CAN YOUR AVATAR IMPROVE YOUR HEALTH?
THE IMPACT OF AVATAR CUSTOMIZATION

A Dissertation in
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by
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Abstract

As health communication campaigns enter the realm of games and virtual worlds, an important affordance is the ability to navigate mediated environments through avatars. Our investigation explores the psychological significance of virtual-world avatars on real-world outcomes. In particular, it explores the role played by avatar customization on users’ self-preservation behaviors.

Participants (N = 95) in a between-subjects experiment were randomly assigned to one of four conditions: a desired avatar condition in which users were directed to customize their avatars to reflect their ideal, desired selves; and an actual avatar condition in which users were directed to customize their avatars to resemble their actual selves; an assigned attractive avatar condition in which the user was assigned an attractive avatar by the system; and an assigned unattractive avatar condition. The first two conditions were used to test propositions derived from the agency model of customization whereas the latter two were inspired by behavior confirmation theory. Behavior confirmation theory predicts that avatar users’ behaviors would be influenced by others’ expectations raised by the physical appearance of the avatar. Therefore, an attractive avatar would motivate users to undertake behaviors that would help them keep up this appearance in real life. On the other hand, the agency model of customization would argue that it is not the attractiveness of the avatar’s appearance but the sense of agency arising from the active construction of one’s avatar that would motivate self-preserving behaviors. Therefore, this study attempts to reveal the key factors driving a user’s self-preservation motivations by testing these two competing theories to predict the user’s behavior pursuant to avatar use.

This study yielded a significant effect for avatar customization on motivations for self-
preservation. Participants who customized their avatars indicated that they would spend a significantly higher percentage of their time maintaining good health, compared to participants who were assigned avatars. Furthermore, this effect was mediated by sense of agency. This study also found that customizing one’s avatar to resemble a desired ideal self promotes visualization of his/her ideal body, which is positively related to prevention-focused sense of self-preservation. We also found that customizing one’s avatar to resemble one’s actual self increases perceived risk, which is negatively related to promotion-focused sense of self-preservation due to reductions in self-efficacy. Overall, the findings support the agency model of customization over behavior confirmation theory.

The key contribution of this study is the demonstration that psychological benefits obtained from avatar customization can be leveraged for promoting users’ wellness. Theoretical and practical implications of these findings are discussed, followed by an outline of the study’s limitations and directions for future research.
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Introduction

Human desire to control others’ impression formation has resulted in the widespread use of self-representing technologies, including photographs, videos, and virtual characters (or avatars). With the emergence of virtual worlds such as Second Life and Web 2.0 technologies such as social networking sites, users have become more actively involved in representing the self in online mediated environments (for reviews, see Hancock & Dunham, 2001 and Kalyanaraman & Sundar, 2008).

The biggest advantage offered by these technological developments is the freedom from physical appearance, which is critical in face-to-face communication. People can communicate with others with or without revealing their actual physical appearance and can transform their self-representations drastically and instantly while presenting various aspects of the self that may not have been fully expressed in real life.

Avatars, or virtual-character representations of the self, are the best example of self-representative forms that allow for dramatic transformation (Yee & Bailenson, 2007) as well as for reflecting one’s multiple identities. Avatars allow users to create and build their own identities in online communities, video games, and virtual environments (VEs).

Over the past decade, numerous studies have been conducted in various fields to explore the effects of avatars. Most of these studies have shown that avatars’ appearances and behaviors influence interactions in computer-mediated communication (CMC) and users’ cognitive outcomes, such as learning and perception. However, we still do not have a theoretical understanding of the psychological processes underlying avatar as a form of self-representation. In particular, how does the appearance of one’s avatar which is self-constructed affect one’s conception of self, both psychological and physical, both virtual and real? Does it matter if the
avatar is simply chosen from an existing gallery or carefully constructed by the user? If so, is it because of their avatar’s physical appearance or because of the self-concepts reflected and enhanced in the process of avatar customization? That is, do users feel greater self-presence and sense of agency if they customize the avatars themselves? And do these lead to positive outcomes related to their self-concept, such as self preservation?

This dissertation attempts to answer these questions by examining how avatar appearance and customization influence avatar creators’ self-concepts and, furthermore, their motivation to physically improve their bodies.

It begins by describing the various forms of self-representation including those that are online and offline to visualize where the embodied avatars as self-representation forms are positioned. Then, it will review the various aspects of the self that can be presented with the help of avatars. After that, several studies will be presented to illustrate the effect of avatars as self-representations in immersive virtual environment upon user’s psychological and behavioral consequences. Then, in the theoretical framework section, it will be introduced two concepts which might play a role as psychological mechanisms to connect the use of avatar as a self-representation and the avatar user’s psychological and behavioral outcome along with several theories. Research questions and hypotheses will be followed.

The dissertation then describes the method and results of an experiment to test the proposed research questions and hypotheses. From the findings, both theoretical and practical implications will be derived, followed by a discussion of study limitations and directions for future research.
Literature Review

Given that the focus of this dissertation study is the effect of avatars as self-representations upon user’s psychological and behavioral consequences, we begin by reviewing literature pertaining to various forms of self-representations which are available online and offline, and the self-concepts that are associated with certain forms of self-representation such as avatars. Then, we will examine theoretical frameworks relating to the notion of “self” in both psychology and communication technology literatures, resulting in the proposal of specific research questions and hypotheses.

Representations of the self

In environments where individuals interact with others, the images that represent their selves are very influential and help them understand their identities. Imagine your everyday life—what you wear, what hair style you have, what you say, how you behave, and even what bags you carry—all of these things represent who you are. We call these self-representations. That is, physical appearances, including clothes, hair styles, behaviors, language styles and personal belongings, are representative forms of one’s real self (see Figure 1).

<table>
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<th>Non-visual forms</th>
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<th>Online</th>
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<td>- Language (including language style (e.g., feminine, masculine, dominant, submissive), speaking tone (e.g., introvert, extrovert))</td>
<td>- Username</td>
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<tr>
<td>- Behavior</td>
<td>- Text messages (in chat or blog environment)</td>
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<td>- Personal Belongings (indirect)</td>
<td>- Personal homepage</td>
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<td></td>
<td>- Virtual structures that are created by the user (indirect)</td>
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Do these forms of self-representation change online? With the development of new technologies, the options from which users can choose to represent their selves have increased. They vary from visual to non-visual, from real-time to non-real time, from a high degree of correspondence to a person’s physical appearance and behavior to a low degree of correspondence, and from digital to non-digital.

In chat environments, a person’s username or text message is a good example of a self-representation that reflects that individual’s personality. For example, user names like “Footballlover” and “CarMania” indicate the users’ affection toward football and cars, respectively. In addition, through a user’s particular style of text messages in an online community or blog, we can determine whether the user is friendly or not.

Of course, it is hard to judge one’s identity only by examining his/her username or text messages. As Higgins (1987) pointed out, we possess multiple identities, including our true self, actual self, ought self, and ideal self. Interestingly, the Internet allows users to present various aspects of their self (Bargh, McKenna, & Fitzsimons, 2002; McKenna, Green, & Gleason, 2002). As such, “footballlover” or “Carmania” can be one part of these users’ identities that, together with other parts, compose their real self. (A more thorough discussion of this concept of multiple identities appears in a later section).

Some people use visual representations, such as icons, images of objects, animals, or celebrities, to project their identities. These representations are called avatars. Nowak (2004)
defined avatars as virtual characters to represent the self in online communities, chat rooms, video games, and virtual reality environments. These also reflect one’s personalities. For example, when one presents an image of a cute dog to represent himself/herself, we interpret that the user might want to show himself/herself as being cute or as a dog lover or that the user may simply want to show off his/her cute dog.

On the contrary, some users directly project self by posting their real photographs or videos. These are highly correspondent in terms of visual form, although users can and often do manipulate these images using software for image improvement, like Photoshop or Final Cut Pro.

In addition, with the rise in the video games and virtual environment (VE), the use of embodied characters for self-representation has rapidly increased. These embodied characters are called avatars as well. Bailenson and Blascovich (2004) defined avatar as “a perceptible digital representation whose behaviors reflect those executed, typically in real time, by a specific human being” (p. 65). In his dissertation, Nick Yee positioned this type of avatar (called “digital avatar”) in VE as a being that has a moderate degree of visual as well as behavioral correspondence to the user. (see Figure 2)
In CMC environments, including VE, where users are able to communicate without presenting their physical features, their avatars’ digital appearance takes the place of their physical appearances.

**Avatar as a digital appearance**

Conceptually, an avatar is any graphical character—from objects to human beings, from cartoon-like to realistic characters, and from real-time to non-real time—that represents users in online communities, chat rooms, or virtual reality games (Nowak, 2000).

The term “avatar” became popular after Neal Stephenson (1992) used it in his science fiction book, *Snow Crash* (Cassell & Vilhjalmsson, 1999). However, the word “avatar” is originally comprised of two Sanskrit words, “Ava” and “Terr.” “Ava” means “to descend” or “to pass,” and “terr” means “beneath” or “earth.” Literally, avatar means a “descent into a lower
realm of existence.” In Hindu philosophy, avatar refers to the incarnation (bodily manifestation) of a being on Earth. Therefore, among various forms of avatars, the digital embodied character, which has a moderate degree of visual and behavioral correspondence to a user in VE, is very close to the idea of avatars in Ancient Indian philosophy.

In a virtual world (e.g., Second Life, There, Sims), users interact with other users and virtually experience everything through avatars. It is not possible for users to visit virtual places or to meet other users without using their avatars in a virtual world (Chung, 2005). Every experience and every interaction is performed through avatars. As such, the avatar is a way of experiencing the virtual world as well as a way of communicating with others; that is, the avatar represents the user in a virtual world and therefore constitutes the primary vehicle for conveying the user’s identity. It is no wonder then that most users spend a lot of time and even money to create their avatars (Taylor, 2002).

Most virtual environments provide users a great degree of flexibility when it comes to changing the appearance of their avatars. Of course, depending on the characteristics of the VE, the forms and options to create avatars are slightly different. For example, in World of Warcraft (WoW) and Online Casino De Deauville, which are Massively Multiplayer Online games (MMOGs) that more than 7 million users playing the game simultaneously in real-time, the purpose of the avatar is to convey the player’s role, skill level and achievements. Given that each character possesses different powers and skills, users are more likely to choose avatars that resemble warriors or poker players (Figures 3 and 4) than self-representative forms that project their identity.
Therefore, the options for creating avatars in these environments is very limited as
compared to MMO social games, such as Second Life, wherein users socialize and build social networks in a virtual space instead of playing a game with specific missions or goals.

In VEs such as Second Life, avatars are more likely to be used as a means to communicate and obtain virtual experiences. Because these avatars represent individuals, the body and facial features are more realistic, and users are given more detailed and customizable options to control their appearance, from body thickness to the size of ears (see Figure 5).

Figure 5. Avatar customization panel in Second Life

Embodied avatars reflecting multiple identities in CMC environments

In CMC environments, where users communicate and interact with others using their embodied avatars, various features and appearances of embodied avatars exist in the same space. Such environments resemble the real world in which our physical features and appearances are all unique and different from one another. However, because some environments provide more
options for avatar feature customization, including unrealistic features (e.g., an angel-like avatar with wings or a cat-headed avatar), features or appearances of avatars are much more diverse than in the real world.

As mentioned before, users utilize their avatars as communication channels to interact and connect with others and choose and create them accordingly in order to represent their self in CMC environments. As such, several major questions arise: When a user creates an avatar as a self-representation, what does it look like? Does it resemble the user’s physical appearance or not? Is his/her avatar’s appearance the same all of the time? If not, then why?

Kang and Yang (2006) investigated the degree to which appearances or features of the avatars resemble the user’s identity. They found that the anonymity of the medium gave users the freedom to create different types of avatar, thus reflecting their multiple identities. Users can and do create multiple avatars and often switch between them seamlessly.

Kang and Yang also found that users create more realistic avatars (i.e., avatars that have realistic appearances and characteristics) in instant messaging (IM), a medium that they use to communicate with individuals whom they already know, while users create more unrealistic avatars (i.e., avatars that have more attractive appearances and fanciful figures) in instant relay chat (IRC), which is a medium used typically to communicate with strangers. That is, depending on the medium, users tend to use different types of avatars. This finding not only supports the idea that avatars are used to reflect individuals’ multiple identities, but also suggests that a network’s characteristics play an important role in determining aspect of their identities they wish to activate. In a similar vein, Kim and Sundar (2009) found that in mixed environments, like social networking sites that users use for building new networks and for maintaining existing networks, users tend to create avatars that resemble their actual physical appearances, rather than
creating avatars that resemble their desired images (i.e., the images which they would like to look like).

The notion that a person possesses multiple personas or identities is not novel in the field of psychology (Goffman, 1959; Jung, 1953). Higgins (1987) introduced three self-concepts related to an individual: ideal, ought, and actual. The “ideal self” is a future version of the self that one wants to be, while the “actual self” is the current and public version of the self that one presents in real life. On the other hand, the “ought self” could be either a current or a future version, since it is the self that one feels obligated to be. The “ought self” is similar to Markus and Nurius’ (1986) “possible self,” which refers to the self that one may possibly become in the future if s/he strives to do so. However, given that “possible self” entails one’s wish, it is distinguished from “ought self.”

The anonymity of virtual environments has enabled users to project these selves, many of which have not been truly expressed in real life (Bargh, McKenna, & Fitzsimons, 2002; McKenna, Green, & Gleason, 2002). Some scholars called this type of self the “ideal self.” The term “ideal self” has often been interchangeably used with the term “desired self” in psychology. The Merriam-Webster Dictionary (2008) defines “ideal” as “existing as a mental image or in fancy or imagination only.” That is, the word “ideal” conveys a sense of unrealism. Therefore, in an avatar context, the avatar which represents the user’s ideal self is closer to the unrealistic feature such as angel. The desired self, however, is a broader concept overarching the unrealistic ideal self and possible self. So, we can say that the avatar which looks like user’s physical appearance projects one’s actual self, while the avatar which resembles the image that one wants to have projects one’s desired self (Kim & Sundar, 2009).
Psychological and behavioral consequences of using avatar as self-representation

Technological developments allow us to create avatars that have a high degree of similarity in form and behavioral correspondence with the users that they represent. The Virtual Human Interaction Lab at Stanford University, led by Dr. Jeremy Bailenson, has conducted several studies investigating the effects of these digital avatars as self-representations in immersive virtual environments (IVE) upon user’s psychological and behavioral consequences.

For example, one study found that an avatar’s attractiveness influenced the avatar user’s behavior in interaction contexts. More specifically, when users were given attractive avatars in IVE, they were more likely to walk closer to the partner and disclose personal information than users who were given unattractive avatars (Yee & Bailenson, 2007).

In a similar vein, Fox and Bailenson (2009) investigated how users’ behaviors were influenced by observing the behaviors of self-resembling avatars in IVE. The findings showed that when users observed their self-resembling avatars exercising in IVE, they were more likely to repeat the physical exercises in the real world than users who observed avatars that resembled other individuals exercising in IVE, leading the researchers to claim that an avatar resembling the user’s physical appearance can serve as a self-model for motivating certain behaviors.

A common finding across all these studies is that the appearance of avatars in VEs has a strong impact on users’ behavioral and psychological outcomes. Yet, it is surprising that none of these delve into the psychological antecedents of avatar creation and self-representation. Considering that users choose or create them, avatars are likely to be inherently related to their own self-concepts. This may underlie the psychological and behavioral effects of avatar use online.

A primary goal of this dissertation is to investigate the link between the degree to which
the avatar reflects the user’s identity and the user’s psychological and behavioral outcomes when using such an avatar as a form of self-representation in a virtual environment.

The basic hypothesis is that the process of creating one’s avatar, which also plays a role in self-representation, helps the user identify with his/her self and, in turn, influences the interactions the user has with other avatars when using his/her self-created avatar. That is, the very act of avatar creation may affect users’ psychological and behavioral outcomes. In particular, when the interaction is mainly about health information to preserve one’s well-being, creating and observing one’s avatar, both of which reflect one’s self-concept, might play an integral role in the avatar creator’s information processing and decision making about his/her health behaviors.

Behavior confirmation theory (Snyder, Tanke, & Berscheid, 1977) predicts that users will behave in ways that are consistent with their avatars in order to conform to others’ expectations that are raised by the physical appearance of the avatar. Therefore, having a highly desirable avatar will drive the user to behave in ways that would preserve that appearance. On the other hand, the agency model of customization (Sundar, 2008) would argue that users behave in ways that will preserve the self because they created their avatars themselves and, therefore, feel ownership towards their online persona, resulting in greater involvement, self-identity, and control over their avatars’ welfare.

Therefore, if behavior confirmation is key, regardless of whether it was created by the user or not, an avatar that the user perceives as attractive may impact the user’s sense of self-preservation (i.e., the sense to preserve the self) so that her/his offline self can live up to the image created by her/his online self. On the contrary, if agency is key, user-created avatars will have a greater impact on their sense of self-preservation than assigned avatars.
These theoretical ideas will be developed further in the next section. Support for them will be assessed in the discussion chapter.

Theoretical Frameworks

This investigation draws on theoretical frameworks relating to the notion of “self” in both psychology and communication technology literature. The psychology of witnessing oneself in a mediated environment is discussed first, followed by a consideration of the technological tools that afford self-presentation not only by giving users choices but also through the avatar-creation process in general.

Psychology of Observing Self:

Avatars afford us an opportunity to see ourselves in the third person. If we create an avatar that resembles us, we have stronger identification with it, resulting perhaps in an increased consciousness of our own self. On the other hand, if our avatar is designed to reflect our notion of an ideal or desired self, then it provides an opportunity for self-modeling (Fox and Bailenson, 2009), akin to the vicarious learning proposed by social learning theory (Bandura, 1961). Additionally, a desired avatar can be seen as attractive by the user, thereby encouraging actions associated with being attractive or desirable, as proposed by behavior confirmation theory (Snyder & Swann, 1978).

Social learning theory

According to social learning theory, one can learn simply by observing the behavior of a social model (Ormrod, 1999). As shown in the Bobo doll experiments (Bandura, 1961), for
example, children who observed an adult model’s violent behavior toward the Bobo doll imitated the adults and showed the same patterns of behavior as that of the observed model. This experiment has long served as empirical evidence to support audiences’ learning by media exposure in various contexts (e.g., Kim & Kim, 2008).

