EFFECTS OF AVATAR APPEARANCE ON USER PERCEPTION AND BEHAVIOR: ROLE OF LABELS AND COGNITIVE MEDIATION IN THE PROTEUS EFFECT

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Justice Quick

Thesis Committee:

Robert Kelly Aune, Chairperson
Min-Sun Kim
Hye Eun Lee

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Abstract

Previous studies suggest avatar appearance can influence user cognition and behavior (i.e., the Proteus Effect), though the mechanism responsible is debated. This study examined whether the mechanisms proposed by two explanations of the Proteus Effect could be experimentally induced and subsequently measured via assessing user response time when rating their avatar's traits. This study also explored whether in-game labels used to describe an avatar can bias users' interpretations of their avatars in label-consistent ways, and potentially lead to similar changes in users' offline behaviors. It was predicted that users generating their own evaluations of their avatars would do so more quickly than users asked to generate evaluations from the perspective of imagined others, and that users would rate their avatars in a manner stereotypically consistent with the avatar label. Participants were brought into a laboratory and played as an avatar in the desktop computer game *The Sims* before rating their avatar and squeezing a handgrip apparatus intended to measure potential changes in participants' offline behavior*.* General support was found for the effect of label on avatar assessments; these labels biased users toward rating their avatars as having higher levels of 3 of 5 label-consistent traits. No support was found for any effect of label on users' offline behaviors. Finally, results indicate response time may hold potential as a proxy measure for detecting the proposed mechanisms of the Proteus Effect. Implications of these results are discussed.

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CHAPTER 1. INTRODUCTION AND REVIEW OF LITERATURE

The landscape of the Internet has changed dramatically since its initial conception. In the formative years of the Internet, communication with others occurred strictly via text-based platforms, such as instant messengers or multiuser domains. Because these platforms restricted information exchange primarily to the verbal channel, initial theories of communication technologies focused on how these cue-lean environments constrained interactions occurring within them (see Culnan & Markus, 1987). As users grew accustomed to communicating over the Internet, they began to imbue their interactions with additional nonverbal cues. Today, it is anachronistic to view the Internet as offering only lean methods of communication. In addition to increased user familiarity with the Internet, digital technologies have advanced considerably from when the Internet was first created. Presently, the Internet includes a host of different platforms that facilitate cue-rich communication between users. These platforms range from real-time video to complex three-dimensional spatial environments known as virtual worlds (Messinger et al., 2009).

Virtual worlds are rapidly becoming some of the most popular forms of online entertainment, with millions of users interacting and collaborating with each other in these environments on a daily basis (Yee, Bailenson, Urbanek, Chang, & Merget, 2007). Many different types of virtual worlds exist, and these digital environments differ in the motivations their users bring to them. Two general types of virtual worlds are social life simulation environments and goal-directed gaming environments. Some social virtual worlds, such as *Second Life*, have over 36 million registered accounts, with over 400,000 new users joining every month (LindenLab, 2013). Collectively, these users have spent over 217,000 real-time years within the *Second Life* environment. Players of goal-directed gaming environments are equally numerous, with over 21 million active users holding subscriptions to a specific type of game genre known as massively multiplayer online role-playing games (MMORPGs) (MMOData, 2014). MMORPG players report spending an average of 22 hours per week in these environments (Yee, 2006).

Users of social and goal-driven virtual worlds occupy and interact in these spaces through avatars—digital representations that often possess human-like qualities (Fox, Bailenson, & Tricase, 2013). These avatars provide users with "bodies" in digital spaces and act as the vehicle through which users represent themselves within these worlds. Recent research suggests that operating avatars can influence a host of users' communicative processes (see Pena, 2011). Several studies have shown that the appearance of an avatar can alter the cognitions and behaviors of its user (e.g., Fox et al., 2013; Pena & Kim, 2014; Van Der Heide, Schumaker, Peterson, & Jones, 2012). As virtual worlds continue to grow in popularity, exploring how avatar use in digital environments affects user psychology and behavior becomes an increasingly important endeavor (Messinger et al., 2008).

