the Virtual. Human-Computer Interaction Series. Springer, London. https://doi.org/10.1007/978-1-84882-825-4_14

Bailenson, J. N., Yee, N., Merget, D., & Schroeder, R. (2006). The effect of behavioral realism and form realism of real-time avatar faces on verbal disclosure, nonverbal disclosure, emotion recognition, and copresence in dyadic interaction. *Presence: Teleoperators and Virtual Environments*, *15*(4), 359-372.

Banks, J., & Bowman, N. D. (2016). Emotion, anthropomorphism, realism, control: Validation of a merged metric for player–avatar interaction (PAX). *Computers in Human Behavior*, *54*, 215–223. https://doi.org/10.1016/j.chb.2015.07.030

Barr, D. J. (2013). Random effects structure for testing interactions in linear mixed-effects models. *Frontiers in Psychology*, *4*, 328.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Beck, A. T., & Haigh, E. A. P. (2014). Advances in Cognitive Theory and Therapy: The Generic Cognitive Model. *Annual Review of Clinical Psychology*, *10*(1), 1–24. https://doi.org/10.1146/annurev-clinpsy-032813-153734

Bem, D. J. (1972). Self-perception theory. In *Advances in experimental social psychology* (Vol. 6, pp. 1-62). Academic Press.

Bessière, K., Seay, A. F., & Kiesler, S. (2007). The ideal elf: Identity exploration in World of Warcraft. *Cyberpsychology & behavior*, *10*(4), 530-535.

Birk, M. V., Atkins, C., Bowey, J. T., & Mandryk, R. L. (2016). Fostering intrinsic motivation through avatar identification in digital games. In *Proceedings of the 2016 CHI conference on human factors in computing systems* (2982-2995).

Birk, M. V., & Mandryk, R. L. (2019). Improving the Efficacy of Cognitive Training for Digital Mental Health Interventions Through Avatar Customization: Crowdsourced Quasi-Experimental Study. *Journal of Medical Internet Research*, *21*(1), e10133. https://doi.org/10.2196/10133

Birk, M. V. (2018). Investigating avatar customization as a motivational design strategy for improving engagement with technology-enabled services for health. Doctoral dissertation, University of Saskatchewan.

Carver, C. S., & Ganellen, R. J. (1983). Depression and components of self-punitiveness: High standards, self-criticism, and overgeneralization. *Journal of Abnormal Psychology*, *92*(3), 330–337. https://doi.org/10.1037/0021-843X.92.3.330

Carver, C. S. (1997). You want to measure coping but your protocol is too long: Consider the brief cope. International journal of behavioral medicine, 4(1), 92-100.

Chang, F., Luo, M., Walton, G., Aguilar, L., & Bailenson, J. (2019). Stereotype threat in virtual learning environments: Effects of avatar gender and sexist behavior on women's math learning outcomes. *Cyberpsychology, Behavior, and Social Networking*, *22*(10), 634-640.

Cohn, M. A., & Fredrickson, B. L. (2010). In search of durable positive psychology interventions: Predictors and consequences of long-term positive behavior change. *The journal of positive psychology*, *5*(5), 355-366.

Consalvo, M., & Harper, T. (2009). The sexi (e) st of all: Avatars, gender, and online games. In Virtual Social Networks (pp. 98-113). Palgrave Macmillan, London.

Cuthbert, R., Turkay, S., & Brown, R. (2019). The Effects of Customisation on Player Experiences and Motivation in a Virtual Reality Game. Proceedings of the 31st Australian Conference on Human-Computer-Interaction, 221–232. https://doi.org/10.1145/3369457.3369475

Dias, C., Cruz, J. F., & Fonseca, A. M. (2012). The relationship between

multidimensional competitive anxiety, cognitive threat appraisal, and coping strategies: A multi-sport study. International Journal of Sport and Exercise Psychology, *10*(1), 52-65.