Social learning theory has also been broadly applied to explain audiences’ personal body perception through body image exposure on TV or magazines. Harrison and Cantor (1997) found that exposure to thin models was highly associated with female audience members’ drive for thinness as well as their body dissatisfaction. Audiences tend to construct their own internalized ideal body image, called “self-schema” (Biocca & Myers, 1992), resulting from exposure to socially represented ideal body images (e.g., magazine model’s body image) in the media.

The emergence of avatar is meaningful in terms of individuals’ visualizations of their internalized ideal body images. As discussed above, avatars enable individuals to present any aspect of their selves that they have imagined but not been able to express in reality. Their respective self-schema could influence the nature of the avatars that they create. And when they create an ideal version of themselves in the form of avatars, they are able to observe their distorted self-representations from a third person perspective just like they observe social models on TV or in magazines. This further influences avatar users’ mental body images and, in turn, affects their own physical body perception, creating an even bigger distortion between imagined and real selves.

So far, the observation of the ideal image through social models on TV or in magazines has been empirically revealed to cause negative emotions and discourage people by experiencing the discrepancy between their actual images and ideal images which are shown on TV and in magazines (Phillips & Silvia, 2005). This idea is supported by self-discrepancy theory, which
basically suggests the negative effect of discrepancy between actual and ideal image on one’s emotion (Higgins, 1987). However, this study also argues that when users select and project their ideal images to represent themselves in a virtual environment, the discrepancy between actual and ideal self will be over-ridden by the fact that the users themselves created their representations, which might evoke positive emotions and induce the sense of self-efficacy by visualizing their ideal (but possible future) self images.

Then, how does the observation of the actual image through avatar (like seeing oneself in a mirror) influence users’ self-perception or behavior? Objective self-awareness theory suggests that self-awareness occurs when attention is focused on self and it, in turn, induces self-evaluation by comparing the projected self and the standard (Duval & Wicklund, 1972). However, in avatar-mediated environment, actual avatar users do not experience any negative self-evaluation between their self-images and the images projected through avatar because they are one and the same. That is, there is no discrepancy because the avatar, which supposedly reflects their real self, is the same as the ideal self-schema they hold of themselves in their head. Therefore, the avatar serves as reification of one’s desire to have an ideal body image, leading to heightened self-esteem (Duval & Silvia, 2002). In addition, it could lead to positive self-enhancing behaviors, as suggested by empirical findings revealing the positive effect of seeing one’s actual self images in a mirrored environment on users’ physical activities (e.g., Katula & McAuley, 2001).

According to social learning theory, learning also occurs through vicarious experience. When audiences realize that certain behaviors or images are socially accepted by the majority, they become motivated to imitate the models. For example, physical attractiveness is a socially accepted reference for self-confidence or self-esteem. The pervasive idea is that a physically
attractive person is socially desirable; therefore, his/her self-confident behaviors are socially acceptable, which often drives audiences to perceive these individuals and their behaviors as attractive.

Behavior confirmation theory (Snyder & Swann, 1978; Snyder, Tanke, & Berscheid, 1977) predicts that when a perceiver believes that the target thinks that he/she is interacting with is attractive, the perceiver behaves in a way which is consistent with the target’s expectation. In other words, when person A has an interaction with person B who believes that person A is attractive, person A behaves in a confident and friendly way, which is how physically attractive people usually behave. Therefore, regardless of a target’s behavior, a physically attractive person behaves in confident and friendly ways, thus conforming to the target’s expectations. Based on this framework, Yee and Bailenson (2007) found empirical support for the “Proteus effect,” which can be summarized as follows: Just as people change their behavior by simply changing wardrobes in an offline context, the different looks of avatars will have a significant impact on avatar users’ behaviors online. In a series of experiments, they found that when users were assigned to attractive avatars, they showed greater confidence and higher self-disclosure. For example, when users see their avatars as being attractive, they think that they are really attractive, and then behave in the confident and friendly way that attractive people are expected to behave. In addition, when they see their avatars as being old, they show more positive attitudes and less negative biases toward the elderly (Yee and Bailenson, 2006). Like in role playing, different faces on an avatar influences a user's self-perception and behavior. Cognitive dissonance theory (Brehm & Cohen, 1962; Festinger, 1957; Wicklund & Brehm, 1976) and self-perception theory (Bern, 1972) also support this idea by arguing that the public display of the self carries over to subsequent private self-appraisals and, in turn, influences one's public behavior.
The nature of the public display of self was determined by random assignment in the aforementioned Proteus Effect study. Some participants were assigned an attractive or tall avatar while others were assigned unattractive or short avatars. However, in reality, avatar assignment is not random and not objectively attractive all the time. Interfaces offer sophisticated tools to enable users to construct richly detailed avatars to represent themselves. Users will represent themselves in ways that might reflect their self-schema, but may not be attractive by an objective measure. They could be subjectively attractive to the users because they created them. Therefore, an important conceptual consideration is the agency afforded to users when it comes to creating avatars to reflect their own selves. This would mean that users have a greater sense of ownership of their avatar. Regardless of how the created avatars look objectively, avatar users are more likely to be aware of their own "self" in virtual environments, which consequently could influence their private behaviors, particularly health behaviors to preserve the self.

*Self-presence*

An avatar is a tool that users choose for communication as well as for self-presentation in cyberspace. It plays the role of a mirror that reflects a user’s identity as well as being a window for viewing the world. Therefore, users’ identification with their self-created avatars occurs more readily, particularly when they believe that the avatars reflect one of their selves.

Biocca (1997) conceptualized this psychological state as “self-presence,” whereby users are aware of their self-identity inside a virtual environment. According to Lee (2004), avatar users virtually experience their own selves even though they are artificially constructed by technology or para-authentically in the virtual environment. The first-person perspective in which users identify with either the whole (e.g., users view the virtual world through the avatars’ eyes; the avatars are invisible in this case) or the partial avatar (e.g., users view their avatars’
arms or legs in a gun-shooting game) often enhances users’ sense of their para-authentic virtual selves. However, the observation of their virtual bodies from the third-person perspectives enables users to construct a sense of either their artificial or para-authentic virtual selves. For example, an avatar that is created as a user’s desired self (i.e., one that a user wants to be) is closer to the artificial self, while an avatar that is created as the user’s actual self (i.e., one that a user actually is) is closer to the para-authentic self.

The observation of para-authentic self (i.e., actual avatar) or artificial self (i.e., desired avatar) will enhance different kinds of self presence. For example, users who see their desired avatars will be aware of an idealized version of the self, while users who see their actual avatars will be aware a realistic version of the self. Apparently, the awareness of different aspects of self is highly associated with avatar users’ sense of self-preservation through different psychological routes. The desired avatar enables users to visualize their ideal images (i.e., the desired end-state) they see and motivates them to put forth the effort to achieve such ideal images. This idea is similar to a dentist encouraging patients to be treated by showing them possible future versions of their teeth after treatment, using computer graphics. On the contrary, the actual avatar enables users to realize and see their actual images, as when they look at themselves in the mirror, and in turn, can increase their concerns about their current physical bodies. Consequently, it motivates them to put forth an effort to retain or improve their current images by avoiding negative behaviors. Social psychologists have conceptualized these two different motivation systems with “approach-avoidance motivation” (Elliot & Covington, 2001; Elliot & Thrash, 2002) or “promotion-prevention motivation” (Higgins 1997; Higgins, Shah, & Friedman 1997). Basically, these concepts illustrate that the aspiration toward desired end-states (e.g., desired image) motivates people to take actions to attain their ideal goals, while the safety or responsibility of
current end-states (e.g., actual image) motivates people to avoid negative outcomes. When applied to this dissertation study, the observation of either the desired self or the actual self through avatar creation might motivate avatar users to take actions either to achieve their ideal image (i.e., approach or promotion motivation) or to avoid negative behaviors (i.e., avoid or prevention motivation). Consequently, it will bring about positive influences on avatar users’ overall health behaviors.

Furthermore, extending the mechanism of self-presence, the act of routinely seeing one’s own representation in the midst of an environment is akin to an out-of-body experience, giving the user a unique perspective on his/her own place in the world. This is likely to influence the user’s stance toward stimuli encountered in virtual worlds by replacing the experiential with the phenomenal, i.e., the user is able to perceive through his/her senses the interaction between the self (as represented by the avatar) and external stimuli. The user is no longer simply experiencing stimuli as happens when watching a movie, for example. Instead, the user will see himself or herself in the ongoing narrative of the movie and can, therefore, obtain an extrasensory perception of his/her actions and reactions to events in the virtual world. As a result, the user is likely to develop dispositions toward his/her own avatar, just as we develop favorable dispositions toward protagonists in dramatic portrayals, as suggested by entertainment theorists (e.g., Zillmann, 1991). When watching films and other media portrayals involving heroes and villains, we form strong dispositions toward these characters, such that we experience euphoria when the hero is winning a battle against the villain but experience empathetic distress if the villain is succeeding. That is, we begin to care deeply for the welfare of the protagonist. When we know that danger is lurking behind the hero (as in some suspense films where the camera is the point-of-view of the villain) or around the corner (when we as viewers have the privilege of
an overview or master shot of the scene in which the hero is involved), we find ourselves wanting to help the hero to avoid or otherwise overcome the peril awaiting him or her. Likewise, we can expect the positive disposition toward our own self (as represented by our avatar in a virtual world) to guide our welfare.

**Psychology of Creating Self:**

Avatar creation highlights the role of the user as a source by enhancing the sense of agency while constructing an idiosyncratic self-representation. Based on the agency model of customization, this section will review the psychological mediator, sense of agency, predicted by avatar customization.

*Agency model of customization*

The technological strength of the avatar is that users are able to customize their body images by selecting from body features, including skin color, hair, eyes, and even accessories, enabling users to freely create and manipulate their identities. Customization, which refers to “adaptive interfaces,” allows each user to be unique and distinct, highlighting his/her sense of self (Sundar, 2008) by modifying various characteristics based on one’s individual needs (Alpert, Karat, Karat, Brodie, & Vergo, 2003). Petty, Barden, and Wheeler (2002) asserted that customization reflects aspects of one’s self by displaying the emotional tone that is consistent with one’s personality and by catering to the user’s specific cognitive needs and processing styles.

The agency model of customization (Sundar, 2008) emphasizes the role of the self as a “creator” and “source” for filtering individual needs and connecting the technological
affordances (interactivity, modality, and navigability) underlying customization and the resulting psychological outcomes (i.e., cognitive, affective, and behavioral) (see Figure 6).

![Figure 6. Sundar’s (2008) agency model of customization](image)

Customization is strongly associated with the interaction between the system and the user. In particular, a system provides contingent response based on user’s input or requests. This, in turn, facilitates a rich dialogue between the system and the user, thereby enhancing the ‘sourceness’ of the self (Sundar, 2008). In addition, the various forms of modalities, such as text, audio, and video, allow users to represent their selves in a richer way. Navigability contributes to the feeling of self-as-source by affording users the ability to individually and idiosyncratically explore the system, be it a customized portal or a virtual world. All of these affordances are likely to play an even stronger role in imbuing a sense of self as source in virtual environments than on portal websites.

In CMC, an avatar is a visible form of “self as a source.” Because of this, it is likely that avatar creation and control over the avatar highlights users’ sense of self more than any other type of customization. More specifically, richer modalities, including the availability of facial
expressions and movement, facilitate users’ self-representation. In addition, by providing idiosyncratic features of the virtual self that are different from others, the user’s feeling of “self as source” is likely to be heightened. Furthermore, users have more control over their interaction with the system and with the avatars during the process of customizing their avatars since avatar customization provides users with a high degree of flexibility in terms of their avatars’ appearance, ranging from skin color to body thickness. Identity, control, and involvement are theorized by the agency model to govern one’s sense of “self as source,” each with significant psychological benefits. Therefore, when users create their avatars, they are more likely to feel a strong sense of agency than users who are just assigned avatars.

Sense of Agency

Agency is generally defined as the capacity of an agent to act (Bandura, 2001). Tracing the origin of agency, it needs to go back to agricultural societies from almost 4000 years ago. In the face of nature’s forces like drought, disease, storm, and starvation, human beings were often left incapable and feeble. However, in order to survive, humans began developing tools and skills to overcome nature’s more devastating effects, eventually gaining control over nature, their surrounding environments, and their lives (Rosenau, 1992). And now, the reach of human power has been aggrandized with the development of new technology that enables people to have more control over and make changes to their lives. This power is the crux of the concept of agency.

The term ‘agency’ is often presented by combining an object (i.e., agent) that makes things happen (i.e., event) with the object’s enduring property. Leslie (1995) argued that everything that causes an event could be called an agent, but the agent should endure properties over the event or cause. For example, when I say that the storm broke the tree last night, the storm here is an agent because it was the entity that broke the tree, but there is no agency in this
situation due to the lack of the storm’s enduring property (i.e., intention). This is the essence of human agency that Bandura has developed over the past three decades. Bandura (2006) proclaimed that “to be an agent is to intentionally make things happen by one’s action. Agency embodies the endowments, belief systems, self-regulatory capabilities and distributed structures and functions through which personal influence is exercised, rather than residing as a discrete entity in a particular place” (p.2).

When referring to agency, the adjective ‘agentic’ is more commonly used. Theorizing about the different genders’ social roles based on the division of labor, Eagly and his colleagues (Eagly, 1987; Eagly & Wood, 2003; Eagly, Wood, & Diekman, 2000) characterized men as agentic, highlighting their assertive, competent, and confident behavior. This shows a correlation between agency and its agentic attributes. Moreover, returning to the noun usage of agency as a capacity to exert control over something, we see that it pertains to a potential causal relationship: “as people feel agency (i.e., agentic), they become assertive, competent, and confident.”

One of the primary assumptions of Bandura’s social cognitive theory of agency is that people are intentional agents who produce experiences and shape events (Bandura, 2000). Bandura saw agency as a completely human concept that makes humans different from other objects. In the theory of human agency, he argued that human beings proactively function based on their freedom to exercise self-influence on their own goals and desired outcomes. Therefore, the environment in which individuals are living is shaped by them, and thus, the management of their inner life is a part of the agentic process.

When referring to a sense of agency, the relationship between the sense of self and action needs to be clarified. Marcel (2003) defined a sense of agency as “a sense of oneself as an actor or a sense that actions are one’s own” (p. 54). His definition entails two important concepts: the
sense of oneself as an agent and one’s awareness of one’s own actions. It also raises a subsequent psychological question about whether it is possible to generate agency separating the perception of self as an agent from the awareness of what one is doing. For this question, he answers “no,” by providing the example of him unintentionally stepping on someone’s toe. Marcel argued that even though he perceived himself as the one who stepped on someone’s toe, it was hard to say that he felt a sense of agency since he was not aware of the action. Chaminade and Decety (2002) reframed the self-awareness of their own actions as a sense of ownership (e.g., I am aware that I am undergoing an experience) and asserted that this is necessary for feeling a sense of agency, but not sufficient. In the case of Marcel stepping on someone’s toe, Chaminade and Decety argued that even though he was aware of the action of stepping someone’s toe, since there was no ‘intention’ to cause or generate the action, it is, strictly speaking, not a sense of agency.

Considering Bandura’s idea that human agency is the capacity to exercise control over one’s activities and nature, sense of agency entails having more proactive control over actions, not just an awareness of self and action. In this view, Kabeer (2000)’s conceptualization of agency as the “ability to define one’s goals and act upon them” (p. 29) appears to be more appropriate. In particular, Kabeer emphasized one’s sense of “power within” (p. 29), when operationalizing sense of agency. Then, what is power? Kabeer defined power as “decision making” over a person’s own activities and listed several decisions that make women feel power. For example, Indian women feel power when making a decision about food purchases, children’s education, and disciplining their children (Jejeebhoy, 1997).

There are several components for defining agency in the context of avatars. An avatar is used for representing one’s self in online communities, chat rooms, or virtual reality games (Nowak, 2000). Given that the core component of agency is the awareness of self as an actor, the
one premise of agency in the avatar environment that should be fulfilled is the users’ recognition of their avatars as their selves (i.e., identification). Therefore, for perceiving agency, how much users identify with their avatars and acknowledge them as their selves in online environments is key.

Furthermore, agency should accompany actions. Just presenting and observing avatars do not induce any agency, since the concept of agency pertains to action. Therefore, users’ capability to have control over their avatars or make movements is critical for addressing agency in avatar environments. Given this, the customization of avatar that allows users to make changes is a powerful tool for realizing one’s agency.

In addition, in the view of agentic processes, avatar use has many psychological benefits. Particularly, with the development of new technology that stimulates users to be actively involved in information processing, users play more proactive roles, which in turn influences their lives significantly. Avatar use helps users overcome physiological and geological limits and achieve a greater sense of agency by allowing them to have control over technologies and observe the changes through their virtual selves.

Therefore, we can expect that avatar customization enhances users’ sense of agency and, consequently, influences creators’ cognitive, affective, and behavioral outcomes. In particular, given that avatar customization highlights one’s sense of self, it is likely that avatar creators will develop a positive disposition toward their self-created avatars, which would, in turn, motivate them to protect their own well-being.

**Research questions and hypotheses**

Fundamentally, this dissertation attempts to examine the effect of self-created avatars on
avatar creators’ motivations to improve their own bodies offline. As stated earlier, the process of creating a self-representing avatar would help the user identify with his/her self and, in turn, influence the interactions the user has with other avatars when using his/her self-created avatar. That is, the very act of avatar creation may affect users’ psychological and behavioral outcomes. In particular, when the interaction is mainly about health information to preserve one's well-being, this identification might play an integral role in the avatar creator’s information processing and decision making about his/her health behaviors.

This leads to the following research question and hypothesis:

RQ1: Does self-representation through self-created avatars enhance avatar creators’ sense of self-preservation?

H1: Avatar creators will show a higher sense of self-preservation than non-avatar creators.

Avatars afford us an opportunity to see ourselves in the third person. It helps users identify with their avatars, and, in turn, enhances users’ sense of self-presence (i.e., feeling being aware of self) in VE. It would affect users’ sense of self-preservation. Another possible psychological mediator to predict the avatar users’ psychological and behavioral outcomes is the sense of agency (i.e., feeling control over something) which would be enhanced by customizing their avatars (Sundar, 2008). Therefore, it is hypothesized that sense of self-presence and/or sense of agency would mediate the relationship between avatar customization and avatar customizers’ sense of self-preservation. More formally,
RQ2: Does self-representation through self-created avatars enhance avatar creators’ sense of self-preservation by influencing their sense of self-presence and sense of agency?