One specific way that avatars affect their users is through appearance cues. Yee and Bailenson (2007) found that appearance cues of an avatar led users to experience attitudinal and behavioral changes in a manner stereotypically consistent with these cues, a phenomenon referred to as the *Proteus Effect*. To illustrate, the user of a female avatar may behave less aggressively, as this is congruent with popular societal views linking femininity to agreeableness. Stereotypes play a critical role in the Proteus Effect by translating observable avatar characteristics into user expectations about avatar disposition.

Although consistent evidence in support of the Proteus Effect has been found, studies to date have exclusively relied on avatars with easily interpretable appearance cues as means of activating the stereotypes that affect user behavior. Manipulations of avatar appearance used in previous studies involve highly stereotypical physical cues that evoke unmistakable associations between the avatar and the expected traits and behaviors inferred from its appearance. For example, studies of the Proteus Effect have variously involved avatars dressed as Ku Klux Klan (KKK) members, glamorous supermodels, and black-cloaked villains. In each of these cases, stereotypes are apparently readily activated in users' minds solely upon observation of avatar appearance; there exists little ambiguity regarding the behaviors expected of someone who possesses these straightforward appearance cues. While using avatars with appearances cues strongly linked to certain stereotypes has been effective in evoking the relevant associations, the Proteus Effect is not necessarily limited to such cases; so long as some avatar-related cue activates a stereotype related to appearance, emergence of the Proteus Effect is theoretically possible. Despite this, research examining the effect in contexts involving appearance cues of a less straightforward nature is scant. This represents a gap in the Proteus Effect literature, as the customizable and malleable nature of avatars often lead virtual world users to create avatars with appearance cues that do not translate as readily into such unequivocal expectations. Indeed, one may contend that the vast majority of avatars currently in use do not possess visual cues as strongly linked to particular stereotypes as the avatars used in prior empirical studies. As a result, scholarly understanding of the boundary conditions of the Proteus Effect remains unclear.

What is now needed is an exploration of whether the Proteus Effect continues to emerge when stereotypes are activated via subtler avatar-related cues. To address this lacuna in the literature, the first goal of this investigation is to examine whether in-game role labels—semantic descriptors used to indicate an avatar's role within the virtual world—can function to activate relevant stereotypes about the avatar, thereby influencing user interpretations of avatar appearance and producing stereotype-consistent attitudes and behaviors. Put differently, this study examines whether role labels can replace avatar appearance cues as stimuli that subsequently guide user interpretations and evaluations of avatar disposition. In this way, the present study explores whether simply changing how a single avatar is labeled (as opposed to changing the actual appearance of the avatar) is sufficient to engender the Proteus Effect.

Despite consistent evidence supporting the presence of the Proteus Effect, different conceptual camps invoke separate explanations of the theoretical mechanisms driving the effect. Two prominent theoretical perspectives reference self-perception theory or the automaticity model of priming effects (cf., Pena, Hancock, & Merola, 2009; Yee & Bailenson, 2007). According to the self-perception argument, users observe the appearance cues of an avatar from the perspective of an imagined third-party and conform their behaviors to the expectations they believe others will have about the avatar. Alternatively, the priming perspective posits that avatar appearance serves as a situational cue that activates neurological networks related to associated concepts in users' minds. These activated networks lead users to act in a manner consistent with these mental representations. Although both perspectives agree that avatar cues will lead to changes in user attitude and behavior in a manner consistent with stereotypes evoked by these cues, they differ in the nature of the processes invoked to explain these changes.

Due to the lack of a stringent measurement methodology, existing studies aimed at detecting the processes proposed by the self-perception and priming perspectives fall short of their goal. As a result, tests of the Proteus Effect to date have largely conflated the two mechanisms, and scholars continue to have an unclear understanding of how this phenomenon operates. More exacting methods of detecting the mechanisms underlying the Proteus Effect are therefore needed to identify and understand sources of behavioral influence in virtual environments. To address this issue, the second goal of this study is to test a novel measurement technique to detect the pathways postulated by both the self-perception and priming explanations in the context of avatar use. In so doing, emphasis is shifted away from attempting to substantiate one explanation over the other; instead, both processes are experimentally induced and subsequently detected according to a theoretically-relevant metric. In this way, this study does not aim to definitively support one process at the expense of the other, but to instead establish a method capable of stringently detecting them through observable differences in a key variable. This variable—user response time—was selected due to its relevance to the unique theories invoked to explain the mechanisms responsible for the Proteus Effect. The intended theoretical contribution of this study is to help communication scholars better understand the nature of the mechanisms underlying the Proteus Effect. The practical value is that it gives virtual world users a better understanding of how and why the attributes of their avatars have profound effects on their behavior within these environments.