Dietrich, D. R. (2013). Avatars of whiteness: Racial expression in video game characters. *Sociological Inquiry*, *83*(1), 82-105.

Downs, E., Bowman, N. D., & Banks, J. (2019). A polythetic model of player-avatar identification: Synthesizing multiple mechanisms. *Psychology of Popular Media Culture*, *8*(3), 269.

Ducheneaut, N., Wen, M. H., Yee, N., & Wadley, G. (2009, April). Body and mind: a study of avatar personalization in three virtual worlds. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1151-1160).

DuCros, F. M., Chin, C. B., Lee, J. J.-H., Yuen, N. W., Deo, M. E., & Milman, N. (2018). Asian Americans and Pacific Islanders on TV. Contexts, 17(4), 12–17. https://doi.org/10.1177/1536504218812863

Dunn, R. A., and Guadagno, R. E. (2012). My avatar and me: Gender and personality predictors of avatar-self discrepancy. *Computers in Human Behavior* 28, 97–106. doi: 10.1016/j.chb.2011.08.015

Evans, E., Pierce, J., Li, L., Rawson, R., & Hser, Y. I. (2012). More alike than different: Health needs, services utilization, and outcomes of Asian American and Pacific Islander (AAPI) populations treated for substance use disorders. *Journal of Ethnicity in Substance Abuse*, *11*(4), 318-338.

Eysenck, M. W., & Fajkowska, M. (2018). Anxiety and depression: Toward

overlapping and distinctive features. *Cognition and Emotion*, *32*(7), 1391–1400. https://doi.org/10.1080/02699931.2017.1330255

Faulk, K. E., Gloria, C. T., & Steinhardt, M. A. (2013). Coping profiles characterize individual flourishing, languishing, and depression. *Anxiety, Stress & Coping*, *26*(4), 378-390.

Fodor, L. A., Coteț, C. D., Cuijpers, P., Szamoskozi, Ș., David, D., & Cristea, I. A. (2018). The effectiveness of virtual reality based interventions for symptoms of anxiety and depression: A meta-analysis. *Scientific reports*, *8*(1), 1-13.

Fox, J., & Bailenson, J. N. (2009). Virtual self-modeling: The effects of vicarious reinforcement and identification on exercise behaviors. Media Psychology, 12, 1–25.

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: the broaden-and-build theory of positive emotions. *American psychologist*, *56*(3), 218.

Fredrickson, B. L. (2004). The broaden–and–build theory of positive emotions. *Philosophical transactions of the royal society of London. Series B: Biological Sciences*, *359*(1449), 1367-1377.

Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and emotion*, *24*(4), 237-258.

Gallagher, M. W., & Lopez, S. J. (2007). Curiosity and well-being. *The Journal of Positive Psychology*, *2*(4), 236–248. https://doi.org/10.1080/17439760701552345

Goffman, E. (1959). *The Presentation of Self in Everyday Life*. Doubleday, Garden

City, NY.

Gonzalez-Franco, M., Bellido, A. I., Blom, K. J., Slater, M., & Rodriguez-Fornells, A. (2016). The neurological traces of look-alike avatars. *Frontiers in human neuroscience*, *10*, 392.

Guegan, J., Segonds, F., Barré, J., Maranzana, N., Mantelet, F., & Buisine, S. (2017). Social identity cues to improve creativity and identification in face-to-face and virtual groups. *Computers in Human behavior*, *77*, 140-147.

Herrera, F., Oh, S. Y., & Bailenson, J. N. (2020). Effect of behavioral realism on social interactions inside collaborative virtual environments. *Presence*, *27*(2), 163-182.

Hoffman, H. G., Chambers, G. T., Meyer III, W. J., Arceneaux, L. L., Russell, W. J., Seibel, E. J., ... & Patterson, D. R. (2011). Virtual reality as an adjunctive non-pharmacologic analgesic for acute burn pain during medical procedures. *Annals of behavioral medicine*, *41*(2), 183-191.