H2a: Sense of self-presence will mediate the relationship between avatar customization and avatar creators’ sense of self-preservation.

H2b: Sense of agency will mediate the relationship between avatar customization and avatar creators’ sense of self-preservation.

Furthermore, as mentioned before, since an avatar reflects one’s multiple identities in CMC, two types of self-created avatars will be examined in this study: desired avatar and actual avatar. Again, the desired avatar is one that is created based on what the user wants to be, while the actual avatar is one that is created based on the user’s current appearance. The desired avatar might act as a mirror that reflects the future version of ideal self while the actual avatar acts as a mirror to reflect the current version of the actual self. Therefore, it is hypothesized that desired avatar creators would envision their ideal body image through their avatars, and actual avatar creators would increase their concerns about their physical body image (while looking at the current body image reflected through the actual avatar). These, in turn, would enhance the sense of self-preservation. This leads to the following research question and hypothesis:
RQ3: How do the different types of self-created avatars reflecting the different self concepts of the avatar creator enhance avatar creators’ sense of self-preservation?

*H3a: Desired avatar creators will show higher visualization of their ideal body image and lower perceived risk to their physical body image than actual avatar creators, and these will in turn enhance the desired avatar creators’ sense of self-preservation.*

*H3b: Actual avatar creators will show lower visualization of ideal body image and a higher perceived risk to their physical body image than desired avatar creators, and these will in turn enhance the actual avatar creators’ sense of self-preservation.*

*Figure 8. Hypothesized Model II.*

By testing the research questions and hypotheses above, this dissertation ultimately attempts to find the key factors that predict avatar users’ psychological and behavioral outcomes (i.e., sense of self-preservation). As we reviewed in this chapter, the avatar as a form of self-representation is closely connected to the self. As such, the process of customizing an avatar is expected to provide the opportunity for a user to realize the self and observe the self as an agent from a third-person perspective. Therefore, it is predicted that the agency enhanced through avatar customization will cause users to behave in ways to preserve themselves.
Another line of research suggests that users’ behaviors can be influenced by their avatars’ physical attractiveness. In Yee and Bailenson’s (2007) study, when users were given attractive avatars as forms of self-representation, they behaved in confident and friendly ways.

To test these two competing theoretical propositions, this dissertation employs a between-subject experimental design with avatar customization/non-customization groups for which the avatars’ attractiveness in the non-customization condition was manipulated. The detailed manipulation and the procedures of this study will be addressed in the next chapter.
Dissertation Study

This dissertation attempts to answer the aforementioned questions and examines the impact of avatar customization in virtual reality. As a stimulus for this study, Second Life (SL) was employed. In addition to the fact that SL is the best example of a virtual platform, we chose this platform for several reasons: 1) ecological validity: avatars are commonly used in Second Life; 2) the active role of avatars: in SL, users communicate and socialize through their avatars; and 3) great range of control over avatar appearance: SL provides a great range of flexibility for avatar customization.

Therefore, in this proposed study, I would like to begin by briefly discussing SL as well as the methods and analysis.

Second Life

Second Life is the most prominent 3-D virtual platform (http://slife.com/) in which more than thirteen million residents reside and interact with others in order to build social networks. The exponential growth in the number of residents reflects not only the popularity, but also the potentiality of Second Life as a market for business and education. In fact, an increasing number of companies and institutes are actively becoming involved in virtual marketing and developing projects targeting teen residents of Second Life. For example, Toyota and Pontiac have opened virtual dealerships and promote their cars to avatars who they believe to be potential consumers. Educational communities sponsored by profit and nonprofit organizations have increasingly grown in both number and size, providing resources and information. Furthermore, as a growing body of literature addresses the potential benefits of Second Life in communicating health
information, major health institutes, such as the National Institutes of Health (NIH), the Center for Diseases Control and Prevention (CDC), and the University of Pittsburgh Medical Center (UPMC) are also using Second Life for disseminating health information and educating residents in the Second Life world. For example, UC Davis is doing a virtual hallucinations project aimed at educating people about mental illnesses by allowing users to experience schizophrenia virtually (Boulos, Hetherington, & Wheeler, 2007).

As a web-based, simulated multi-media entertainment, Second Life provides rich and engaging experiences through multi-media content (Boulos, Hetherington, & Wheeler, 2007). For example, Second Life SONY BMG Music Entertainment on Media Island allows users to access and navigate an extensive music library. Like in the real world, users sell, buy, and advertise virtual and real-life goods such as Nike Jeans and Honda Cars. In addition, users can travel and visit cities that virtually exist in Second Life (e.g., Virtual Morocco) and can enjoy multi-player games. Through virtual experiences, users are also able to develop social skills (e.g., clinical skills in the Second Life Heart Murmur Sim\(^1\)) and build communities to share experiences and obtain information. The fascinating thing about Second Life is that people can literally ‘inhabit’ this world, experiencing virtually everything that they can experience in the real world.

*Avatar in Second Life*

Second Life provides a great deal of flexibility in terms of avatar customization. As I briefly stated, from body shape to eye color, users have a wide variety of choices to manipulate their avatars. If a user imagines and dreams of being someone, it can be realized and visualized.

\(^1\) A Sim in Second Life means land parcels with pre-built educational facilities. There are several Sims that aim to provide health information in Second Life. For example, the Ohio University Sim offers a ‘nutrition game’ and the Heart Murmur Sim educates people on how to distinguish healthy heart sounds from unhealthy heart sounds. The CDC Sim is another example.
One can be tall, short, old, or sexy. Furthermore, since every interaction or experience in second 
life is done through their avatars (e.g., having a social interaction with other avatars or visiting 
virtual cities), the role of the self-created avatar is integral. The more fascinating thing is the 
avatar’s ability to navigate and express self emotions in Second Life. Users have great control 
over their avatar’s movement as well as their creation. Avatars can walk, run, and fly and can 
exhibit a variety of expressions by moving their heads, such as nodding. Such movements 
enhance users’ sense of agency by giving them control over their creatures, their virtual selves 
(Sundar & Marathe, 2006).
Method

Design

In order to answer the research questions and test the hypotheses proposed in this study, a between-subjects experiment was conducted in a virtual environment. Study participants were asked to enter this environment through an avatar and learn facts about a chosen health topic. One-half of the participants were assigned an avatar by the experimenter while the other half customized their own avatar. Participants in the assigned avatar condition were further divided and randomly assigned to represent themselves with either an attractive avatar or an unattractive avatar. Likewise, participants in the customization group were subdivided with one half customizing their avatars to look like their actual selves and the other half customizing them to look like their desired selves. In all, there were four avatar conditions to which participants were randomly assigned: a desired avatar condition in which users were directed to customize their avatars to be like their desired selves (CD), an actual avatar condition in which users were directed to customize their avatars to be like their actual selves (CA), an assigned attractive avatar condition (AA), and assigned unattractive avatar condition (AU). After customizing or being assigned their avatars depending on the condition, participants were asked to have a virtual interaction with the agent in the virtual CDC office, which was created for this study in Second Life. The participants were then asked to complete the online questionnaire asking about their sense of self-preservation, sense of agency, sense of presence, visualization of their ideal body, and perceived risk to their physical body as well as their demographic information.

Participants
Ninety-five undergraduate students (69 women, 26 men) participated in this study for extra credit and assigned to one of conditions. To recruit students, a link for an implied informed consent form was distributed to the various courses. Once the students agreed to the conditions and clicked the sign-up link that was embedded in the consent form, they could sign up for one of the sessions. Then, students were sent a reminder via email before the study session for which they signed up occurred.

Second Life stimulus description

For the current experiment, a virtual health island was created. Modeled after the CDC (Centers for Disease Control and Prevention; http://www.cdc.gov) in Second Life, a two-story CDC office was built on the island. The total size of the island is about 65,536 square meters (about 16 acres), and the CDC office takes up about 6,100 sqm (Figure 9).

In front of the building, a big screen was installed to enable participants to watch a video clip and on which several posters about the specific health issues (i.e., sleep disorders or obesity) were hung. The virtual office had a front desk, and there were several health-related posters on the inside wall as well. Also, a sitting area was created for the agent and the participant to sit and talk.
Figure 9. Snapshots of the CDC island and the office in Second Life

**Procedures**

The experiment was administered to one participant at a time in the Media Effects Research Laboratory, which has an experimental room, an observation room, and a waiting room.

Upon arriving at the lab, the participant was greeted by the experimenter in the waiting room.
Since the informed consent was obtained when recruiting participants, the participant was immediately given a pre-questionnaire, which asked him/her about his/her familiarity with virtual environments and satisfaction with his/her own facial and bodily appearance.

After completing the pre-questionnaire, the participant was led to the experimental room, which was equipped with headphones and a laptop computer (MacBook Pro). The participant was told to sit in front of the computer, which had been logged in to Second Life, so he/she would not experience any image-loading problems upon login. Depending on the participant’s gender and assigned condition, he/she was assigned different avatar: a male participant was assigned a male avatar while a female participant was assigned a female avatar. Before starting the experiment, the participant was asked to read the study instructions, which were placed on the table next to the laptop computer.

Once the participant was done reading the instructions, he/she was asked to wear the headset and watch a two-minute video clip that explained what Second Life is and what kind of activities avatar users could do in Second Life. The length of the video was the same for all conditions. Since some participants were not familiar with Second Life and avatar usage, this introduction was necessary. Once the participant began playing the video by clicking the play button at the bottom of the screen, the experimenter left the room and dimmed the lights. After finishing the video, the experimenter turned on the lights and returned to the experimental room.

The experimenter showed the participant a tutorial, demonstrating how to control his/her avatar (e.g., moving forward/backward or turning around) and objects (e.g., sitting on the chair or zooming in/out) and how to type in the chat box. Then, the participant was asked to practice until he/she felt comfortable controlling his/her avatar and the objects. The participant was
informed that he/she could always return to the manual, which was placed in front of him/her, if he/she forgot how to control the avatar during the course of the experiment.

Participants in the customization conditions were shown an additional tutorial about how to create their avatars (participants in the assigned avatar condition skipped this stage). Before creating their avatars, however, it was necessary to strengthen the manipulation. That is, to make sure that participants in the condition of actual avatar customization visualized their actual selves and participants in the condition of desired avatar customization visualized their desired selves, they were asked to fill out a questionnaire requiring them to list words that described the facial and bodily features (e.g., head, nose, legs, or skin color) they actually had at the time of the experiment (actual avatar customization) or words that described the features they would ideally like to have (desired avatar condition) (Harrison, 2001).

After the participant filled out the questionnaire, the experimenter showed the tutorial about avatar customization while allowing the participants to view the avatar customization manual that had snapshots of each menu as well as explanations for each step of the customization process. The participant was first directed to click the “inventory” button at the bottom of the screen. After clicking the button, the participant was shown six sub-folders (1A-6A) under the “styles” folder. Each folder featured a choice of skin colors and body shapes. When the participant picked one of these folders, he/she saw his/her avatar change, and he/she could change the avatars’ hairstyle, hair color, and clothes by selecting items under the sub-folders “clothes” and “hair styles” in the same “styles” folder.

After selecting one of the styles, the participant was directed to close the “inventory” screen and open a new panel to change their appearance by right-clicking his/her avatars and selecting the “appearance” menu. (see Figure 10).
Before letting the participant create his/her avatar, two important facts were emphasized. First, the participant was told about issues that he/she might encounter while customizing his/her avatar. For users who were not familiar with Second Life, it is often hard to change their avatars’ skin color and hairstyles, so the participant was asked to go back to the “inventory” menu if he/she wanted to change skin color or hairstyles again. Second, the participant was reminded to think about his/her ideal image (or their actual image, depending on the condition) as he/she described it before the tutorial and to use that image while creating his/her avatar.

The participant was then given time to create his/her ideal avatar (for participants in the ideal avatar customization condition) or his/her actual avatar (for participants in the actual avatar customization condition).

After the participant customized hi/her avatar (participants who were assigned avatars skipped the customization stage), the participant was asked to freely browse the virtual island for

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2 There was no time restriction for avatar customization. On average, participants spent about 12 minutes to create their avatars.
two minutes in order to become familiar with controlling the avatar. After browsing the island, the participant was asked to come to the CDC office. If he/she did not arrive at the CDC office within two minutes, the agent sent the participant a memo, which appeared on the upper right side of the participant’s screen. When the participant clicked the memo, his/her avatar would be immediately transported to the CDC office.

Participants were greeted by a virtual agent with the same gender as the participant: a female agent greeted the female avatars, while a male agent greeted the male avatars. The agent introduced herself/himself and briefly explained the CDC’s mission. Then, the agent showed posters and provided health information about sleep disorders or obesity for ten minutes. The scripts for this portion of the virtual interaction were prepared based on information collected from WebMD.com and CDC.org (e.g., overview of the health topic, symptoms, causes, and treatments) (see Appendix A). During their interaction with the virtual agent, the participant was allowed to ask questions and obtain feedback. After ten minutes, the agent asked the participant to click the button to teleport him/her to an online questionnaire, which contained the dependant variables and elicited the participant’s demographic information.

The participant was then asked to go to the waiting room where the instructions about the random drawings and six large colored pictures of coupons had been posted on the wall while the participant was filling out the online questionnaire. These coupons were not real and were created for the study to measure the participant’s behavioral responses. The participant was allowed to pick three out of the six slips for the coupons and was asked to write down his/her full name and email address on each slip.

The participant was then asked to put each slip into its corresponding box that was visually labeled for each coupon. The participant was told that he/she would be notified via email
once winners were randomly selected from each box after the study was completed. After filling out the coupons, the participant was thanked and debriefed.

**Pretest for selecting an avatar, an agent, and a health issue**

In order to select attractive avatars for the assigned avatar conditions, 13 students (4 males, 9 females) were recruited to rank 20 female and 20 male avatars that were created for this study in terms of their perceived attractiveness using an 11-point scale (where “-5” indicated highly unattractive and “5” indicated highly attractive). Among them, two highly ranked avatars in each gender ($M = 3.46, 3.46$ for attractive female avatars, $M = 2.54, 1.38$ for attractive male avatars) were randomly given to the assigned attractive avatar group, and two of the lowest ranked avatars in each gender ($M = -4.23, -2.85$ for unattractive female avatars, $M = -4.23, -3.46$ for unattractive male avatars) were randomly given to the assigned unattractive avatar group (Figure 11).

*Figure 11. Examples of the assigned avatars (From left: assigned attractive female avatar, assigned unattractive female avatar, assigned attractive male avatar, and assigned unattractive male avatar)*
In addition, to rule out any effects due to the attractiveness of the virtual CDC agent, the same students were asked to rank 10 female agents and 10 male agents in terms of their perceived attractiveness using an 11-point scale (where “-5” describes highly unattractive and “5” describes highly attractive) and their perceived credibility using an 11-point scale (where “-5” describes highly untrustworthy and “5” describes highly trustworthy). Among them, the mid-ranked female ($M = 0.23$ for attractiveness, $M = 1.31$ for trustworthiness) and the mid-ranked male agent ($M = -0.08$ for attractiveness, $M = -0.69$ for trustworthiness) were used for this study (see Figure 12).

![Virtual agents](image)

*Figure 12. Virtual agents*

Since different levels of involvement with health issues could influence the outcomes, the same students were asked to rank 13 health issues depending on their intrinsic involvement using an 11-point scale (where “1” describes less involved and “10” describes highly involved). Among the issues, sleep disorders ($M = 3.15$) and obesity ($M = 3.23$) were ranked in the middle and were used and participants were randomly assigned to one of two health issues. Involvement with health issue was measured in the experiment as well.
Measurement

Manipulation check for independent variables

To check the manipulation for the independent variables, participants in the customization conditions were asked to rate the following statements on a 1-7 scale, with 1 representing strongly disagree and 7 representing strongly agree: seven items for the actual avatar (e.g., “My avatar looks like me”; “My avatar represented my actual self well”) and five items for the desired avatar (e.g., “My avatar represents what I would ideally want to look like”; “My avatar represented my ideal self well”) (See Appendix B). The ratings across 7 items for the actual avatar were averaged to yield the perceived physical appearance similarity (Cronbach’s α = 0.98), and the ratings across 5 items for the desired avatar were averaged to yield the perceived ideal appearance similarity (Cronbach’s α = 0.96). In addition, the perceived attractiveness using 3 items (“My avatar is socially desirable,” “My avatar will be attractive to others,” and “My avatar looks attractive to me.”) was also measured on a 1-7 scale, ranging from strongly disagree to strongly agree.

Dependent variables

Sense of self-presence. Lee (2004) defined self-presence as “a psychological state in which virtual (para-authentic or artificial) self/selves are experienced as the actual self in either sensory or nonsensory ways” (p.46). Self-presence, in short, is a feeling and a psychological state that enables one to feel aware of themselves in virtual environments. This occurs when users notice the presence of their selves through their avatars. Therefore, sense of self-presence was measured with 14 items revised from the private self-consciousness scale (Fenigstein, Scheier, &
Buss, 1975) and developed from Lee’s (2004) concept explication of self-presence (e.g., “During the Second Life interaction, I felt quite self-conscious,” “During the interaction, I found myself reflecting about my own health behaviors,” or “I could see myself during the interaction”). These items were measured using a 1-7 scale, ranging from *strongly disagree* to *strongly agree*. The ratings across 14 items were averaged to yield the sense of self-presence index (Cronbach’s $\alpha = 0.86$).

*Sense of agency.* To measure sense of agency, five questions were adapted from Stavrositu & Sundar’s (2008) and Kim & Sundar’s (2009) sense of agency scales, which are originally based on Eagly’s (1987) concepts (e.g., “I feel like I have control over my actions” or “I feel that I can control my destiny”). In addition, nine items were created based on the agency model of customization (Sundar, 2008) (e.g., “I feel like I can exercise my free will” or “I can influence the nature and course of my health”) (see Appendix B). These items were measured using a 1-7 scale, ranging from *strongly disagree* to *strongly agree*. The ratings across 14 items were averaged to yield the sense of agency index (Cronbach’s $\alpha = 0.87$).