In the following sections, an overview of the literature on virtual worlds and avatars is first provided. Next, existing findings of the Proteus Effect are reviewed. This is followed by an explication of the cognitive and neurological mechanisms proposed by both the self-perception and priming perspectives. Lastly, an experiment designed to manipulate avatar labels and assess user response time to detect the two mechanisms is introduced.

Virtual worlds

Virtual worlds are immersive, three-dimensional digital environments that enable large numbers of users to interact with each other (Ducheneaut, Wen, Yee, & Wadley, 2009). Schroeder (2002) defined a virtual environment as "a computer-generated display that allows or compels the user(s) to have a feeling of being present in an environment other than the one they are actually in and to interact with that environment" (p. 2). Although virtual worlds initially emerged in the early 1990s, their popularity began to grow exponentially in the late 1990s to early 2000s (Barnett & Coulson, 2010). Messinger and his colleagues (2009) attributed this growth of participation to improvements in virtual-reality technology, increased accessibility and affordability of personal computers, and the diffusion of high-speed Internet access.

Today, virtual worlds are extremely common and support a wide range of activities, some of which are strikingly similar to activities in the offline world (Sung, Moon, & Lin, 2011). Some researchers (e.g., Steinkuehler & Williams, 2006) believe that virtual worlds represent a new form of "third places," providing users with spaces for informal social interaction beyond the workplace and home. In this way, virtual worlds can function as digital equivalents to coffee shops, pubs, or other gathering spaces. Virtual worlds may also serve as the backdrop for more focused goal-driven game play as in MMORPGs, such as *World of Warcraft* and *City of Heroes.* Users of these virtual worlds rally around common goals of game progression and vanquishing their opponents. Beyond game play, virtual worlds are also used for educational, social scientific, and business-related purposes (Ducheneaut et al., 2009; Nowak & Rauh, 2008).

Avatars

Overview

Virtual worlds vary greatly in form and function but nearly all involve the use of avatars to represent their users. An avatar is a perceptible digital representation or character whose behavior is executed, typically in real time, by a specific human being (Bailenson & Blascovich, 2004). Avatars provide users with digital "bodies" and act as media through which users interact with virtual environments and other individuals within them. These digital representations need not always assume a humanlike form; players may elect to use a fantasy-like character instead. For example, a *World of Warcraft* player may decide to play as a dwarf wizard while a *Second Life* player may assume the role of a young human woman. Avatars function in these virtual worlds not only as visual representations of users but also as users' primary identity cue. This is because many traditional physical signifiers of users' identities are absent in virtual environments, thus deindividuating them. For example, whereas our corporeal bodies contain many markers of identity (e.g., hairstyle, tattoos), these signifiers do not translate onto our virtual bodies by default. In these so-called deindividuated contexts, users instead rely on the appearance cues of their avatar to form the basis of their online identity (Ducheneaut et al., 2009).

Avatars are often also highly customizable in nature. The avatar creation process in *Second Life*, for example, uses over 150 unique sliders allowing users to customize everything from hair color to cheekbone structure to foot size. In *The Sims Online*, users can manipulate avatar appearance in addition to temperament, personality, and development trajectory. The malleability of avatar appearance affords users a great deal of flexibility in their online self-presentation (Yee & Bailenson, 2007). Although attempts at self-transformation in offline settings are constrained by pragmatic considerations, personal transformation in virtual worlds has far fewer limitations. Instead, the mutability of avatar appearance provides users with complete freedom to experiment with various identities not possible in the physical world. For instance, whereas changing one's sex in the offline world entails many costly medical procedures, changing the sex of an avatar can be completed with only a single click of the mouse.