Horigome, T., Kurokawa, S., Sawada, K., Kudo, S., Shiga, K., Mimura, M., & Kishimoto, T. (2020). Virtual reality exposure therapy for social anxiety disorder: A systematic review and meta-analysis. *Psychological Medicine*, *50*(15), 2487-2497.

Huang, Y., Churches, L., & Reilly, B. (2015, April). A case study on virtual reality American football training. In *proceedings of the 2015 virtual reality international conference* (pp. 1-5).

Hudson, I., & Hurter, J. (2016, July). Avatar types matter: review of avatar literature for performance purposes. In *International conference on virtual, augmented and mixed reality* (pp. 14-21). Springer, Cham.

Hsu, L. (2012). Web 3D simulation-based application in tourism education: A case study with Second Life. *Journal of Hospitality, Leisure, Sport & Tourism Education*, *11*(2), 113-124.

Jin, S. A. A. (2012). Self-discrepancy and regulatory fit in avatar-based exergames. *Psychol. Rep.* 111, 697–710. doi: 10.2466/06.07.21.PR0.111.6.697-710

Kafai, Y. B., Cook, M. S., & Fields, D. A. (2010). ‘‘Blacks Deserve Bodies Too!’’: Design and Discussion About Diversity and Race in a Tween Virtual World. *Games and Culture*, *5*(1), 43-63.

Kang, H., & Kim, H. K. (2020). My avatar and the affirmed self: Psychological and persuasive implications of avatar customization. *Computers in Human Behavior*, *112*, 106446. https://doi.org/10.1016/j.chb.2020.106446

Kang, S. H., & Watt, J. H. (2013). The impact of avatar realism and anonymity on effective communication via mobile devices. *Computers in Human Behavior*, *29*(3), 1169-1181.

Kalyanaraman, S., and Wojdynski, B. W. (2015). “Affording control: how customization, interactivity, and navigability affect psychological responses to technology,” in *The Handbook of the Psychology of Communication Technology*, ed. S. Shyam Sundar (Hoboken, NJ: John Wiley and Sons, Ltd), 425–444. https://doi.org/10.1002/9781118426456.ch19

Kato, T. (2015). Frequently used coping scales: A meta-analysis. Stress and Health, 31(4), 315-323.

Kim, Y., & Sundar, S. S. (2012). Visualizing ideal self vs. actual self through avatars: Impact on preventive health outcomes. *Computers in Human Behavior*, *28*(4), 1356–1364. https://doi.org/10.1016/j.chb.2012.02.021

Kim, Y. (2010). *Can your avatar improve your health? The impact of avatar customization.* Doctoral Dissertation, Penn State University. ProQuest Dissertations and Theses Database.

Kingston, J., Chadwick, P., Meron, D., & Skinner, T. C. (2007). A pilot randomized control trial investigating the effect of mindfulness practice on pain tolerance, psychological well-being, and physiological activity. *Journal of Psychosomatic Research*, *62*(3), 297–300. https://doi.org/10.1016/j.jpsychores.2006.10.007

Koulouris, J., Jeffery, Z., Best, J., O'neill, E., & Lutteroth, C. (2020, April). Me vs. Super (wo) man: Effects of Customization and Identification in a VR Exergame. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (pp. 1-17).

Laver, K. E., Lange, B., George, S., Deutsch, J. E., Saposnik, G., & Crotty, M. (2017). Virtual reality for stroke rehabilitation. *Cochrane database of systematic reviews*, (11).

Latoschik, M. E., Roth, D., Gall, D., Achenbach, J., Waltemate, T., & Botsch, M. (2017, November). The effect of avatar realism in immersive social virtual

realities. In *Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology* (pp. 1-10).