*Sense of self-preservation.* Self-preservation, or the desire to survive, is inherently human. To fulfill this natural desire, people exercise, diet, and become involved in various activities to stay in good health. Often, commercials and public service advertisements stimulate one’s self-preservation motives, sometimes using a fear appeal. Six questions were created based on Khantzian and Mack’s (1983) conceptualization of self-preservation (e.g., “I feel the need to protect my body,”; “I feel the need to maintain good health.”). These items were measured using a 1-7 scale, ranging from *strongly disagree* to *strongly agree*. Two additional questions asked participants about the percentage of their time and money they would spend to maintain good health (e.g., doing exercise or going to see a doctor) on a 21-point scale, ranging from 0% to 100%
in 5% increments.

In addition, as discussed above, there are two motivational systems in the pursuit of self-preservation: promotion (or approach) and prevention (or avoidance). This study hypothesized that different types of avatar customization (i.e., desired avatar customization or actual avatar customization) would influence users’ sense of self-preservation by activating different motivation systems. Therefore, promotion-focused self-preservation (e.g., “I feel the need to jog on a regular basis for the sake of my health”; “I feel the need to go to the gym to exercise on a regular basis for the sake of my health”) and prevention-focused self-preservation (e.g., “I feel the need not to smoke for the sake of my health”; “I feel the need not to drink for the sake of my health”) were assessed on a 1-7 scale, with 1 representing not at all likely and 7 representing very much likely.

Furthermore, in order to create more valid measures for users’ sense of self-preservation, this study attempted to measure their actual behaviors by asking participants to select coupons that are related to health services and products. Six coupons related to health services or products were created: three coupons were considered to be healthy (e.g., 20% off of a local fitness center membership, 20% off when purchasing organic foods, and 20% off at GNC) and the other three coupons were considered to be unhealthy (e.g., 20% off indoor tanning services, 20% off of a McDonald’s burger and soda, and 20% off when purchasing beer at local bottle shop). (see Figure 13).
Figure 13. Examples of coupons

Visualization of ideal body. To measure visualization of ideal body, study participants were directly asked how vividly they see their ideal body and how deeply they feel about their ideal body on a 1-7 scale, with 1 representing not at all vividly (deeply) and 10 representing very vividly (deeply). The ratings across these 2 items were averaged to yield the “visualization of ideal body” index (Cronbach’s $\alpha = .87$).

Perceived risk to physical body. The dependent measure of perceived risk to individuals’ physical bodies was assessed on a 1-7 scale, with 1 representing strongly disagree and 10 representing strongly agree. One item from Witte’s (1998) scale was modified for this study: I am at risk for (specific health topic). For this study, 3 appearance-related health topics (e.g., skin cancer, eating disorder, and obesity) and 3 non-appearance related health topics (e.g., depression, blood pressure, and skin cancer) were used. For example, “I am at risk for eating disorder,” or “I am at risk for skin cancer.” In addition, one item asked: “How likely do you think you will develop (specific health issue) in the future?”

Additionally, five items were created for this study (e.g., “I am concerned about having a good physique”; “I think I am in danger of becoming physically unattractive”). These items were measured using a 1-7 scale, ranging from strongly disagree to strongly agree. The ratings across
five items were averaged to yield the “perceived risk to general physical body” index (Cronbach’s α = .70).

**Control variables**

*Body Satisfaction.* To measure participants’ body and face satisfaction, a modified version of the Body Esteem Scale (BES) (Franzoi & Shields, 1984) and the Body Rating Scale (Stunkard, Sorensen, & Schulsinger, 1983) were used. Before the main experiment, participants were asked to indicate how they felt about each part of their own body (e.g., head, eyes, lips, chin, shoulders, or arms) using a 1-5 scale, with 1 representing “have strong negative feelings,” 2 representing “have moderate negative feelings,” 3 representing “have no feeling one way or the other,” 4 representing “have moderate positive feelings,” and 5 representing “have strong positive feelings.” Then, to measure participants’ body discrepancy between their actual features and their desired features, Stunkard, Sorensen, and Schulsinger’s (1983) pictorial diagram was used, and participants were asked to indicate their answers by selecting the number associated with the drawing that looks most like their own figures and the drawing that participants most want to look like (Cohn & Adler, 1992) on a 1-9 figure scale, ranging from 1 associated with a very thin figure to 9 associated with a very overweight figure (see Appendix B).

*Familiarity with Second Life and Virtual Environment.* Participants were asked to answer whether they were familiar with Second Life, other virtual game use (e.g., There.com, Sims online, or any virtual environments), or online avatars using a 0-9 scale, with 0 representing no experience at all and 9 representing very experienced. In addition, demographic information, such as gender and race were measured at the end of the study.
Identification with Avatar. Identification has often been measured by the degree of similarity with “me.” However, because this study starts with avatar creation as a way of presenting self, it is necessary to rule out certain items, such as “how much do you think the avatar looks like me?” Therefore, we asked participants more directly about their sense of identification with their avatars (e.g., “I identified with my avatar”) on a 1-7 scale, with 1 representing not at all and 7 representing very much.

Involvement. Adapted from Kalyanaraman and Sundar’s study (2006), four items were measured for perceived involvement (e.g., “I got emotionally involved in the interaction with the virtual agent in Second Life,” “I paid a great deal of attention when having an interaction with a virtual agent in Second Life,” “I got involved with the information and content that the virtual agent provided,” and “I found myself responding strongly to the interaction with the virtual agent.”) on a 1-7 scale, with 1 representing not at all and 7 representing very much.

Virtual interaction time. Using the software Silverback, participants’ web activities were recorded, and the total amount of time that participants spent on the virtual interaction was recorded.

Index construction and preparation for data analysis

Sense of self-preservation. An exploratory factor analysis was conducted upon the fourteen items relating to sense of self-preservation, yielding three factors accounting for 47 percent of the variance. Pursuant to rotation, six items (e.g., “I feel the need to protect my body”; “I feel the need to take care of my health.”) loaded under the first factor, labeled “General sense of self-preservation.” This item exhibited a high degree of internal consistency (Cronbach’s α = .90). Four items (e.g., “I feel the need to change my lifestyle to maintain good health”; “I feel the need not to smoke for the sake of my health.”) loaded under the second factor labeled
“Prevention-focused sense of self-preservation” (Cronbach’s $\alpha = .48^3$). Lastly, three items (e.g., “I feel the need to jog on a regular basis for the sake of my health”; “I feel the need to see a doctor to check my body condition on a regular basis for the sake of my health”) loaded under the third factor labeled “Promotion-focused sense of self-preservation” (Cronbach’s $\alpha = .59$) (see Appendix B). Two additional questions asking the percentage of time and money that participants spent in order to maintain good health (e.g., doing exercise or going to see a doctor) were used as two factors independently since these items were measured using different rating scales. They were labeled “sense of self-preservation (time)” and “sense of self-preservation (money),” respectively. Finally, the behavioral measure of sense of self-preservation through coupon selection was coded, yielding an index by subtracting the number of selected unhealthy coupons from the number of selected healthy coupons. For example, if a participant selected two healthy coupons and one unhealthy coupon, then his/her score on this measure would be 1. Therefore, a positive number indicated that the participant picked more healthy coupons than unhealthy coupons whereas a negative number indicated that the participant picked more unhealthy coupons than healthy coupons.

*Perceived Risk to physical body.* Reliabilities between two items [e.g., “I am at risk for (health issue) and how likely do you think you will develop (specific health issue) in the future?”] for each topic were high (Cronbach’s $\alpha = .86$ for skin cancer, .89 for eating disorder, .82 for obesity, .89 for depression, .76 for blood pressure, and .86 for skin cancer). Then, the ratings across the six items for the three appearance-related health topics were standardized and averaged to yield the perceived risk to appearance-related physical body index (Cronbach’s $\alpha$

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3 Since the internal consistency of this factor was quite low, follow-up analyses using each individual item were conducted.
= .86), and the ratings across six items for three non-appearance related health topics were standardized and averaged to yield the “perceived risk to non-appearance related physical body” index (Cronbach’s α = .80).

**Face Satisfaction and Body Satisfaction.** Participants’ ratings across their own facial parts (face, head, eyes, nose, lips, teeth, ears, cheeks/cheekbones, and chin) were averaged to yield face satisfaction index (Cronbach’s α = .82) and the ratings across their own body parts (weight, height, figure/physique, skin tone, hair, shoulders, arms, hands, chest/breast, waist, buttock, hips, thighs, legs, feet, and body hair) were averaged to yield body satisfaction index (Cronbach’s α = .82). Overall, the mean score for participants’ face satisfaction and body satisfaction was 3.69 (SD = 0.57) and 3.42 (SD = 0.52), respectively.

**Body Discrepancy.** To yield the body discrepancy index, the number which users selected for their ideal figures was subtracted from the number which they selected for their current figures. For example, if a given participant selected 6 for their current figure and 3 for their ideal figure, then his/her body discrepancy rating is 3. Therefore, a positive number indicated that the participant wanted to be thinner, while a negative number indicated that the participant wanted to be heavier. In addition, a high number indicated that the participant felt a high degree of body discrepancy. Overall, the mean score for participants’ body discrepancy was 0.72 (SD = .94).

Participants’ responses to the dependent variables (e.g., sense of presence, sense of presence, sense of self-preservation, visualization of their ideal body, and perceived risk to their physical body) and the control variables (e.g., body satisfaction, familiarity with Second Life and virtual environments, identification with avatar, involvement, and virtual interaction time) were imported into JMP 6.0.2 software on a Microsoft Windows computer to perform all the analyses.
Results

Preliminary Analysis

Participants

A total of 95 students participated in this study. The majority of the participants were female (n = 69). Fifty-eight percent of participants were juniors followed by seniors (22%) and sophomores (19%). In addition, ninety-two percent self-identified as White/Caucasian, the rest were Asians/Pacific Islanders (4%), African Americans (2%), Hispanic/Latino (1%), or other (1% unidentified). Participants reported having little previous experience in virtual environments, specifically Second Life (M = 0.3 on a 10-point scale, anchored at 0 = no experience at all and 9 = very experienced), There (M = 0.03 on a 10-point scale), Sims (M = 2 on a 10-point scale). They reported moderate experience in virtual environments involving gaming (M = 4 on a 10-point scale), moderate experience in interacting with online avatars, e.g., virtual avatars in Wii, Playstation, or chat room (M = 3.1 on a 10-point scale) and little experience in creating avatars (M = 1.97 on a 10-point scale). In addition, participants reported that they spent, on average, approximately one hour per week in virtual worlds (M = 68 minutes). As stated above, participants reported having moderately positive feelings about their face (M = 3.69, on a 1-5 scale) and body (M = 3.42). In addition, they reported feeling little body discrepancy, but the majority wanted to be thinner (M = 0.72^4).

Manipulation Check

^4 The number was obtained by subtracting the number the individual selected for his/her ideal figure from the number he/she selected for his/her current figure (see section ‘body satisfaction in method chapter, p.47)
To check the effectiveness of the manipulation for avatar customization, avatar customizers were asked to rate the degree of similarity between their avatars and their ideal/desired selves, on five scaled items (listed in Appendix B). The result showed that the perceived ideal appearance similarities were rated significantly higher in the desired avatar customization condition ($M = 4.95, SD = 1.01$) than in the actual avatar customization condition ($M = 3.55, SD = 1.31$), $t (42) = 3.93, p < .01$. In addition, to check for the effectiveness of the avatars’ attractiveness, participants’ ratings of perceived attractiveness for their avatars were entered into a simple t-test. The results showed that participants who were assigned attractive avatars rated their avatars to be significantly more socially desirable ($M = 4.18, SD = 1.66$), attractive to others ($M = 4.90, SD = 1.58$), and attractive to themselves ($M = 4.25, SD = 1.71$) than participants who were assigned unattractive avatars ($M = 2.37; t (25) = 3.28, p < .01, M = 2.37; t (25) = 4.55, p < .01$, and $M = 2.18; t (49) = 5.42, p < .01$, respectively). Furthermore, to see how avatar customizers perceived their avatars in terms of attractiveness, avatar customizers’ ratings of perceived attractiveness were entered into a simple t-test. The results showed that participants in the desired avatar customization condition rated their avatars to be more socially desirable ($M = 6.25, SD = 0.75$), attractive to others ($M = 6.08, SD = 0.67$), and attractive to themselves ($M = 5.89, SD = 1.03$) than participants in the actual avatar customization condition ($M = 4.79; t (24) = 3.54, p < .01, M = 4.71; t (24) = 3.65, p < .01$, and $M = 4.11; t (42) = 4.46, p < .01$, respectively). Overall, these results showed that avatar customization of actual vs. desired selves in the two customization conditions, and the attractiveness of assigned avatars in the two non-customization conditions were successfully manipulated.

Data Analysis Plan
Although this study has four avatar groups (a desired avatar customization condition (CD), an actual avatar customization condition (CA), an assigned attractive avatar condition (AA), and an assigned unattractive avatar condition (AU)), most of the hypothesis testing was performed using a simple two-group comparison. First, to test for the simple effects of avatar customization (IV) on avatar customizers’ sense of self-preservation (DV), the CA and CD groups were combined into one group called the avatar customization group (C). Also, the AA and AU groups were combined into another group called the avatar non-customization group (A). Then, controlling for body discrepancy\(^5\), a multivariate analysis of covariance (MANCOVA) was performed on several measures of self-preservation (H1). Second, a mediation analysis was conducted to examine how avatar customization would affect avatar customizers’ sense of self-preservation through their sense of agency and/or sense of self-presence, which served as mediators (H2a and H2b). To do this, Baron and Kenny’s (1986) causal steps and bootstrapping procedures (Preacher & Hayes, 2004, 2008) were used. Third, similar to the second analyses, using only the avatar customization groups (CA and CD) as an independent variable, mediation analyses were performed to examine how two types of self-created avatars would enhance avatar creators’ sense of self-preservation via different mechanisms (H3a and H3b). Before conducting mediation analyses, we performed exploratory factor analysis, putting all items of sense of agency and sense of self-presence measures together. The result showed that most agency items loaded with each other, and distinctly from sense of self-presence items, which also tended to load with each other, and that there were no other systematic patterns among factors to suggest

\(^5\) None of the control variables, except body discrepancy, was significant. Therefore, only body discrepancy was used as a covariate and was controlled for in the main analysis.
that particular aspects of questions (e.g., health vs. non-health-related questions) were psychometrically pertinent.

**Hypotheses tests**

*The effect of avatar customization on avatar customizers’ sense of self-preservation*

H1 predicted that participants who customized their avatars would show a higher sense of self-preservation than participants who were assigned avatars (see Figure 14).

![Figure 14](image)

*Figure 14.* Hypotheses (H1, H2a, and H2b) model I.

Since there were highly related measures of sense of self-preservation, a multivariate analysis of covariate (MANCOVA) was employed. Zero-order correlations for sense of self-preservation measures are presented in Table 1.

<table>
<thead>
<tr>
<th>1. General sense of self-preservation</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<td>1.00</td>
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</table>
This analysis demonstrates that when controlling for body discrepancy, avatar customization had a significant multivariate effect, Wilks’ $\Lambda = .83$, $F(6, 85) = 2.88$, $p < .05$, $\eta^2_p = .17$, with significant univariate effects obtained for sense of self-preservation (time), $F(1, 90) = 4.99$, $p < .05$, $\eta^2_p = .05$, and for coupon selection, $F(1, 90) = 7.97$, $p < .01$, $\eta^2_p = .08$. These results indicate that as hypothesized, participants who customized their avatars said that they would devote a significantly higher percentage of their time to maintaining their good health ($M = 50.5$ on 0-100% scale) as compared to participants who were assigned avatars ($M = 39.8$ on 0-100% scale). However, the behavioural measure using coupons revealed that participants who customized their avatars selected a higher number of coupons for unhealthy products/services ($M = -0.51^6$) than participants who were assigned avatars ($M = 0.17$) (see Table 4). Overall, H1 was partially supported.

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6 The number was yielded by subtracting the number of coupons for unhealthy products/services from the number of coupons for healthy products/services. Therefore, a negative number indicates that the individual selected coupons for unhealthy products/services more than coupons for healthy products/services, while a positive number indicates that the individual selected coupons for healthy products/services more than coupons for unhealthy products/services.
Table 2.

*Participants’ sense of self-preservation responses as a function of avatar customization.*

<table>
<thead>
<tr>
<th>Avatar customization</th>
<th>Univariate F</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customization</strong></td>
<td>*<em>Non-</em></td>
<td></td>
</tr>
<tr>
<td><strong>M (SD)</strong></td>
<td><strong>M (SD)</strong></td>
<td></td>
</tr>
<tr>
<td>General sense of self-preservation</td>
<td>5.93 (.66)</td>
<td>5.86 (.96)</td>
</tr>
<tr>
<td>Prevention-focused sense of self-preservation</td>
<td>4.22 (1.03)</td>
<td>4.24 (1.18)</td>
</tr>
<tr>
<td>Promotion-focused sense of self-preservation</td>
<td>5.00 (1.11)</td>
<td>4.73 (1.43)</td>
</tr>
<tr>
<td>Sense of self-preservation (time)</td>
<td>50.45 (23.10)</td>
<td>39.80 (22.84)</td>
</tr>
<tr>
<td>Sense of self-preservation (money)</td>
<td>36.93 (20.44)</td>
<td>36.22 (22.37)</td>
</tr>
</tbody>
</table>

*Behavioral measure of sense of self-preservation*

<table>
<thead>
<tr>
<th></th>
<th>Univariate F</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coupon selection</strong></td>
<td><strong>.52 (1.21)</strong></td>
<td><strong>.18 (1.24)</strong></td>
</tr>
</tbody>
</table>

Multivariate: Wilks’ $\Lambda = .83$, $F (6, 85) = 2.88, p < .05, \eta_p^2 = .17$.

* $p < .05$; ** $p < .01$.