Interpersonal Effects

The ease in which self-representations can be altered in virtual worlds has led to a proliferation of research exploring the effects of avatar appearance on other users' perceptions, expectations, and behavior toward the avatar. One line of research examines whether offline social norms manifest in avatar-mediated interactions. Yee et al. (2007) discovered that offline sex norms involving eye gaze and interpersonal distance have analogs in virtual settings. In *Second Life*, for instance, male-male dyads were observed to have larger interpersonal distances and maintain less eye contact than female-female dyads (Bailenson, Blascovich, Beall, & Loomis, 2001). This effect is well documented in face-to-face settings, and is consistent with equilibrium theory (see Patterson, 1977). The carryover of norms related to physical distance into virtual worlds has similarly been discovered in other studies (e.g., Smith, Farnham, & Drucker, 2002). Avatar sex also influences how effective the avatar is at eliciting helping behaviors from others (Lehdonvirta, Nagashima, Lehdonvirta, & Baba, 2012). Female avatars received more sought-after help from other users than male avatars, a finding consistent with studies of offline helping behavior (e.g., Simon, 1971). Also, simply seeing another's avatar as a gender-stereotypical female increases the likelihood that an individual will express agreement with misogynistic sentiments. Fox and Bailenson (2009) found that users shown female avatars with stereotypical combinations of appearance and behavior cues (i.e., sexualized appearance with high gaze and non-sexualized appearance with low gaze) exhibited more sexist attitudes against women in a virtual environment than those who viewed non-stereotypical female avatars.

A different line of research on interpersonal effects of avatars explored whether the *chameleon effect*—the positive influence that nonverbal behavioral mimicry has on social influence and liking—can be replicated with avatars. Studies have demonstrated that mirroring the nonverbal behaviors of another person can lead to increased perceptions of likeability and persuasiveness in offline settings (e.g., Chartrand & Bargh, 1999), but Bailenson and Yee (2005) found that this effect translates to virtual environments as well. Avatars programmed to mimic the head movements of their users in an immersive virtual reality environment were rated by those who controlled them as more likeable and persuasive than avatars that did not closely mimic the users' nonverbal movements.

Another sizable body of literature focuses on how avatars contribute to feelings of presence and copresence in virtual environments. Lee (2004) defined virtual presence as "a psychological state in which virtual objects are experienced as actual objects in either sensory or nonsensory ways" (p. 37). Put simply, virtual presence is the sense of "being there" and virtual copresence is the sense of "being there" with another person. These studies examine how avatar realism engenders feelings of virtual presence. High levels of avatar realism appear to increase feelings of virtual presence and copresence while decreasing rates of self-disclosure (Schroeder, 2002; Sproull, Subramani, Kiesler, Walker, & Waters, 1996). The high behavioral realism of avatars, which could take such forms as realistic eye gaze behaviors (i.e., increased direct eye contact between avatars and observers), led to stronger feelings of virtual copresence and improved performance on memory tasks (Bailenson, Blascovich, Beall, & Loomis, 2001). Other studies have examined the impact of visual realism of the avatar on virtual copresence (e.g., Vinayagamoorthy, Brogni, Gillies, Slater, & Steed, 2004). Interestingly, high visual realism was not a requisite for feelings of copresence with an avatar so long as the avatar behaved realistically (Garau, Slater, Vinayagamoorthy, Brogni, Steed, & Sasse, 2003).

Despite varied interests, research on avatars has largely focused on examining the various perceptions, attitudes, and behaviors that individuals exhibit in response to viewing another avatar. That is, the preponderance of research has focused exclusively on interpersonal effects of avatar use. Much less attention has been focused on *intrapersonal* effects that arise from avatar use. In contrast to studies that examine how people react toward someone else's avatar, studies on the intrapersonal effects of avatar use examine how an avatar's appearance can change the behavior of the user. In the following section, an intrapersonal effect of avatar use—the Proteus Effect—is introduced.