Le, T. M., Zhornitsky, S., Wang, W., & Li, C.-S. R. (2020). Perceived burdensomeness and neural responses to ostracism in the Cyberball task. *Journal of Psychiatric Research*, *130*, 1–8. https://doi.org/10.1016/j.jpsychires.2020.06.015

Lee, J.-E. R., & Park, S. G. (2011). "Whose Second Life Is This?" How Avatar-Based Racial Cues Shape Ethno-Racial Minorities' Perception of Virtual Worlds. *Cyberpsychology, Behavior, and Social Networking*, *14*(11), 637–642. https://doi.org/10.1089/cyber.2010.0501

Lee, J. E. R. (2014). Does virtual diversity matter?: Effects of avatar-based diversity representation on willingness to express offline racial identity and avatar customization. *Computers in Human Behavior*, *36*, 190-197.

Lee, J. E. R. (2009). To reveal or to cloak? Effects of identity salience on stereotype threat responses in avatar-represented group contexts. *International Journal of Internet Science*, *4*(1), 34-49.

Lee, S., Juon, H. S., Martinez, G., Hsu, C. E., Robinson, E. S., Bawa, J., & Ma, G. X. (2009). Model minority at risk: Expressed needs of mental health by Asian American young adults. *Journal of Community Health*, *34*(2), 144-152.

Li, B. J., & Lwin, M. O. (2016). Player see, player do: Testing an exergame motivation model based on the influence of the self avatar. *Computers in Human Behavior*, *59*, 350-357.

Liaw, S. Y., Wu, L. T., Soh, S. L. H., Ringsted, C., Lau, T. C., & Lim, W. S. (2020). Virtual reality simulation in interprofessional round training for health care students: a qualitative evaluation study. *Clinical simulation in nursing*, *45*, 42-46.

Litam, S. D. A. (2020). "Take Your Kung-Flu Back to Wuhan": Counseling Asians, Asian Americans, and Pacific Islanders with race-based trauma related to Covid-19. *Professional Counselor*, *10*(2), 144-156.

Mancini, T., and Sibilla, F. (2017). Offline personality and avatar customisation. Discrepancy profiles and avatar identification in a sample of MMORPG players. *Computers in Human Behavior,* 69, 275–283. doi: 10.1016/j.chb.2016.12.031

Marathe, S., & Sundar, S. S. (2011, May). What drives customization? Control or identity?. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 781-790).

McArthur, V. (2017, May). The UX of avatar customization. In *Proceedings of the 2017 CHI conference on human factors in computing systems* (pp. 5029-5033).

McArthur, V., & Jenson, J. (2014, December). E is for everyone? Best practices for the socially inclusive design of avatar creation interfaces. In *Proceedings of the 2014 Conference on Interactive Entertainment* (pp. 1-8).

Mitchell, J., Stanimirovic, R., Klein, B., & Vella-Brodrick, D. (2009). A randomised controlled trial of a self-guided internet intervention promoting well-being.

Computers in Human Behavior, *25*(3), 749–760. https://doi.org/10.1016/j.chb.2009.02.003

Mon, L. (2010). Communication and education in a virtual world: Avatar-mediated teaching and learning in second life. *International Journal of Virtual and Personal Learning Environments (IJVPLE)*, *1*(2), 1-15.

Messinger, P. R., Ge, X., Smirnov, K., Stroulia, E., & Lyons, K. (2019). Reflections of the extended self: Visual self-representation in avatar-mediated environments. *Journal of Business Research*, *100*, 531–546. https://doi.org/10.1016/j.jbusres.2018.12.020

Nakamura, L. (1995). Race in/for cyberspace: Identity tourism and racial passing on the Internet. *Works and Days*, *13*(1-2), 181-193.

Nielsen Company. (2020, May 18). Engaging Asian American consumers at the dawn of a new decade. Retrieved from https://www.nielsen.com/us/en/insights/report/2020/engaging-asian-american-consumers-at-the-dawn-of-a-new-decade/

Nowak, K. L., & Fox, J. (2018). Avatars and computer-mediated communication: a review of the definitions, uses, and effects of digital representations. *Review of Communication Research*, *6*, 30-53.