*Mediation Analyses*

In this study, we argue that customizing avatars as an act of self-representation allows individuals to see their representations from a third-person perspective and feel agency while controlling their avatars. These feelings, in turn, would enhance avatar customizers’ sense of self.
preservation. Therefore, it was hypothesized that sense of self-presence and/or sense of agency enhanced by avatar customization would mediate the relationship between avatar customization and avatar customizers’ sense of self-preservation (H2a and H2b). To examine this mediation, two methods of analysis were employed. For the first analyses, we performed a series of regressions, following Baron and Kenny’s (1986) causal steps approach. Since we found significant effects for avatar customization on sense of self-preservation (time) and coupon measure, these two measures were employed as the dependent variables in the analysis, which satisfied the first step of Baron and Kenny’s mediation analysis. For the second step, the avatar customization group (IV) was used as the predictor of sense of self-presence and sense of agency (the mediators). Then, these two mediators were employed as the predictor of sense of self-preservation (dependent variable). Although the avatar customization group was found to be significant for both sense of self-presence (β = .23, p < .05) and sense of agency (β = .22, p < .05), we found that only sense of agency had a significant effect on sense of self-preservation (time) (β = .27, p < .05). Therefore, for the final step, we found that after controlling for sense of agency (mediator), the effect of avatar customization (IV) on sense of self-preservation (time) (DV) was reduced. The regression weights associated with these analyses shows that the sense of agency served as a partial mediator for sense of self-preservation (time). That is, avatar customizers felt a higher sense of self-presence (i.e., feeling of being aware of the self) and higher sense of agency (i.e., feeling of having control over something) than non-avatar customizers; nevertheless, sense of agency only partially mediated the relationship between avatar customization and avatar customizers’ sense of self-preservation (time).

The second set of mediation analyses employing bootstrapping procedures (Preacher & Hayes, 2004, 2008) were conducted to examine the multiple mediation model. Since this study
has a small sample size and tests multiple mediators, bootstrapping, particularly Bias-corrected bootstrapping (Briggs, 2006), is an appropriate method in terms of both power and Type 1 error (Williams and MacKinnon, 2008). To perform these analyses, an SPSS macro developed by Preacher and Hayes (available at http://www.comm.ohio-state.edu/ahayes/SPSS%20programs/indirect.htm) was used. The bootstrap estimates were based on 5,000 samples. The results showed that although the total indirect effect through a set of mediators (sense of self-presence and sense of self-agency) was not significant (i.e., Bias-corrected 95% CI shows that the difference between the total and direct effect of avatar customization on sense of self-preservation (time) is not different from zero), an examination of the specific indirect effects indicates that the sense of agency is a predictor of avatar customization on sense of self-preservation (time) since its 95% CI does not contain zero (see Table 3). Finally, two sets of mediation analyses showed that only the sense of agency mediated the relationship between avatar customization and sense of self-preservation.

Table 3.
*Indirect effects of avatar customization group on sense of self-preservation: bootstrapping mediation.*

<table>
<thead>
<tr>
<th>Sense of self-preservation (DV)</th>
<th>Point estimate</th>
<th>Product of coefficients</th>
<th>Bias-corrected 95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of self-preservation (time)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total indirect effect</td>
<td>2.28</td>
<td>1.69</td>
<td>-0.48</td>
</tr>
<tr>
<td>Indirect effect via sense of self-presence</td>
<td>.03</td>
<td>0.80</td>
<td>-1.92</td>
</tr>
<tr>
<td><strong>Indirect effect via sense of agency</strong></td>
<td><strong>2.25</strong></td>
<td><strong>1.54</strong></td>
<td><strong>.10</strong></td>
</tr>
</tbody>
</table>
Coupon selection

<table>
<thead>
<tr>
<th></th>
<th>Total indirect effect</th>
<th>Indirect effect via sense of self-presence</th>
<th>Indirect effect via sense of agency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
</tr>
<tr>
<td></td>
<td>.08</td>
<td>1.01</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>.79</td>
<td>-.12</td>
<td>-.01</td>
</tr>
<tr>
<td></td>
<td>-.08</td>
<td>.14</td>
<td>.28</td>
</tr>
<tr>
<td></td>
<td>.29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H3a predicted that desired avatar creators would show higher visualizations of their ideal body image, which would enhance the desired avatar creators’ sense of self-preservation. H3b predicted that actual avatar creators would show a higher perceived risk to their physical body image, which would enhance the actual avatar creators’ sense of self-preservation (see Figure 15).

Figure 15. Hypotheses (H3a and H3b) model II.

Before examining each prediction in H3a and H3b, it was necessary to confirm that there was no significant difference between the desired avatar customization group and the actual avatar customization group in terms of sense of self-preservation (time) and coupon selection, even though a significant effect of avatar customization on sense of self-preservation (time) and coupon selection (H1) was confirmed. Therefore, a MANCOVA was performed, which found
that when controlling for body discrepancy, the two different types of avatar customization had no significant effect, Wilks’ \( \Lambda = .96, F(2, 41) = 0.82, p = .45 \). This indicates that there was no difference between desired avatar customization and actual avatar customization in terms of sense of self-preservation (time) and coupon selection. Then, to examine H3a, an analysis of variance (ANOVA) was performed to see if there was a difference between desired avatar customization and actual customization on participants’ visualizations of their ideal body. The results indicate that participants who customized their avatars to look like their ideal images reported significantly higher scores on visualizing their ideal body (\( M = 4.84 \)) than participants who customized their avatars to look like their actual physical image (\( M = 3.44 \)), \( F(1, 42) = 10.52, p < .01 \). In order to examine the relationship between participants’ ideal body visualization and their sense of self-preservation (time) and coupon selection, a linear regression was performed. This analysis demonstrated that ideal body visualization had no significant effect on either sense of self-preservation (time) (\( \beta = .21, p = .19 \)) or coupon selection (\( \beta = .01, p = .94 \)). Therefore, it was shown that ideal body visualization did not predict sense of self-preservation. A mediation analysis using the bootstrapping method also revealed that visualization of ideal body did not serve as a predictor of avatar customizers’ sense of self-preservation (time) or coupon selection.

To test H3b, which predicts that actual avatar customizers would perceive risk to their physical body more than desired actual avatar customizers, a multivariate analysis of variance (MANOVA) was performed first since there were three factors for perceived risk that are highly related. Zero-order correlations for the perceived risk to physical body measures are presented in Table 4.
Table 4.
Zero-order correlations for perceived risk to physical body measures.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General physical body</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Appearance-related physical body</td>
<td>.58**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>3. Non-appearance related physical body</td>
<td>.63**</td>
<td>.57**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note:* **Correlation is significant at $p < .01$

This analysis showed a significant multivariate effect of the two different types of avatar customization, Wilks’ $\Lambda = .72, F (3, 37) = 4.81, p < .05, \eta^2_p = .28$, with a significant univariate effect for perceived risk to general physical body, $F (1, 39) = 5.58, p < .05, \eta^2_p = .13$ (See Table 5).

Table 5.
Participants’ perceived risk to physical body responses as a function of type of avatar customization.

<table>
<thead>
<tr>
<th>Type of avatar customization</th>
<th>Desired avatar customization M (SD)</th>
<th>Actual avatar customization M (SD)</th>
<th>Univariate $F$</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived risk to physical body</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General physical body</td>
<td>3.35 (0.80)</td>
<td>3.96 (0.85)</td>
<td>5.58*</td>
<td>.13</td>
</tr>
<tr>
<td>Appearance-related physical body</td>
<td>3.00 (1.63)</td>
<td>3.36 (1.46)</td>
<td>.58</td>
<td>.02</td>
</tr>
<tr>
<td>Non-appearance related physical body</td>
<td>5.01 (1.98)</td>
<td>5.09 (1.46)</td>
<td>.02</td>
<td>.00</td>
</tr>
</tbody>
</table>

Wilks’ $\Lambda = .72, F (1, 39) = 4.81, p < .05, \eta^2_p = .28, *p < .05$

In order to examine the relationship between perceived risk to general physical body and
sense of self-preservation (time) and coupon selection, a linear regression was performed. The analysis demonstrated that perceived risk to general physical body had a marginal effect on sense of self-preservation (time) only ($\beta = -0.29$, $p = 0.06$), but in a direction that is opposite of what we hypothesized. That is, the higher participants perceived the risk to their general physical body, the less amount of time they reported to maintaining their good health. For the next step, to examine the overall indirect effect of the two different types of avatar customization (IV) on sense of self-preservation (time) (DV) through perceived risk to general physical body (mediator), a bootstrapping procedure (5,000 samples) was employed through a series of regressions. This analysis showed a significant relationship between both the IV and the mediator ($\beta = -0.35$, $p < 0.05$) and between the mediator and the DV ($\beta = -0.29$, $p < 0.10$).

Overall, this bootstrapping method using AMOS revealed that participants’ perceived risk to their general physical body served as a mediator for the type of avatar customization (desired avatar customization vs. actual avatar customization) on sense of self-preservation (time) (bias-corrected 95% confidence interval did not contain zero), but in a direction counter to prediction (see Figure 16). This is consistent with the findings from the linear regression.

Figure 16. Mediation model.
Note 1. Numbers reflect standardized regression coefficients. The number in parentheses reflects the standardized regression coefficient in the absence of the mediating variables. $^+ p < .10$, $^* p < .05$. 

Note 2. Type of avatar customization was coded as a dichotomous variable with 0 = Actual avatar customization and 1 = Desired avatar customization

**Summary of results from hypothesis tests**

This study found that avatar customizers reported wanting to spend a higher percentage of their time to preserving their wellbeing than non-avatar customizers. H1, which predicted that avatar customizers would show a higher sense of self-preservation than non-avatar customizers, was supported. However, when we offered coupons, interestingly, avatar customizers were more likely to pick coupons for unhealthy products/services than non-avatar customizers. This discrepancy between self-reported and behavioral measures of self-preservation will be discussed in the next chapter.

We argued that avatar customization would allow users to feel a higher sense of self-presence by observing the self from a third-person perspective and/or feel a higher sense of agency by exerting control over their avatars in the process of customization, and that these feelings would mediate the relationship between avatar customization and sense of self-preservation. Although a series of regressions demonstrated that avatar customization had a significant effect on both sense of self-presence and sense of agency, the two sets of mediation analyses revealed that sense of agency partially mediated the relationship between customization and sense of self-preservation, whereas sense of self-presence did not.

As an extension of H1, we examined the effects of two types of avatar customization on sense of self-preservation in detail and attempted to reveal the psychological mechanisms behind
them. Avatar customizers, both for participants who customized their avatars to look like their ideal images (i.e., desired avatar customizers) and for participants who customized their avatars to look like their current image (i.e., actual avatar customizers), were predicted to report similar responses for sense of self-preservation. The results supported this prediction by showing no significant difference between desired avatar customization and actual customization in terms of self-preservation (for both the self-reported measure and the behavioral measure). However, the reasons for their respective contributions to self-preservation were hypothesized as being different—it was hypothesized that the relationship between the desired avatar customizers and their sense of self-preservation would be mediated by their visualizations of their ideal body, while the relationship between the actual avatar customizers and their sense of self-preservation would be mediated by their perceived risk to their physical body. The findings showed that desired avatar customization enhanced feelings of ideal visualization more so than actual avatar customization, while actual avatar customization enhanced feelings of perceived risk to general physical body more so than desired avatar customization. However, the indirect effects test using bootstrapping revealed that only perceived risk to one’s general physical body functioned as a significant mediator to predict participants’ sense of self-preservation, but the direction was opposite to what we hypothesized.

**Exploratory analysis**

In addition to the hypotheses tests, we performed supplemental analyses involving all four conditions in order to test competing theoretical propositions about the key factor underlying one’s avatar (attractive appearance versus own-ness/agency) that is instrumental in
shaping avatar users’ psychological and behavioral consequences.

Participants’ perceived attractiveness toward their avatars by employing three items (e.g., “My avatar is socially desirable,” “My avatar will be attractive to others,” and “My avatar looks attractive to me.”). Results showed that for these three items of perceived attractiveness, participants exhibited exactly the same patterns. As Table 6 illustrates, participants rated their self-created avatars that looked like their ideal images as the most attractive followed by self-created avatars that looked like their current image and assigned attractive avatars.

Table 6.
Perceived attractiveness of avatars across conditions.

<table>
<thead>
<tr>
<th>Perceived Attractiveness</th>
<th>Customized Avatar</th>
<th>Assigned Avatar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self-created</td>
<td>Assigned</td>
</tr>
<tr>
<td></td>
<td>desired avatar</td>
<td>attractive avatar</td>
</tr>
<tr>
<td>Socially attractive</td>
<td>6.25_a (.75)</td>
<td>4.19_b (1.66)</td>
</tr>
<tr>
<td>Attractive to others</td>
<td>6.08_a (.67)</td>
<td>4.91_b (1.58)</td>
</tr>
<tr>
<td>Attractive to me</td>
<td>5.89_a (2.01)</td>
<td>4.26_b (1.90)</td>
</tr>
</tbody>
</table>

Wilks’ $\Lambda = .22, F (9, 115) = 11.20, p < .001, \eta^2_p = .40.$

Note 1. Means within the same raw associated with different subscripts differ at $p < .01$ using stepwise Bonferroni post hoc procedures.

Note 2. All items were recorded on scales ranging from 1 to 7.

Additionally, they rated the assigned unattractive avatars as least attractive. It is noteworthy that there was no difference between participants who customized their avatars to look like their actual images and participants who were assigned attractive avatars in terms of the
avatars’ perceived attractiveness. In general, these two groups were significantly lower in terms of the perceived attractiveness of their avatars than those participants who customized their avatars to look like their desired selves; however, they were significantly higher than participants who were assigned unattractive avatars.

Both the behavior confirmation theory and the Proteus effect basically assume that the physical attractiveness of an individual (or of that individual’s avatar) makes that person believe that the confederate perceives him/her to be attractive. Whether the confederate’s perception really develops that way (behaviour confirmation theory) or merely occurs in the individuals mind (the Proteus effect), it drives that person’s behaviors. Therefore, to test if the avatar’s physical attractiveness really causes the participant to think a confederate would perceive him/her to be attractive, we first combined the actual avatar customization group and the assigned attractive avatar group, which showed similar responses on perceived attractiveness of their avatars, and labeled them “the moderately attractive group.” The desired avatar group was labeled “the highly attractive group,” and the assigned unattractive avatar group was labeled “the low attractive group.” Then, we performed a one-way ANOVA and found that there was no significant difference among the highly attractive group ($M = 4.0$ on 1-7 scale), the moderately attractive group ($M = 3.69$), and the low attractive group ($M = 3.56$) in terms of how attractive they thought the confederate would perceive them $^7$ ($F(2, 25) = 0.36, p = .70$).

Furthermore, we performed a MANOVA to test if there was a relationship between the avatar’s physical attractiveness and the sense of self-preservation measures. The analysis demonstrated that the avatar’s physical attractiveness did not have a significant multivariate

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$^7$ It was measured by asking the question “During the interaction, I felt that the CDC agent perceived me as attractive” on a 1-7 scale, ranging from strongly disagree to strongly agree.
effect, Wilks’ Λ = .82, $F (12, 172) = 1.49$, $p = .13$. Therefore, this analysis failed to show that the avatar’s physical attractiveness is a key factor underlying users’ sense of self-preservation.

We then decided to compare each pair of groups (original groups of this study: CA, CD, AA, and AU) in terms of their means on self-preservation measures. If the Proteus effect (which proposes that an avatar’s physical attractiveness is key for influencing user behavior) is correct, we would expect that the self-created actual avatar group and the assigned attractive avatar group would show no difference in terms of their sense of self-preservation since there was no difference between the two groups regarding their avatars’ perceived attractiveness. However, as Table 7 illustrates, the results showed that there was a significant difference between the self-created avatar group and the assigned attractive avatar group in terms of their sense of self-preservation (time).

Table 7. 
*Responses for the sense of self-preservation measures across conditions.*

<table>
<thead>
<tr>
<th>Sense of self-preservation</th>
<th>Customized Avatar</th>
<th>Assigned Avatar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M (SD)$</td>
<td>$M (SD)$</td>
</tr>
<tr>
<td>General</td>
<td>6.04$_a$ (.65)</td>
<td>5.82$_a$ (.67)</td>
</tr>
<tr>
<td>Prevention-focused</td>
<td>4.35a (1.07)</td>
<td>4.10$_a$ (1.00)</td>
</tr>
<tr>
<td>Promotion-focused</td>
<td>4.97a (1.25)</td>
<td>5.03$_a$ (1.00)</td>
</tr>
<tr>
<td>Time$^a$</td>
<td>46.43$_{ab}$ (21.40)</td>
<td>54.13$_a$ (24.43)</td>
</tr>
<tr>
<td>Money$^a$</td>
<td>34.52$_a$ (18.63)</td>
<td>39.13$_a$ (22.14)</td>
</tr>
<tr>
<td>Coupon selection$^b$</td>
<td>-.67$_b$ (1.24)</td>
<td>-.39$_b$ (1.20)</td>
</tr>
</tbody>
</table>
Wilks’ Λ = .72, \( F (18, 244) = 1.66, p < .05, \eta_p^2 = .11. \)

Note 1. Means within the same raw associated with different subscripts differ at \( p < .05 \) using stepwise Bonferroni post hoc procedures.

Note 2. \(^a\) was recorded on scales ranging from 0 to 100 in 5% increment. \(^b\) was scored by subtracting the number of selected coupons for healthy products/services from the number of selected coupons for unhealthy products/services. All other measures were recorded on scales ranging from 1 to 7.

Additionally, we analyzed the responses for the sense of agency measures across conditions. As you can see in Table 7, the hierarchy of means for the four conditions was identical to the pattern noticed for the sense of self-preservation (time) in Table 8, with the highest mean in the Self-created actual avatar condition and lowest mean in the Assigned avatar condition.

Table 8.

<table>
<thead>
<tr>
<th></th>
<th>Customized Avatar</th>
<th>Assigned Avatar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-created desired</td>
<td>Agency</td>
<td>Assigned</td>
</tr>
<tr>
<td>avatar</td>
<td></td>
<td>avatar</td>
</tr>
<tr>
<td></td>
<td>M (SE)</td>
<td>M (SE)</td>
</tr>
<tr>
<td></td>
<td>5.45(^a) (.15)</td>
<td>5.51(^a) (.16)</td>
</tr>
<tr>
<td>Self-created actual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>avatar</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M (SE)</td>
<td>M (SE)</td>
</tr>
<tr>
<td></td>
<td>5.99(^b) (.14)</td>
<td>5.36(^ab) (.13)</td>
</tr>
</tbody>
</table>

Note 1. Means within the same row but with different subscripts differ at \( p < .05 \) using stepwise Bonferroni post-hoc procedures.

Note 2. All items were recorded on scales ranging from 1 to 7.

Together, these analyses indicate that agency is more likely than attractiveness in determining avatar effects on self-preservation.
**Significant effects of control variable**

In the ANCOVA analysis reported above, significant positive effects were found for body discrepancy on prevention-focused sense of self-preservation \((F(1, 90) = 4.01, p < .05)\) and coupon selection \((F(1, 90) = 6.69, p < .05)\). This means the larger the discrepancy felt between actual and ideal body, the higher the motivation to be involved in prevention-focused self-preserving behavior, and the more likely they were to pick coupons for healthy products/services over those for unhealthy products.