The Proteus Effect

In addition to the effects avatars have on others whom occupy virtual environments, avatars have been shown to change the attitudes and behaviors of their own users. In a series of studies, Yee and Bailenson (2007, 2009) found that appearance cues of an avatar (e.g., physical attractiveness, height) led users to behave in a manner stereotypically consistent with their avatar's appearance. Previous research has demonstrated that physically attractive individuals tend to be more extraverted (Langlois et al., 2000). Consistent with this pattern, individuals who embodied physically attractive avatars in an immersive virtual environment behaved in a more extraverted manner (i.e., disclosed more information about themselves to a confederate) than those who controlled unattractive avatars (Yee & Bailenson, 2007). Yee and Bailenson also found that people assigned to use tall avatars reported higher levels of self-confidence and negotiated more confidently in a virtual money-split task than those who used short avatars. This is consistent with the notion that height is often associated with status such that tall individuals are often judged as the most assertive (Young & French, 1996). In short, the presence of avatar-related visual cues (e.g., tall height) led participants to think and behave in ways consistent with popularly-held expectations or stereotypes that can be inferred from these cues (e.g., assertively). Consequently it was argued that when operating avatars, users assess the avatar's appearance and adopt cognitions and behaviors that people would expect from someone of that particular appearance.

Subsequent research that sought to replicate the Proteus Effect in desktop settings using varied methods has generally yielded support for its propositions. A longitudinal study of players' behaviors in *World of Warcraft* examined gender and players' in-game behaviors. Players using a female avatar were found to engage in more healing and less player-to-player violence, consistent with the expectation that females are nurturing and docile (Yee, Ducheneaut, Yao, & Nelson, 2011). Other studies have demonstrated support for the Proteus Effect using experimental designs. Participants instructed to use black-cloaked avatars in virtual group discussions reported more aggressive attitudes and intentions than those using white-cloaked avatars (Pena et al., 2009). Pena and his colleagues postulated that avatar users in black cloaks likely responded in a manner consistent with the stereotypical association between dark colors—especially black—and evil or hostility (Adams & Osgood, 1973). Pena et al. (2009) also demonstrated that individuals who used avatars dressed like Ku Klux Klan (KKK) members tended to write stories with aggressive themes embedded in them, whereas those who used avatars resembling doctors chose to write stories with more affiliative themes. Similarly, Pena, McGlone, Jarmon, and Sanchez (2009) found that women using a female avatar dressed in formal attire (i.e., gray pantsuit) made more references to education and books than did women who used an avatar dressed in glamorous attire (i.e., fancy red dress) when asked to craft spontaneous stories about "a day in the life of their avatar." In contrast, women using the glamorous avatar made more references to entertainment, clothing, and sports. Pena and Kim (2014) also discovered that women who used avatars of normal weight exerted *more* physical activity when playing an "exergame" than women using obese avatars. It was argued that avatar users were acting in accordance with the expectation that overweight individuals are inactive and sedentary (Harris & Hopwood, 1982).

Taken together, results from these studies suggest that avatar appearance leads users to think and behave in ways stereotypically expected from someone with that appearance. In each of these studies, participants adjusted themselves in a way consistent with the attitudes and behaviors that could be inferred about their avatars based on assumed expectations derived from popularly-held stereotypes. That is, according to this reasoning in order for the Proteus Effect to occur, users must interpret the appearance cues of their avatar and assign traits to the avatar based on common expectations about how people of that particular appearance will think and behave (Ash, 2015). In this way, stereotypes form the crux of the Proteus Effect process by translating the observation of avatar appearance cues into dispositional inferences and expectations that subsequently influence user behavior (Sherrick, Hoewe, & Waddell, 2014).

While the aforementioned studies attest to the effectiveness of avatar appearance in evoking relevant stereotypes, visual appearance cues are not the only avenue through which stereotype activation can occur. The Proteus Effect is predicated on users forming a set of expectations based on stereotypes activated by an avatar-related cue; as such, the effect can be driven by any cue that successfully creates associations to particular traits or behaviors (Ash, 2015). In the following section, another avatar-related cue capable of influencing user interpretations of avatar appearance—role labels—is introduced.