Ong, A. D., & Allaire, J. C. (2005). Cardiovascular intraindividual variability in later life: the influence of social connectedness and positive emotions. *Psychology and aging*, *20*(3), 476.

Pandita, S., Humphreys, L., & Won, A. S. (2021, May 27-31). Satisficing Self-Presentation: Navigating “Multiple Choice” in Avatar Creation and

Identification. The 71st Annual International Communication Association Conference, Online.

Paxton, S. J., Neumark-Sztainer, D., Hannan, P. J., & Eisenberg, M. E. (2006). Body Dissatisfaction Prospectively Predicts Depressive Mood and Low Self-Esteem in Adolescent Girls and Boys. *Journal of Clinical Child & Adolescent Psychology*, *35*(4), 539–549. https://doi.org/10.1207/s15374424jccp3504_5

Peña, J., Ghaznavi, J., Brody, N., Prada, R., Martinho, C., Santos, P. A., ... & Dimas, J. (2017). Effects of human vs. computer-controlled characters and social identity cues on enjoyment. *Journal of Media Psychology*.

Peng, T. (2021). *The Role of Customization on Avatar Identification and Performance in a Kart Racing Game* (Doctoral dissertation, Northeastern University).

Pingitore, R., Spring, B., & Garfieldt, D. (1997). Gender Differences in Body Satisfaction. *Obesity Research*, *5*(5), 402–409. https://doi.org/10.1002/j.1550-8528.1997.tb00662.x

Ratan, R. A. (2011). *Self-presence: Body, emotion, and identity extension into the virtual self*. University of Southern California.

Ratan, R. (2013). Self-presence, explicated: Body, emotion, and identity extension into the virtual self. In *Handbook of research on technoself: Identity in a technological society* (pp. 322-336). IGI Global.

Ratan, R., & Sah, Y. J. (2015). Leveling up on stereotype threat: The role of avatar customization and avatar embodiment. *Computers in Human Behavior*, *50*, 367-374.

Ratan, R. A., & Dawson, M. (2016). When Mii is me: A psychophysiological examination of avatar self-relevance. *Communication Research*, *43*(8), 1065-1093.

Reid, G. (2012). Motivation in video games: a literature review. *The computer games journal*, *1*(2), 70-81.

Rizzo, A. S., & Shilling, R. (2017). Clinical virtual reality tools to advance the prevention, assessment, and treatment of PTSD. *European Journal of Psychotraumatology*, *8*(sup5), 1414560.

Rogers, T. B., Kuiper, N. A., & Kirker, S. (1977). Self-reference and the encoding of personal information. Journal of Personality and Social Psychology, 35, 677–688.

Ryan, R. L., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68-78.

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

RStudio Team (2021). RStudio: Integrated Development Environment for R. RStudio, PBC, Boston, MA. http://www.rstudio.com/.

Sah, Y. J., Rheu, M., & Ratan, R. (2021). Avatar-User Bond as Meta-Cognitive Experience: Explicating Identification and Embodiment as Cognitive Fluency. *Frontiers in Psychology*, *12*, 2669.

Schielzeth, H., Dingemanse, N. J., Nakagawa, S., Westneat, D. F., Allegue, H., Teplitsky, C., ... & Araya-Ajoy, Y. G. (2020). Robustness of linear mixed-effects models to violations of distributional assumptions. *Methods in Ecology and Evolution*, *11*(9), 1141-1152.

Simard, V., & Dandeneau, S. (2018). Revisiting the Cyberball inclusion condition: Fortifying fundamental needs by making participants the target of specific inclusion. *Journal of Experimental Social Psychology*, *74*, 38–42. https://doi.org/10.1016/j.jesp.2017.08.002

Slaby, J., Paskaleva, A., & Stephan, A. (2013). *Enactive Emotion and Impaired Agency in Depression*. *20*(7–8), 33–55.