**Motivator of health behavior**

As may be recalled from our tests of H3a and H3b, perceived risk and visualization of ideal body were tested above as predictors of avatar customizers’ health behaviors. We found that perceived risk to general physical body mediated the relationship between the type of avatar customization (actual avatar customization vs. desired avatar customization) and sense of self-preservation (time). However, a linear regression between perceived risk and sense of self-preservation (time) disconfirmed our hypothesis. That is, it demonstrated that the higher participants perceived the risk to their general physical body to be, the lesser the amount of time they said they would devote to maintaining good health. To explore reasons behind this negative relationship, we examined the mediating role of “efficacy” between perceived risk and sense of self-preservation (time).

Efficacy was measured by asking participants to rate their perceived capabilities in dealing with three appearance-related health topics (e.g., skin cancer, eating disorder, and obesity) and three non-appearance related health topics (e.g., depression, blood pressure, and skin cancer) on a 1-7 scale, with 1 representing *not at all* and 7 representing *very much*. For example, we
asked participants “If you were to develop obesity, how capable do you feel about dealing with it?” The ratings across the six items were standardized and averaged to yield the “efficacy” index (Cronbach’s α = .85).

For the mediation analysis, the path analytic technique using AMOS was used. As Figure 17 indicates, the type of avatar customization (IV) was negatively related to perceived risk (i.e., desired avatar less likely than actual avatar to cause risk) to general physical body (mediator 1), mediator 1 was negatively related to efficacy (mediator 2), and mediator 2 was positively related to sense of self-preservation (time) (DV).

![Figure 17. Path model.](image)

*Note 1.* Numbers reflect standardized regression coefficients. †p < .10, *p < .05, **p < .01

*Note 2.* Type of avatar customization was coded as a dichotomous variable with 0 = Actual avatar customization and 1 = Desired avatar customization.

Our next set of analyses examined the direct effect of avatar customization alongside the direct effect of avatar attractiveness in addition to measuring their combined (i.e., interaction) effect. We used a 2 (avatar customization; customization vs. non-customization) X 2 (avatar’s physical attractiveness; attractive vs. unattractive) between-subjects fully-crossed factorial analysis. In preparation for this analysis, desired avatar customization group was categorized as customized *attractive* group while actual avatar customization group was categorized as customized *unattractive* group, given that desired avatar customizers perceived their avatars to be more attractive than actual avatar customizers. Sense of agency, sense of self-presence,
visualization of ideal body, and perceived risk to physical body were analyzed as multiple mediators.

First, a MANOVA was performed to test for the main effects of avatar customization (IV1) and avatar’s physical attractiveness (IV2) and their interaction effect on six indicators (DVs) of participants’ sense of self-preservation (general, prevention-focused, promotion-focused, time, money, and coupon). The analysis showed a significant multivariate effect of IV1, Wilks’ Λ = .84, $F(6, 86) = 3.10, p < .05, \eta^2_p = .17$, with significant univariate effects for sense of self-preservation (time), $F(1, 91) = 4.35, p < .05$, and for sense of self-preservation (coupon), $F(1, 91) = 8.08, p < .01$. Next, we performed several ANOVAs to examine the relationship between the IVs and the mediators. The results showed a significant main effect of IV1 (avatar customization) on sense of agency ($F(1, 82) = 4.63, p < .05$), sense of self-presence ($F(1, 91) = 4.98, p < .05$), and visualization of ideal body ($F(1, 91) = 4.98, p < .05$). Those who customized their avatars reported higher sense of agency ($M = 5.48, SE = .11$), higher sense of self-presence ($M = 3.86, SE = .13$), and higher visualization of ideal body ($M = 4.19, SE = .22$) than those who did not customize their avatars ($M = 5.19, SE = .10; M = 3.48, SE = .12; M = 2.56, SE = .21$, respectively). The results also showed a significant main effect of IV2 (avatar’s physical attractiveness) on sense of self-presence ($F(1, 91) = 5.65, p < .05$) and visualization of ideal body ($F(1, 91) = 22.80, p < .001$). Those who entered the virtual world with attractive avatars reported higher sense of self-presence ($M = 3.88, SE = .13$) and higher visualization of ideal body ($M = 4.1, SE = .22$) than those who had unattractive avatars ($M = 3.47, SE = .12; M = 2.66, SE = .20$, respectively)\(^8\).

\(^8\) We also performed another MANOVA to investigate the relationship between the two IVs and three indices of perceived risk to physical body, but we did not find any significant main or interaction effects.
As a second step, we performed several linear regressions to ascertain the relationship between each of the mediators and DV indices pertaining to sense of self-preservation, but found no significant effects except for the effect of sense of agency on sense of self-preservation (time) ($\beta = .27, p < .05$). In the final step of this mediation analysis, we found that when we controlled for sense of agency (mediator), the effect of avatar customization (IV1) on sense of self-preservation (time) (DV) was reduced. The regression weights associated with these analyses shows that only sense of agency served as a significant, even if partial, mediator for sense of self-preservation (time). This finding is consistent with the result of H2b, which showed that sense of agency mediated the relationship between avatar customization and avatar creators’ sense of self-preservation (time).

We also employed bias-corrected bootstrapping with 5,000 samples using Preacher and Hayes (2008)’s SPSS macro, putting six variables (sense of agency, sense of self-presence, visualization of ideal body, and three factors of perceived risk to physical body) as multiple mediators of the relationship between each IV (avatar customization/ avatar’s physical attractiveness) and sense of self-preservation (time). The results showed that only the visualization of ideal body mediated the relationship between the avatar’s physical attractiveness and sense of self-preservation (time) (i.e., the visualization of ideal body is a predictor of attractive avatar on sense of self-preservation (time) since its 95% CI does not contain zero) (see Table 9).
Table 9.

*Indirect effects of avatar customization on sense of self-preservation: bootstrapping mediation.*

<table>
<thead>
<tr>
<th>Sense of self-preservation (DV)</th>
<th>Point estimate</th>
<th>Product of coefficients</th>
<th>Bias-corrected 95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SE</td>
<td>Z</td>
</tr>
<tr>
<td>Sense of self-preservation (time)</td>
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</tr>
<tr>
<td>Total indirect effect</td>
<td>4.96</td>
<td>3.73</td>
<td>1.33</td>
</tr>
<tr>
<td>Indirect effect via sense of self-presence</td>
<td>.52</td>
<td>1.07</td>
<td>.48</td>
</tr>
<tr>
<td>Indirect effect via sense of agency</td>
<td>1.61</td>
<td>1.29</td>
<td>1.25</td>
</tr>
<tr>
<td>Indirect effect via visualization of ideal body</td>
<td>1.96</td>
<td>3.41</td>
<td>.57</td>
</tr>
<tr>
<td>Indirect effect via perceived risk to general physical body</td>
<td>.83</td>
<td>1.36</td>
<td>.61</td>
</tr>
<tr>
<td>Indirect effect via perceived risk to body related physical body</td>
<td>-.15</td>
<td>-.06</td>
<td>.08</td>
</tr>
<tr>
<td>Indirect effect via perceived risk to non-body related physical body</td>
<td>.19</td>
<td>.29</td>
<td>.11</td>
</tr>
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</table>

*Indirect effects of avatar’s physical attractiveness on sense of self-preservation: bootstrapping mediation.*

<table>
<thead>
<tr>
<th>Sense of self-preservation (DV)</th>
<th>Point estimate</th>
<th>Product of coefficients</th>
<th>Bias-corrected 95% confidence interval</th>
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<tr>
<td></td>
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<td>SE</td>
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<tr>
<td>Sense of self-preservation (time)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total indirect effect</td>
<td>.30</td>
<td>3.18</td>
<td>.09</td>
</tr>
<tr>
<td>Indirect effect via sense of self-presence</td>
<td>.23</td>
<td>1.31</td>
<td>.18</td>
</tr>
<tr>
<td>Indirect effect via sense of agency</td>
<td>-1.41</td>
<td>1.23</td>
<td>-1.15</td>
</tr>
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</table>
Finally, zero-order correlations were examined between all of the continuous, measured variables. As illustrated in Table 10, we found a significant positive relationship between visualization of ideal body and sense of self-preservation (prevention-focused only; $\beta = .13$, $p < .05$) but a negative relationship between perceived risk and behavioral intentions to spend time on self-preservation.
### Table 10.

**Zero-order correlation between all of the continuous variables**

<table>
<thead>
<tr>
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<th>1</th>
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<tbody>
<tr>
<td>1. Agency</td>
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<td>2. Self-presence</td>
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<tr>
<td>3. Visualization of ideal body</td>
<td>.08</td>
<td>.65**</td>
<td>1.00</td>
<td></td>
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<tr>
<td>4. Perceived risk to appearance-related physical body</td>
<td>-.09</td>
<td>.06</td>
<td>.17</td>
<td>1.00</td>
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<tr>
<td>5. Perceived risk to non-appearance related physical body</td>
<td>-.18+</td>
<td>.26*</td>
<td>.31**</td>
<td>.58**</td>
<td>1.00</td>
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<tr>
<td>6. Perceived risk to general physical body</td>
<td>-.16</td>
<td>.18+</td>
<td>.18+</td>
<td>.63**</td>
<td>.57**</td>
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<td>7. Body discrepancy</td>
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<td>.09</td>
<td>.10</td>
<td>.34**</td>
<td>.12</td>
<td>.33**</td>
<td>1.00</td>
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<tr>
<td>8. Efficacy</td>
<td>.29**</td>
<td>.01</td>
<td>.03</td>
<td>-.23*</td>
<td>-.19</td>
<td>-.32**</td>
<td>-.37**</td>
<td>1.00</td>
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<tr>
<td>9. General sense of self-preservation</td>
<td>.24*</td>
<td>.02</td>
<td>.14</td>
<td>-.01</td>
<td>-.16</td>
<td>-.02</td>
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<td>.21*</td>
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<td></td>
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<tr>
<td>10. Prevention-focused sense of self-preservation</td>
<td>.10</td>
<td>.13</td>
<td>.21*</td>
<td>.06</td>
<td>.09</td>
<td>.15</td>
<td>.21</td>
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<td>1.00</td>
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<td>11. Promotion-focused sense of self-preservation</td>
<td>.30**</td>
<td>.08</td>
<td>.13</td>
<td>.04</td>
<td>-.20+</td>
<td>-.01</td>
<td>.02</td>
<td>.20+</td>
<td>.55**</td>
<td>.29**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Sense of self-preservation (time)</td>
<td>.24*</td>
<td>.09</td>
<td>.17</td>
<td>-.07</td>
<td>-.22*</td>
<td>-.24*</td>
<td>.06</td>
<td>.16</td>
<td>.40**</td>
<td>.13</td>
<td>.45**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Sense of self-preservation (Money)</td>
<td>.26*</td>
<td>.10</td>
<td>.11</td>
<td>-.09</td>
<td>-.20</td>
<td>-.19</td>
<td>.02</td>
<td>.18</td>
<td>.36**</td>
<td>.06</td>
<td>.35**</td>
<td>.71**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>14. Sense of self-preservation (Coupon selection)</td>
<td>.05</td>
<td>.07</td>
<td>-.14</td>
<td>.17</td>
<td>-.07</td>
<td>.09</td>
<td>.26*</td>
<td>.00</td>
<td>.24*</td>
<td>.21*</td>
<td>.04</td>
<td>-.03</td>
<td>-.02</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Note.** + Correlation is significant at $p < .10$
*Correlation is significant at $p < .05$
**Correlation is significant at $p < .01$
In summary, the exploratory analyses revealed that the significant predictor of avatar users’ health behavior is related more to avatar customization than the physical attractiveness of the avatar. More specifically, we found that customizing one’s avatar to resemble a desired ideal self promotes visualization of ideal body, which is positively related to prevention-focused sense of self-preservation. But, more interesting is the somewhat surprising finding that it (customizing avatar to resemble desired self rather than actual self) serves to minimize perceived risk to physical body, thereby increasing one’s self-efficacy, which predicts behavioral intention to spend time on preventive health actions.

In the next chapter, we will discuss the theoretical and practical implications of these findings and directions for future research arising from the limitations of this study.
Discussion

As the title of this dissertation proposed, the purpose of this study is to determine whether avatars in virtual environments can promote a sense of self-preservation among avatar users and creators. The answer is yes, but only partly. Among the six measures for sense of self-preservation, we found significant effects for two--behavioral intention to spend time in future on self-preservation and indication via coupon selection of relative their intention to purchase healthy over unhealthy products. The participants who customized their avatars reported that they intend to spend more time preserving their health than participants who were assigned avatars by the experimenter. However, after completing the study and being thanked for their participation, when participants were asked to choose three out of six coupons (half of which were for healthy products/services and the other half for unhealthy products/services) as reward, participants in the avatar customization condition picked more coupons for unhealthy products/services than for healthy produces/services than did participants in the non-avatar customization condition.

The reason for this contradictory finding between behavioral intention and behavior may be due to the “lack of self-regulation” caused by ego-depletion. In certain circumstances, the desire to eat a candy bar, for example, wins over one’s personal goal to lose weight. These circumstances are mental states that occur when one’s capacity for self-control or self-regulation is depleted. Ego-depletion scholars argue that certain volitional efforts require using finite self-resources, which, in turn, affects individuals’ subsequent ability to control their behaviors, such as overeating by dieters or impulsive overspending (for reviews, see Vohs & Faber, 2007 and

\[\text{The title of this dissertation is: “Can your avatar improve your health?”}\]

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Vohs & Heatherton, 2000). Ego-depletion has been manipulated by exhausting self-resources of individuals through tasks involving emotion suppression (Vohs and Heatherton, 2000) and temptation resistance (Baumeister, et al., 1998). In addition, Baumeister and colleagues (1998) assert that even making a choice about one’s stance on a particular topic (either pro or against) could become a volitional action that depletes self-resources. Based on this rationale, we could argue that customizing an avatar to reflect one’s actual or desired self might also deplete self-resources because it involves a series of volitional actions relating to representing oneself in the virtual environment. The outcome of ego-depletion is often marked by behaviors that are caused by self-resource depletion, such as quitting early, overeating and impulse-buying. Therefore, avatar customizers’ behaviors for picking coupons for unhealthy, but appealing, products/services may be explained in the context of their lack of self-regulation caused by depletion of self-control resources during the process of avatar customization.

Although this study detected behavioral symptoms of ego-depletion from avatar customization, we found positive effects on self-preserving behavioral intentions and sense of agency as well as self-presence. In fact, sense of agency mediated the relationship between customization and intention to spend time on self-preservation, whereas self-presence did not. This underscores the empowerment potential of avatar creation that goes beyond simple self-representation and immersion. For avatars to successfully translate virtual-world learning to real-world outcomes, they need to be actively constructed by the user. While this construction might cause ego-confusion during the virtual interaction, what really seems to matter is the involvement, identity and control engendered by customizing and using one’s avatar, in keeping with the agency model of customization (Sundar, 2008).

In fact, a major purpose of this dissertation is to perform a test between the agency model
and behavior confirmation theory in order to ascertain support for their predictions about avatar effects on one’s health attitudes and behaviors. The basic assumption of behavior confirmation theory is that others’ expectations for an individual based on the physical appearance of that person’s avatar would influence the avatar user’s behavior. In order to test this possibility, we relabeled the groups based on their perceived attractiveness. If the behavior confirmation theory is correct, there should have been a significant difference between the highly attractive group and the low attractive group in terms of others’ expectation, but there was no significant difference among the attractive groups or among the four original groups (CA, CD, AA, and AU).

Furthermore, participants did not feel differently if the CDC agent (the partner) perceived them as being attractive during the interaction regardless of their avatars’ physical attractiveness. Therefore, the assumption of the behavior confirmation theory was not supported by our data.

Study participants found the desired customized avatars to be most attractive, whereas they found the assigned unattractive avatars to be least attractive. The remaining two groups (actual customized avatars and assigned attractive avatars) reported their avatars to be moderately attractive. If behavior confirmation theory—which predicts that the avatar’s physical attractiveness will affect the user’s behavior—is correct, the two groups that showed no difference in terms of the perceived physical attractiveness of their avatars should show no difference in their intended behaviors. However, this study found that actual avatar customizers showed higher levels of sense of self-preservation (time) than assigned attractive avatar users. This finding further suggests that the avatar’s physical attractiveness is not the key factor predicting users’ self-preserving behavior, but rather its creation by the users, thus supporting the agency model of customization. Furthermore, it was also found that the pattern of sense of self-preservation (time) across the four conditions was consistent with the pattern of agency ratings.
across the four conditions: the actual avatar customizers reported the highest level of agency followed by the desired avatar customizers and the assigned unattractive avatar users. Also, the assigned attractive avatar users reported the lowest levels of agency. This finding further suggests that the avatar’s physical attractiveness is not a key factor in predicting users’ self-preserving behaviors; rather, creation by the users predicts individuals’ self-preserving behaviors.

Another noticeable finding from this study is that the actual avatar customizers showed the highest levels of sense of self-preservation (time). Their responses were higher than the desired avatar customizers’ responses, although the difference between the two groups was not statistically significant. In addition, the assigned unattractive avatar group also showed higher levels of sense of self-preservation (time) than the assigned attractive avatar group. As may be recalled, the actual avatar customizers rated their avatars as being less attractive than the desired avatar customizers, while the assigned unattractive avatar group rated their avatars as being less attractive than the assigned attractive avatar group. Therefore, this finding shows that the unattractive conditions within the larger category of customization and non-customization conditions yielded a positive effect in terms of sense of self-preservation. This raises an interesting question: Why do unattractive avatars motivate users to improve their bodies more than attractive avatars? The data of this study show that agency might be a key answer. As we discussed earlier, the responses of sense of self-preservation across four conditions have been shown to be consistent with the responses of sense of agency across the four conditions. Notably, the unattractive avatar users reported higher sense of agency as well as higher sense of self-preservation (time) than the attractive avatar users in general. These findings suggest that unattractive avatars may be highlighting negative aspects of the self. In particular, the actual avatar customizers were instructed to create their avatars to look like them. Even though a
participant did not like her big thighs, for example, it is possible that she might create her avatar to have big thighs as she does in reality. Observing her new avatar may then remind her of her big thighs repeatedly and unconsciously. This phenomenon might be observed in the assigned unattractive avatar conditions as well. That is, the unattractive avatar images prime the negative aspects of the self, thus posing a “threat” or challenge to overcome. As discussed in the literature review, human agency, which is defined as the capacity of an agent to act (Bandura, 2001), has historically been associated with overcoming such threats like disease, storm, or starvation. In particular, when the threat is more relevant to the self, the capability to conquer the threat becomes stronger (Bandura, 2000). Given this, it makes sense that unattractive avatar users felt higher sense of agency, and in turn, increased motivation to improve their bodies.