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. Archives of internal medicine, 166(10), 1092-1097.

Seidel, E. M., Silani, G., Metzler, H., Thaler, H., Lamm, C., Gur, R. C., ... & Derntl, B. (2013). The impact of social exclusion vs. inclusion on subjective and hormonal reactions in females and males. *Psychoneuroendocrinology*, *38*(12), 2925-2932.

Seo, Y., Kim, M., Jung, Y., & Lee, D. (2017). Avatar face recognition and self-presence. *Computers in Human Behavior*, *69*, 120-127.

Suh, K. S., Kim, H., & Suh, E. K. (2011). What if your avatar looks like you? Dual-congruity perspectives for avatar use. *MIs Quarterly*, 711-729.

Sundar, S. S. (2008). Self as source: Agency and customization in interactive media. In E. A. Konijn, S. Utz, M. Tanis, & S. B. Barnes (Eds.), *Mediated*

Interpersonal Communication (0 ed., pp. 72–88). Routledge. https://doi.org/10.4324/9780203926864-12

Sundar, S. S., & Marathe, S. S. (2010). Personalization versus customization: The importance of agency, privacy, and power usage. *Human communication research*, *36*(3), 298-322.

Stone, J. A., Strafford, B. W., North, J. S., Toner, C., & Davids, K. (2018). Effectiveness and efficiency of virtual reality designs to enhance athlete development: an ecological dynamics perspective. *Movement & Sport Sciences-Science & Motricité*, (102), 51-60.

Tapal, A., Oren, E., Dar, R., & Eitam, B. (2017). The Sense of Agency Scale: A Measure of Consciously Perceived Control over One's Mind, Body, and the Immediate Environment. *Frontiers in Psychology*, *8*, 1552. https://doi.org/10.3389/fpsyg.2017.01552

Tang, Mary. (2020). 'Awe'some Choice: An Expansion of the Broaden and Build Theory. In *BSU Honors Program Theses and Projects.* Item 346. Available at: https://vc.bridgew.edu/honors_proj/346

Tarlow, E. M., & Haaga, D. A. (1996). Negative self-concept: Specificity to depressive symptoms and relation to positive and negative affectivity. Journal of Research in *Personality*, *30*(1), 120-127.

Taylor, C. T., Pearlstein, S. L., Kakaria, S., Lyubomirsky, S., & Stein, M. B. (2020). Enhancing social connectedness in anxiety and depression through amplification of positivity: Preliminary treatment outcomes and process of

change. *Cognitive Therapy and Research*, *44*(4), 788–800. https://doi.org/10.1007/s10608-020-10102-7

Tessler, H., Choi, M., & Kao, G. (2020). The anxiety of being Asian American: Hate crimes and negative biases during the COVID-19 pandemic. American Journal of Criminal Justice, *45*(4), 636-646.

Thieme, A., Wallace, J., Meyer, T. D., & Olivier, P. (2015, July). Designing for mental wellbeing: towards a more holistic approach in the treatment and prevention of mental illness. In *Proceedings of the 2015 British HCI Conference* (pp. 1-10).

Treisman, A. (1982). Perceptual grouping and attention in visual search for features and for objects. *Journal of Experimental Psychology: Human Perception and Performance*, *8*(2), 194.

Treem, J. W., & Leonardi, P. M., (2013). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Annals of the International Communication association, 36*(1), 143-189. http://doi.org/10.1080/23808985.2013.11679130.

Trepte, S., & Reinecke, L. (2010). Avatar creation and video game enjoyment: Effects of life-satisfaction, game competitiveness, and identification with the avatar. *Journal of Media Psychology: Theories, Methods, and Applications, 22*(4), 171-184. http://dx.doi.org/10.1027/1864-1105/a000022

Tugade, M. M., Fredrickson, B. L., & Feldman Barrett, L. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of

positive emotions on coping and health. *Journal of Personality*, *72*(6), 1161-1190.