**Implication for health models**

In addition to the providing a test of theories pertaining to psychology of communication technology, findings of this study hold theoretical implications for health models. Perceived risk is one of the predominant topics in the literature on health campaigns. Nevertheless, the relationship between perceived risk and health behavior is still not quite clear. Some studies have shown a positive correlation between them (Dolinsk, Gromski, & Zawisza, 1987; Larwood, 1978), while others have shown a negative correlation (Svenson et al., 1985; van der Vlde, Hoojikaas, & Plight, 1991) or none at all (Joseph et al., 1987; Robertson, 1977). Our data showed a negative correlation. Participants who perceived there to be a greater risk to their general physical body exhibited a lower sense of self-preservation.

This finding is consistent with argument, put forth by Chaffee and Rogers (1986), that
when perceived risk is high, fear increases, which, in turn, inhibits action. According to the authors, individuals with high risk perceptions might be less motivated to use self-protective behaviors than individuals with low risk perceptions. In other words, they argue that heightened risk perception decreases the efficacy to overcome the risk, which, in turn, inhibits health behavior to preserve the self. Social cognitive theory (Bandura, 1977) postulates that high efficacy makes individuals see a risk as a challenge to overcome, while low efficacy makes individuals feel incapable of accomplishing a task and deteriorates self-preservative motives. Consistent with this prediction, our study found there to be a negative correlation between perceived risk and efficacy and a positive relationship between efficacy and health behavior. That is, the greater participants perceived the risk to their physical body, the less capable they felt about dealing with the risk, and in turn felt less motivated to be engage in self-preserving behaviors. As predicted, risk perception was higher when users customized their avatars to look like their actual selves rather than their desired selves, but this higher perceived risk diminished efficacy for performing self-preserving behaviors.

Efficacy is also an important predictor of health behaviors as well as behavioral intentions in prominent health models, such as the theory of planned behavior (Ajzen, 1991). Most studies have examined efficacy as a moderator of the effect of perceived risk on people’s self-protective behaviors. The Risk Perception Attitude (RPA) framework is one such example of this line of research (Rimal & Real, 2003). The RPA framework categorizes individuals into four attitudinal groups based on their risk perceptions and efficacy beliefs. The first group is responsive, which includes individuals with high risk perceptions and high efficacy beliefs. The second group, avoidance, categorized individuals with high risk perceptions and low efficacy beliefs. The third group, proactive, includes individuals with low risk perceptions but high
efficacy beliefs. The last group, *indifference*, categorizes individuals with low risk perceptions and low efficacy beliefs. In their study, Rimal and Real (2003) found that the proactive group (low risk, high efficacy) was more motivated to enact self-protective behaviors than the avoidance group (high risk, low efficacy). This finding demonstrates the interactive effect of perceived risk and efficacy on self-protective health behavior. However, given the dynamic nature of efficacy beliefs, which vary depending on perceived risk, it is more reasonable to treat efficacy as a mediator rather than as a moderator. In so doing, we may need to take into account the nature of the disease. For example, if the disease is easily treatable, although the perceived risk is high, the efficacy becomes high. This, in turn, would motivate people to engage in self-preserving behaviors. However, if the disease is not easily treatable and requires a long-term plan of care, perceived risk decreases the efficacy and makes people feel incapable of dealing with the disease. Therefore, it is less likely for people to engage in self-preserving behaviors. This study used health topics that need long-term plans and treatments (e.g., depression, sleep disorders, blood pressure, obesity, eating disorders, and skin cancer), which may have contributed to the low efficacy among those who perceived an increased risk to their bodies. It appears that our study participants fit the *avoidance* and *proactive* categories rather than the *responsive* category of RPA as we had anticipated. Perhaps the outcome of avatar customization would have been different if the health topics involved relatively short-term treatments.

It is noteworthy that this study found different mechanisms that motivate different self-preserving behaviors. We measured various ways of enacting self-preservation behaviors. For example, some people are more likely to engage in proactive behaviors, such as jogging on a regular basis or going to the gym, while others are more likely to engage in preventive behaviors, such as not smoking or not drinking for the sake of their health. We hypothesized that these
behaviors would be activated by different mechanisms. This study found that visualization of ideal body motivates the preventive self-preservation system in a positive way, while perceived risk motivates the self-preservation system in a negative way. The more the participants visualized their ideal body through their avatars, the more motivated they were to engage in preventive behaviors (e.g., not smoking or not drinking), and the greater participants perceived the risk through their avatars, the less motivated they were to engage in proactive behaviors (e.g., jogging or going to the gym). These findings suggest that the more the individuals visualized their ideal body through their avatars, the more likely they were to pursue their ideal body by quitting bad habits that are harmful to their health. In addition, the less the individuals perceived the risk through their avatars, the more likely they were to preserve themselves by jogging or going to the gym. This finding is meaningful in terms of theoretical as well as practical implications. Theoretically, it calls for the segmentation of self-preserving behaviors. Although the ultimate personal goal is to preserve one’s health, this study shows that behavioral approaches to achieve that goal might vary. In addition, it suggests that there are varied mechanisms which drive different self-preserving behaviors. Indeed, the empirical connection between perceived risk and self-preserving behaviors established here is, by itself, an important theoretical contribution of the study. Practically, perceived risk has often been used to induce fear in health campaigns (Biener, McCallum-Keller, & Nyman, 2000; Dejong & Hoffman, 2000; Goldman & Glantz, 1998). Based on our findings, however, such fear appeal is not always powerful for promoting desired health behaviors. It is possible that fear actually demotivates individuals; therefore, this study recommends using the hope appeal (e.g., giving people hope that they can achieve a certain goal), such as visualizations in health campaigns. This study also found that avatars enhanced users’ visualizations of their ideal body. Therefore, it shows that
avatar in VE can be used as an effective tool to give hope. This is also richly supported by the finding that customizing a desired ideal avatar had a positive impact on self-preservation tendencies while customizing an avatar to look like one’s actual self had a negative impact.

**Practical implications**

The findings from the manipulation check raise several discussion points and suggest several practical implications. This study manipulated the physical attractiveness of the participants’ avatars in the customization condition, while participants in the non-customization condition were assigned to either an attractive avatar or an unattractive avatar, which were ranked as high or low based on pretest results. In addition, participants in the customization condition were instructed to create their avatars to look like either their current physical appearance or their ideal appearance. Even though, in the pretest, the attractive avatar was scored highest and the unattractive avatar was scored lowest in terms of physical attractiveness, this study found that participants who created their avatars to look like their desired selves rated their avatars as being even more attractive than the attractive assigned avatar. Also, there was no significant difference between those who created their avatars to look like their actual selves and those who were assigned attractive avatars; these two groups rated their avatars moderately attractive. Furthermore, those who were assigned unattractive avatars rated their avatars low in terms of attractiveness. In general, the customization group rated their avatars that looked like their current selves as being highly attractive.

Further, we examined their avatars’ perceived appearance similarity. Interestingly, we found that there was no significant difference between the actual avatar group and the desired avatar group in terms of perceived physical appearance similarity. Those who created their actual
avatars and those who created their desired avatars both perceived their avatars to look like their physical selves. This finding indicates that one’s ideal image is not dramatically different from one’s current image; rather, it is just an improved version of the current image (e.g., “my ideal image looks like my current image, but looks better than the current image”). This finding also provides an explanation for why the actual and desired avatar groups showed no significant difference in their physical appearance similarity (e.g., “my avatar looks like me,” or “my avatar represents my actual self well”), even though there was a significant difference in their perceived ideal appearance similarity (e.g., “my avatar represented my ideal self well,” or “my avatar represents what I would ideally want to look like”). Perceived similarity to one’s self has been shown to influence people’s attitudes and behaviors (McGuire, 1969). It was found that people who are perceived to be more similar are also perceived to be more attractive (Shanteau & Nagy, 1979), trustworthy (DeBruine, 2002), and persuasive (Brock, 1965). In CMC, Kim and Sundar (2008) also found that avatars that are perceived to be more similar to the user were perceived as being more attractive. Self-congruity theory (Sirgy, 1986) postulates that the more the receiver perceives him/herself to be similar in appearance, opinions, and attitudes to a source, the greater persuasiveness the source’s message will have (O’Mahony & Meenaghan, 1998).

We may attribute such findings to “implicit egotism,” which is true for all activities that involves self-related objects. Pelham et al. (2003) argued that “most people possess positive associations about themselves. For this reason…most people should gravitate toward things that resemble the self” (p. 800). In their study, they found that participants showed positive attitudes toward brand names that start with the initial letters of their names and also toward ads in which the manipulated brand name was embedded. Similarly, Faber, Duffy, and Lutchyn (2006) also found that when a self-morphed photograph was used as a model for a brand, it increased
positive attitudes toward the ad and the brand.

VE, like Second Life, provides users with a great degree of flexibility in terms of their avatars’ physical appearance, from hair color to hip size. As such, it is possible to actualize a self-resembling character easily without the help of digital morphing software. Given the psychological benefits of self-resembling objects (e.g., as seen in the studies with brand names starting with the initial letter of participants’ names and the self-morphed photographs), for credibility and persuasiveness, avatars have many practical implications in marketing as well as health campaign, as they allow users to express the self. For example, when a self-created avatar that resembles the user’s self provides information, the information is more likely to be perceived as favorable, trustable, and persuasive than a generic-looking avatar.

Furthermore, findings from this study suggest that self-created avatars make salient users’ mental images of their bodies. Avatar customization is a process for creating and realizing these mental models in virtual reality. As the H3a and H3b results illustrated, the mental model that is realized via an avatar consequently influences a user’s perceptions toward his/her physical body. More specifically, avatars that look like users’ actual bodies make them think about their physical bodies and their overall health. On the other hand, avatars that look like users’ ideal bodies help them visualize their ideal body image in reality. In particular, the impact of the mental model that is represented by the avatar becomes significant when the user is given information related to his/her physical health, such as information about obesity or sleep disorders, via the avatar. Furthermore, with the increased interest in video games, including virtual reality, as a new venue for health intervention, it is notable that avatars can act as a stimulus to evoke mental models of the self, which has implications for individuals’ consumption of and reaction to health information.
It should also be noted that the use of an avatar as a self-model may be beneficial to individuals who feel a high degree of body image self-discrepancy. Analogous to the prediction of self-discrepancy theory (Higgins, 1987), sociological and psychological literature has shown that media exposure to messages conveying the “thin ideal” leads to higher degrees of body discrepancy (the discrepancy between one’s current body image and his/her ideal body image), which, in turn, brings about negative effects, such as depression (Bessenoff, 2006) and disordered eating behaviors (Stice & Shaw, 1994).

However, this study found that the higher the body discrepancy, the more they felt the need to preserve their wellbeing and the higher their interest was for healthy products/services, such as for a fitness center membership, GNC products, or organic food purchase. One possibility for this positive effect could be that the very use of avatars serves to counter the negative effects of high body discrepancy. For those who have highly discrepant self-image a virtual avatar seems to act as a motivating force. However, since this study did not have a non-avatar control, we are not able to test this empirically. If verified in future studies, this finding holds therapeutic implications for those who feel high discrepancy between their ideal and actual selves.

The avatar, which resembles one’s ideal self, helps the user visualize his/her ideal image and motivates him/her to engage in self-preserving behaviors. As discussed in the literature review chapter, according to social cognitive theory (Bandura, 1986, 2002), a behavior can be learned by observing a social model, such as a self-resembling avatar. This study also found that an avatar that was created to reflect one’s identity could become an effective model to motivate the user’s self-preserving behaviors.

The idea of avatars serving as a vehicle for self-modeling, in keeping with the precepts of
social cognitive theory (Bandura, 1986, 2002), could have marketing implications as well, especially for web advertisers seeking effective ways to promote products related to individuals’ bodies (e.g., clothes). Entering an e-commerce portal through an avatar could perhaps increase the positive attitudes and trustworthiness toward products because the user’s own self-representation is seen as experiencing the products. Therefore, instead of using social models for advertising, such as celebrities, it may be more effective for consumers to create their own avatars as self-models to try the products virtually through their avatars while interacting with the system.

**Limitations and future studies**

There are several limitations to this study’s design. The first critical problem was the limited degree of avatar customization options, which blocked some of the modification features. As stated above, Second Life (SL) provides a great deal of flexibility in terms avatar customization, which actually became a disadvantage in this study. Since some of the default choices for the body parts were limited and looked unnatural, it was necessary to buy items to make the features look more natural, which required sophisticated skills. Although we created as many folders and versions as we could do, we could not account for every bodily variation among individuals. As such, we observed that some participants encountered problems with not being able to modify several body parts, which led to their frustration. In addition, for the customization conditions, we asked participants to create their avatars to look like their current physical images or their ideal images and to continue Customizing until they were satisfied with their images. However, in situations in which participants encountered the aforementioned
technical problems, it is possible that participants felt their creation was a task to complete, not a way to self-represent themselves to reflect their identities. This may have subsequently affected their virtual interactions with the system as well as with the online survey that followed.

Another limitation is the uneven stimulus exposure time across conditions. Participants who were assigned to the avatar customization conditions spent about three times longer ($M = 19.2$ minutes) participating than participants who were assigned non-avatar customization conditions ($M = 7.4$ minutes), which could have caused greater exhaustion in the avatar customization conditions.

These limitations point to ideas for future studies. As stated when discussing ego-depletion, a profusion of customization options could deplete individuals’ limited self-resources and, in turn, cause their lack of self-regulation. Customization, which caters to individual needs and allows users to express the self, inherently involves many options and requires effortful choosing. Of course, customization has many benefits, including positive attitudes or behavioral changes, but it can also bring about negative outcomes by requiring active responses or forcing users to make choices even if they are not in the mood to do so (e.g., when being exhausted). The negative outcomes, such as behaviors that are caused by a lack of self-regulation (e.g., overeating or impulsive buying), may occur more often in an experimental setting in which participants are given instructions when customizing websites or avatars that would otherwise not occur in reality.

When designing effective health messages or campaigns, designers must consider individuals’ self-regulation or efficacy in order to achieve the promotion of protective health behaviors. According to Sundar (2008), customization imbues a sense of agency (i.e., the feeling of having control over something), which may be highly associated with efficacy (i.e., the capacity to perform a specific behavior). If this is true, how can we obtain positive outcomes
from customization without losing self-resources? Vohs and colleagues (Vohs et al., 2008) and Iyengar and Lepper (2000) found that when participants were given few choices, compared to many choices, symptoms of ego-depletion were not detected. Zuckerman, et al. (1978) also found that participants given the autonomy to choose among options (i.e., an unrestricted choice of three out of six puzzle problems) showed little ego-depletion. These studies suggest two research ideas. First, one future study should manipulate the degree of avatar customization choices (e.g., one condition giving high levels of avatar customization, one condition giving medium levels of avatar customization, one condition giving low levels of avatar customization and another condition assigning avatars as a control). Another future study should manipulate the instructions, e.g., one condition giving instructions to create avatars that look like the users, one condition giving instructions to create avatars that look like whatever users wish, and another condition giving no instructions (e.g., they are given the autonomy to create the avatar or just use the assigned avatar). These studies can help reveal the optimal degree of customization for obtaining the expected positive results from customization in the context of the health communication field without depleting self-resources.

In addition, given that avatar customization in an experimental setting inherently uses participants’ self-resources, future research would benefit from employing a longitudinal method or survey targeting virtual-reality residents who are already familiar with avatar customization. Strange as it may seem, replicating this study in a live virtual environment would add vastly to the external validity of its findings.

Concluding remarks
Ultimately, one may ask: What benefits can we obtain from avatar customization? Can your avatar really improve your health? The present findings suggest that avatar customization may successfully transfer the psychological benefits obtained from customization to one’s wellbeing. In VE, particularly where people communicate with others through their avatars, avatars are like windows to look at the world as well as mirrors to reflect the self, both of which enable users to focus more on the self. The awareness of the self is an important aspect of sense of agency, which drives motivations for self-preservation behaviors. It is, therefore, important to understand that an avatar’s identity cues, which may facilitate the transfer of the psychological benefits from customization to the self’s wellbeing, is determined by the user’s self-concept, not by the physical appearance of the avatar.
References


Faber, R., Duff, B., and Lutchyn, Y. (2006, September). *Can you see yourself using this brand? The potential impact of facial morphing in advertising*. New Media Research: An Interdisciplinary Conference on New Media and Internet Studies. Minneapolis, MN.


http://jcmc.indiana.edu/vol11/issue1/nowak.html


Appendix A:
CDC Virtual Interaction Script (health topic: Sleep Disorder)
(Reference: http://www.webmd.com/sleep-disorders)

(Welcoming the subject)
CDC agent: Hello! Welcome to the CDC.
My name is Spring (Dotson).

(Wait for the subject’s response)
CDC agent: Nice to meet you. I am an agent of the CDC.
Have you heard about the CDC before?

(Wait for the subject’s response)
CDC agent: CDC is the Centers for Disease Control and Prevention.
For over 60 years, CDC has been dedicated to protecting health and promoting
quality of life through the prevention and control of disease, injury, and
disability.
Today’s my job is to talk about sleep disorders with you.
Please follow me. I want to show you something.

(Take the subject to the poster which shows a guy who suffers from insomnia)
CDC agent: Could you look at this guy in front of me?
How does he look?

(Wait for the subject’s response)
CDC agent: Yes, he suffers from insomnia.
Insomnia is one of types of sleep disorders.
Sleep disorders involve any difficulties related to sleeping, including difficulty
falling or staying asleep, falling asleep at inappropriate times, excessive total
sleep time, or abnormal behaviors associated with sleep.

Have you ever suffered from insomnia or a sleep disorder?

(Wait for the subject’s response)
CDC agent: Please follow me. Let me show you more.

(Take the subject to the 2nd floor where several posters about general sleep disorders and specific
symptoms including insomnia, snoring, RLS, and sleep apnea)
CDC agent: Could you please look around for a moment?
Do you know how many symptoms of sleep disorders exist?

(wait for a response)
CDC agent: Pick any number.
Snoring

General

Snoring is a common sleep disorder that can affect all people at any age, although it occurs more frequently in men and people who are overweight. Snoring has a tendency to worsen with age.

Forty-five percent of adults snore occasionally, while 25% are considered habitual snorers.

Occasional snoring is usually not very serious and is mostly a nuisance for the bed partner of the person who snores.

However, the habitual snorer not only disrupts the sleep patterns of those close to him, he also disturbs his own.

Habitual snorers snore whenever they sleep and are often tired after a night of what like quality rest.

Medical assistance is usually needed for habitual snorers to get a good night's sleep.

Cause

The physical obstruction of the flow of air through the mouth and nose is the cause of snoring.

Health Risks of Snoring

Obstructive sleep apnea is an illness that is often associated with chronic snoring.

Long interruptions of breathing (more than 10 seconds) during sleep caused by partial or total obstruction or blockage of the airway.

Treatments

If you occasionally snore, you can try the following behavior changes to help
treat the problem:

Lose weight and improve your eating habits.  
Avoid alcohol, heavy meals, or snacks at least four hours before you sleep.  
Sleep on your side rather than on your back.  
Tilt the head of your bed up four inches.

If none of the above mentioned behavioral changes help snoring, talk to your doctor.

Otolaryngologists (ear, nose, and throat doctors) offer a variety of treatment options that may reduce or eliminate snoring or sleep apnea.

**Insomnia**

**General**  
*CDC agent:* Insomnia is a sleep disorder that is characterized by difficulty falling and/or staying asleep.

People with insomnia have one or more of the following symptoms: Difficulty falling asleep, Waking up often during the night and having trouble going back to sleep, Waking up too early in the morning, Feeling tired upon waking.

There are two types of insomnia: Primary and Secondary insomnia.  
Primary insomnia means that a person is having sleep problems that are not directly associated with any other health condition or problem.

Secondary insomnia means that a person is having sleep problems because of something else, such as a health condition (like asthma, depression, arthritis, cancer, or heartburn); pain; medication they are taking; or a substance they are using (like alcohol).

Insomnia also varies in how long it lasts and how often it occurs. It can be short-term (acute insomnia) or can last a long time (chronic insomnia). It can also come and go, with periods of time when a person has no sleep problems.

**Cause**  
*CDC agent:* Acute insomnia can be caused by significant life stress or Illness, while chronic insomnia is caused by chronic stress or pain or discomfort at night.

**Treatment**  
*CDC agent:* If you think you have insomnia, talk to your health care provider. An evaluation may include a physical exam, a medical history, and a sleep history.
Acute insomnia may not require treatment. Mild insomnia often can be prevented or cured by practicing good sleep habits.

**Sleep Apnea**

**General**

Sleep apnea is a serious sleep disorder that occurs when a person's breathing is interrupted during sleep. People with untreated sleep apnea stop breathing repeatedly during their sleep, sometimes hundreds of times.

There are two types of sleep apnea: Obstructive sleep apnea syndrome and Central Sleep Apnea Syndrome.

Obstructive sleep apnea syndrome is the most common form of apnea. It is caused by a blockage of the airway, usually when the soft tissue in the back of the throat collapses during sleep.

In the case of Central Sleep Apnea, Unlike OSA, the airway is not blocked but the brain fails to signal the muscles to breathe due to instability in the respiratory control center.

**Cause**

Sleep apnea can affect anyone at any age, even children. However, risk factors for sleep apnea include:

- Male gender
- Being over the age of forty
- Having larger tonsils
- Having a family history of sleep apnea

According to the National Heart, Lung, and Blood Institute, more than 12 million people in the United States have sleep apnea. Of the total, more than half are overweight.

Sleep apnea is more common in men than in women and among people with thick or large necks.

**Treatment**

Sleep apnea treatments range from conservative measures -- such as losing weight if you are overweight or changing sleep positions -- to surgery. In mild cases of sleep apnea, conservative therapy may be all that is needed.

Conservative approaches include:

- Losing weight
- Avoiding alcohol and sleeping pills
- Changing sleep positions to promote regular breathing
- Stop smoking (Smoking can increase the swelling in the upper airway which may worsen both snoring and apnea)
- Avoid sleeping on your back

Continuous positive airway pressure -- also called CPAP -- is a treatment in
which a mask is worn over the nose and/or mouth while you sleep.

The mask is hooked up to a machine that delivers a continuous flow of air into the nostrils. The positive pressure from air flowing into the nostrils helps keep the airways open so that breathing is not impaired. CPAP is considered by many experts to be the most effective treatment for sleep apnea.

**Restless Legs Syndrome Symptoms (RLS)**

**General**

Restless legs syndrome (RLS) is a disorder of the part of the nervous system that affects movements of the legs. Because it usually interferes with sleep, it also is considered a sleep disorder.

People with RLS have strange sensations in their legs (and sometimes arms) and an irresistible urge to move their legs to relieve the sensations. The sensations are difficult to describe: they are not painful, but an uncomfortable, "itchy," "pins and needles," or "creepy crawly" feeling deep in the legs.

The severity of RLS symptoms ranges from mild to intolerable. Symptoms get gradually worse over time in about two thirds of people with the condition and may be severe enough to be disabling.

The symptoms are generally worse in the evening and night and less severe in the morning.

For a restless leg syndrome, the primary warning sign is the irresistible urge to move your legs shortly after you get into bed, in the middle of the night after awakening, or even when wide awake during the day.

**Cause**

RLS affects about 10% of the U.S. population. It affects both men and women and may begin at any age, even in infants and young children. Most people who are affected severely are middle-aged or older.

**Treatment**

RLS is often unrecognized or misdiagnosed. In many people it is not diagnosed until 10-20 years after symptoms begin. Once correctly diagnosed, RLS can often be treated successfully.

**Narcolepsy**

**General**

Narcolepsy is a sleep disorder that causes overwhelming and severe daytime
sleepiness that often occurs at inappropriate times and places.

The daytime sleep attacks may occur with or without warning, and can occur repeatedly in a single day. Persons with narcolepsy often have fragmented nighttime sleep with frequent brief awakenings.

Narcolepsy is typically characterized by the following 4 symptoms with varying frequencies:
Excessive daytime sleepiness (90%)
Cataplexy (sudden and temporary loss of muscle tone often triggered by emotions such as laughter) (75%)
Hallucinations (vivid dreamlike experiences that occur while falling asleep or upon awakening) (30%)
Sleep paralysis (paralysis that occurs most often upon falling asleep or waking up; the person is unable to move for a few minutes) (25%)

Frequently, narcolepsy is unrecognized for many years.

There could be a delay of 10 years between the onset of the condition and the diagnosis.

Approximately 50% of adults with narcolepsy retrospectively report symptoms beginning in their teenage years. For most patients, narcolepsy begins between the ages of 15 and 30 years. It less frequently occurs in children younger than age 10 years (6%).

Narcolepsy may lead to impairment of social and academic performance in otherwise intellectually normal children.

**Treatment**

CDC agent : Narcolepsy is a treatable condition. A multi-modal approach is most effective ([medications](#), a regular nighttime sleep schedule, and scheduled naps during the day) is required for the most favorable outcome.

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CDC agent : Oh, why don't you sit?

*sit on the couch*

CDC agent : In general, maintaining regular sleep habits and a quiet sleep environment may prevent some sleep disorders.
As you recognized, most of symptoms are unrecognized for many years. Therefore, the early detection is very important to treat the sleep disorders.
If you have chance, please go to a sleep clinic for diagnosis of your sleep problem. Sleep clinics are especially useful for diagnosing sleep apnea, narcolepsy, and heart-related sleep problems.

There are tests like Polysomnogram and actigraphy. Polysomnogram is a test measuring activity during sleep and actigraphy is a test to assess sleep-wake patterns over time.

By reviewing the results of your tests, a sleep specialist may be able to tell what, if anything, is wrong.

Or you can simply take quizzes online. It’s free and easy to test if you have any symptoms or not.

OK, it was nice meeting you. Please take a good break to avoid sleep disorders.

Please click the ball in front of you. It will lead you to the online questionnaire. And click “Go to page!”
Appendix B: Measurement Instruments

Pre-questionnaire

Familiarity with Virtual Environment

- Please rate your level of experience in the following environments

**Second Life:**
No experience at all 0-----1-----2-----3-----4-----5-----6-----7-----8-----9 Very experienced

**There.com:**
No experience at all 0-----1-----2-----3-----4-----5-----6-----7-----8-----9 Very experienced

**Sims Online:**
No experience at all 0-----1-----2-----3-----4-----5-----6-----7-----8-----9 Very experienced

**Experience in virtual environments (including video games):**
No experience at all 0-----1-----2-----3-----4-----5-----6-----7-----8-----9 Very experienced

**Experience in interacting with online avatars (e.g., virtual avatars in Wii, Playstaton, or chat room):**
No experience at all 0-----1-----2-----3-----4-----5-----6-----7-----8-----9 Very experienced

**Experience in creating avatars:**
No experience at all 0-----1-----2-----3-----4-----5-----6-----7-----8-----9 Very experienced

* Please estimate in hours and minutes the total amount of time that you spend in virtual worlds in an average week if you have ever experienced (If no experience, please write “0”).

I spend for __________ hours and __________ minutes in virtual worlds during an average week.
**Body Dissatisfaction (Body Esteem Scale)**

- Instructions: On this page are listed a number of body parts. Please read each item and indicate how you feel about this part of your own body using the following scale:

  1 = Have strong negative feelings
  2 = Have moderate negative feelings
  3 = Have no feeling one way or the other
  4 = Have moderate positive feelings
  5 = Have strong positive feelings

1. **Face:** 1------2-------3-------4-------5
2. **Weight:** 1------2-------3-------4-------5
3. **Height:** 1------2-------3-------4-------5
4. **Figure or physique:** 1------2-------3-------4-------5
5. **Skin tone:** 1------2-------3-------4-------5
6. **Hair:** 1------2-------3-------4-------5
7. **Head:** 1------2-------3-------4-------5
8. **Eyes:** 1------2-------3-------4-------5
9. **Nose:** 1------2-------3-------4-------5
10. **Lips:** 1------2-------3-------4-------5
11. **Teeth:** 1------2-------3-------4-------5
12. **Ears:** 1------2-------3-------4-------5
13. **Cheeks/cheekbones:** 1------2-------3-------4-------5
14. **Chin:** 1------2-------3-------4-------5
15. **Shoulders:** 1------2-------3-------4-------5
16. **Arms:** 1------2-------3-------4-------5
17. **Hands:** 1------2-------3-------4-------5
18. **Chest or breasts:** 1------2-------3-------4-------5
19. **Waist:** 1------2-------3-------4-------5
20. **Buttock:** 1------2-------3-------4-------5
21. **Hips:** 1------2-------3-------4-------5
22. **Thighs:** 1------2-------3-------4-------5
23. **Legs:** 1------2-------3-------4-------5
24. **Feet:** 1------2-------3-------4-------5
25. **Body hair:** 1------2-------3-------4-------5
Body Dissatisfaction (Body Rating Scale)

- Please refer to the pictorial diagram. Indicate your answer by the number associated with the drawing.

Q1. Which drawing looks most like your own figure? (Please circle one)

Q2. Which figure do you most want to look like? (Please circle one)
Post-questionnaire

Manipulation Check (Avatar)

- Please answer the following questions with regard to your experience in the Second Life environment today. “Avatar” is the character onscreen that you controlled throughout the interaction.

    Strongly Disagree 1----2----3----4----5----6----7 Strongly Agree

[Perceived ideal appearance similarity]
    My avatar represents what I would ideally want to look like.
    My avatar had facial features that I would like to possess.
    My avatar had a body shape that I want to have.
    I want to look like my avatar.
    My avatar represented my ideal self well.

[Perceived physical appearance similarity]
    My avatar looks like me.
    My avatar shares many physical characteristics with me.
    My avatar was an accurate physical representation of me.
    My avatar physically resembled me.
    My avatar had a body shape like mine.
    My avatar had facial features similar to me.
    My avatar represented my actual self well.

[Perceived attractiveness]
    My avatar is socially desirable.
    My avatar will be attractive to others.
    My avatar looks attractive to me.

Sense of self-preservation

* Please answer the following questions.

    Strongly Disagree 1------2-----3------4------5------6------7 Strongly Agree

[General self-preservation]
    I feel the need to protect my body.
    I feel the need to maintain good health.
    Practicing healthy behavior is important to me.
    I feel the need to preserve good health.
    I feel the need to take care of my health.
    It is important to take care of one's health in order to survive in this world.

[Promotion-focused self-preservation]
    I feel the need to go to jog on a regular basis for the sake of my health.
I feel the need to go to gym to do exercise on a regular basis for the sake of my health.
I feel the need to go to see a doctor to check my body condition on a regular basis for the sake of my health.
How likely are you to be involved in physical exercises in the future, such as going to gym or doing yoga?

[Prevention-focused self-preservation]
I feel the need not to drink anything to disturb my sleep (e.g., coffee).
I feel the need not to smoke for the sake of my health.
I feel the need not to drink for the sake of my health.
I feel the need not to eat junk food or soda for the sake of my health.
How likely is it that you will quit behaviors that threaten your bodily health (e.g., smoking or excessive drinking)?

[Sense of self-preservation (time)]
What percentage of your time will you spend to maintain your good health? (e.g., doing exercise or going to see a doctor)

0% ---5%-----10%---15%---20%--25%---30%---35%---40%---45%---50%--55%---
60%--65%---70%--75%---80%---85%--90%--95%---100%

[Sense of self-preservation (money)]
What percentage of your money will you spend to maintain your good health? (e.g., doing exercise or going to see a doctor)

0% ---5%-----10%---15%---20%--25%---30%---35%---40%---45%--50%--55%---
60%--65%---70%--75%---80%---85%--90%--95%---100%

Sense of Self-presence

• Please answer the following questions with regard to your experience in the Second Life environment today.

Strongly Disagree 1----2-----3-----4-----5-----6-----7 Strongly Agree

During the Second Life interaction, I felt quite self-conscious.
I was very aware of what I was thinking when I interacted with the CDC agent.
During the interaction, I found myself paying attention to changes in my mood.
During the interaction, I found myself attending to my inner feelings.
During the interaction, I felt that I was trying to figure myself out.
During the interaction, I felt like I was watching myself.
During the interaction, I found myself reflecting about my own health behaviors.
I was not aware of myself during the interaction. (R)
I found myself fantasizing about myself during the interaction.
I could see myself during the interaction.
I felt like I personally explored the CDC island.
I felt disconnected from the interaction. (R)
I felt that I was personally talking to CDC agent.

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I felt that CDC agent was concerned about my welfare.

**Sense of Agency**
- Please answer the following questions with regard to your experience in the Second Life environment today.

    Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

    I feel like I have control over my voice.
    I do not feel like I can assert myself. (R)
    I do not feel like I am a distinct self, that I am one among many. (R)
    I feel like I have control over my actions.
    I feel that I can control my destiny.
    I feel like I can exercise my free will.
    I feel like I can access information that is appropriate for me.
    I have control over my health.
    I have a distinct identity.
    I am proud to let the world know who I am.
    I felt in control of my interaction with the CDC agent.
    I can influence the nature and course of my health.
    I am the center of my universe.
    I feel confident about asserting myself.

**Visualization of ideal body**
- Please answer the following questions with regard to your experience in the Second Life environment today. “Avatar” is the character onscreen that you controlled throughout the interaction.

    Not at all agree 1-----2-----3-----4-----5-----6-----7 Highly Agree

    The avatar helped me visualize (see) my ideal body.
    The avatar made me feel strongly about my ideal body.

**Perceived risk to physical body**
- Please answer the following questions.

    Not at all agree 1-----2-----3-----4-----5-----6-----7 Highly Agree

[Perceived risk to general physical body]
- I am concerned about having a good physique.
- I think I am in danger of becoming physically unattractive.
- I feel like I am prone to diseases.
- As I get older, I feel that I am likely to face greater risks to my health.
- I feel that my body is constantly at risk of developing illnesses.
[Perceived risk to appearance-related physical body]
I am at risk for obesity.
I am at risk for skin cancer.
I am at risk for eating disorders.
How likely do you think you will develop obesity in the future?
How likely do you think you will develop skin cancer in the future?
How likely do you think you will develop eating disorders in the future?

[Perceived risk to non-body appearance related physical body]
I am at risk for sleep disorder.
I am at risk for blood pressure.
I am at risk for depression.
How likely do you think you will develop sleep disorders in the future?
How likely do you think you will develop blood pressure in the future?
How likely do you think you will develop depression in the future?

Demographic Info
• Please read the instructions and complete the following questionnaire. Please answer all questions to the best of your ability.

Gender: Male_____ Female______

Academic standing:  Freshman______
                        Sophomore______
                        Junior_______
                        Senior_______
                        Graduate student____

Race/ Ethnicity:  Black/African-American
                   Asian or Pacific Islander
                   White/Caucasian
                   Hispanic or Latino
                   Native American or Alaskan Native
                   Other (please specify)
Youjeong Kim

EDUCATION

Ph.D. in Mass Communications, Pennsylvania State University, University Park, Summer 2010
M.A. in Public Relations, Kansas State University, Manhattan, Spring 2005
B.A. in English Language and Literature /English Education (minor), Kangwon National University, Chuncheon, February 2000.

RESEARCH INTERESTS

New Media Effects (The effect of new communication technology on information processing)
Virtual identity (Avatar)
Heath Communication
CMC (Computer Mediated Communication)
Online advertising
Congruency (relevancy) effect
Corporate Social Responsibility

TEACHING AREAS

TV production
Media Effects
Research Methods
Mass Communication and Society
Advertising

PUBLICATIONS


TEACHING

Instructor, Introduction to Audio and Video Communications, COMM 283 (BA students), Pennsylvania State University (Spring 2009, Fall 2009, Spring 2010).

Lab Instructor, Digital Photo, MC 430 (BA students), Kansas State University (Spring, 2004; Spring, 2005). Teaching Lab of MC 430 with Adobe Photoshop 7.0.

Lab Instructor, Top/Video News, MC 450 (BA students), Kansas State University (Autumn, 2003; Autumn, 2004). Teaching editing skills with Final Cut Pro 4.0 and operating camera.