Turkay, S., & Kinzer, C. K. (2014). The effects of avatar-based customization on player identification. In *Gamification: Concepts, methodologies, tools, and applications* (pp. 247-272). IGI Global.

Turkay, S., & Kinzer, C. K. (2017). The relationship between avatar-based customization, player identification, and motivation. In *Transforming gaming and computer simulation technologies across industries* (pp. 48-79). IGI Global.

Vanderlind, W. M., Millgram, Y., Baskin-Sommers, A. R., Clark, M. S., & Joormann, J. (2020). Understanding positive emotion deficits in depression: From emotion preferences to emotion regulation. *Clinical Psychology Review*, *76*, 101826.

Van Looy, J., Courtois, C., De Vocht, M., & De Marez, L. (2012). Player identification in online games: Validation of a scale for measuring identification in MMOGs. *Media Psychology*, *15*(2), 197–221. https://doi.org/10.1080/15213269.2012.674917

Vasalou, A., Joinson, A. N., & Pitt, J. (2007, April). Constructing my online self: avatars that increase self-focused attention. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 445-448).

Vasalou, A., Joinson, A., Bänziger, T., Goldie, P., & Pitt, J. (2008). Avatars in social media: Balancing accuracy, playfulness and embodied messages. *International Journal of Human-Computer Studies*, *66*(11), 801-811.

Vasalou, A., & Joinson, A. N. (2009). Me, myself and I: The role of interactional context on self-presentation through avatars. *Computers in human behavior*, *25*(2), 510-520.

Velten, J., Scholten, S., Brailovskaia, J., & Margraf, J. (2021). Psychometric properties of the S-Scale: Assessing a psychological mindset that mediates the relationship between socioeconomic status and depression. *PloS one*, *16*(10), e0258333.

Vrieze S. I. (2012). Model selection and psychological theory: a discussion of the differences between the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). *Psychological methods*, *17*(2), 228–243. https://doi.org/10.1037/a0027127

Waddell, T. F., Sundar, S. S., & Auriemma, J. (2015). Can customizing an avatar motivate exercise intentions and health behaviors among those with low health ideals?. *Cyberpsychology, Behavior, and Social Networking*, *18*(11), 687-690.

Waddell, T. F., Ivory, J. D., Conde, R., Long, C., & McDonnell, R. (2014). White man's virtual world: A systematic content analysis of gender and race in massively multiplayer online games. *Journal For Virtual Worlds Research*, *7*(2).

Watson, D., Clark, L. A., & Tellegen, A. (1988). *Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales*. *54*(6), 1063–1070.

Williams, N. (2014). The GAD-7 questionnaire. *Occupational Medicine*, *64*(3), 224–224. https://doi.org/10.1093/occmed/kqt161

Williams, K. D., & Jarvis, B. (2006). Cyberball: A program for use in research on interpersonal ostracism and acceptance. *Behavior Research Methods*, *38*(1), 174–180. https://doi.org/10.3758/BF03192765

Yee, N., & Bailenson, J. (2007). The Proteus effect: The effect of transformed self-representation on behavior. *Human communication research*, *33*(3), 271-290.

Yee, N., Bailenson, J. N., & Ducheneaut, N. (2009). The Proteus effect: Implications of transformed digital self-representation on online and offline behavior. *Communication Research*, *36*(2), 285-312.

Yee, N., Ducheneaut, N., Yao, M., & Nelson, L. (2011, May). Do men heal more when in drag? Conflicting identity cues between user and avatar. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 773-776).

Yu, D., & Yau, K. K. (2012). Conditional Akaike information criterion for generalized linear mixed models. *Computational Statistics & Data Analysis*, *56*(3), 629-644.

Zahabi, M., & Abdul Razak, A. M. (2020). Adaptive virtual reality-based training: a systematic literature review and framework. *Virtual Reality*, *24*(4), 725-752.