Effect of Avatar Role Labels

Another avatar-related cue relevant to the Proteus Effect involves the role labels ascribed to an avatar within the virtual environment. A nascent line of research suggests that these labels can also function to activate appearance-related stereotypes, thereby influencing the inferences users make about their avatars. In their study of formally- versus glamorously-dressed avatars, Pena and his colleagues (2009) also explored whether adding in-game role labels describing the avatars influenced participants' stories. Specifically, half of the participants in the formally-dressed condition had the role label of "professor" ascribed to their avatar, while half of the participants in the glamorously-dressed condition received the role label of "supermodel." The remaining half of the participants in each condition received no such labels. It was found that while the glamorous avatar with no label elicited story themes linked to people, thoughts, and locations in the avatar's life, the glamourous avatar with the "supermodel" label elicited more exotic name-brands (e.g., Dolce and Gabbana) and references to age and the aging process (Pena, McGlone, Jarmon, & Sanchez, 2009). The authors observed that these themes are consistent with the stereotypical associations brought to mind by the concept of "supermodel." Similarly, adding the "professor" label to the formally-dressed avatar led participants to write stories with more themes of education and school life as compared to those who used the same avatar without the label. These findings provide preliminary evidence attesting to the effect that role labels have on influencing users' interpretations of their avatar's appearance cues; these labels activated particular stereotypes about the avatar, which influenced how users perceived and interpreted their avatar's appearance. This in turn guided the inferences they made about the avatar's disposition and likely behaviors. In this case, the stereotypes brought to mind by these labels then led to the increased presence of stereotype-congruent themes in users' stories as compared to the stories written by those in the no-label conditions.

However, these studies are limited by the fact that role labels were assessed only as additional cues in supplement to already existing cues (i.e., unequivocal avatar appearance). In other words, these studies only examined the combined effect of two cues (i.e., role label *and* appearance) on users' attitudes. Although these efforts did demonstrate the additive effect of role labels in augmenting congruent pre-existing visual cues, a question left unanswered is whether the labels *themselves* are sufficient to sway users' interpretations of an avatar with a comparatively less clear-cut appearance that fails to evoke strong stereotypical associations on its own.

To address this question, the present study examined whether altering the in-game role labels ascribed to an avatar with ambiguous appearance cues (as opposed to unequivocal appearance cues) led to changes in user attitudes consistent with stereotypes evoked by these labels (i.e., the Proteus Effect). Specifically, this study gauged the extent users rated their avatar in terms of label-relevant stereotypes (see Ash, 2015). In the next section, previous research on commonly-held perceptions related to one stereotype—body shape—is reviewed, and predictions following from these stereotypical associations are offered to explore the influence of avatar labels on user interpretations.

Stereotypes Related to Body Shape

Also known as somatotypes, human body shapes often fall into one of three general categories: the thin and lanky *ectomorphs*, the round and plump *endomorphs*, and the muscular and brawny *mesomorphs* (see Ryckman, Robbins, Kaczor, & Gold, 1989). Previous research has documented the existence of distinct stereotypes related to each somatotype. These commonly-held stereotypes function to associate each body shape with a particular constellation of expected traits and behaviors. The present study used differences in the stereotypical views about individuals with endomorphic versus mesomorphic body shapes to examine the potential influence of role labels on user interpretations of their avatar. Specifically, previous research has shown that mesomorphs and endomorphs are perceived to engage in different levels of physical activity (Harris, Harris, & Bochner, 1982; Philips & Drummond, 2001), vary in industriousness (Allon, 1975), receive differing levels of social support (Spillman & Everington, 1989), exhibit different levels of self-restraint (Rothblum, Miller, & Garbutt, 1988; Tiggemann & Rothblum, 1988), and enjoy different levels of career satisfaction (Harris et al., 1982; Puhl & Brownell, 2001). In all of these studies, participants perceived mesomorphs as exhibiting higher levels of each trait.

To summarize, stereotypes related to body shape function to produce differing associations between mesomorphs and endomorphs on a variety of traits and characteristics including physical activity, industriousness, social support, self-restraint, career satisfaction. Consequently, we expect that users who interpret their avatar's appearance as mesomorphic or endomorphic will describe the avatar with stereotype-consistent characteristics. Because previous research on the Proteus Effect suggests that avatar labels can activate stereotypes and influence user interpretations of their avatar in a manner consistent with these stereotypes, it is hypothesized that:

H1: Manipulating avatar role labels will lead users to describe a visually ambiguous avatar in label-congruent ways, such that users of mesomorph-labeled avatars will rate their avatar as engaging in higher levels of (a) physical activity, (b) being more industrious, (c) experiencing more social support, (d) capable of more self-restraint, and (e) enjoying more career satisfaction than will users of endomorph-labeled avatars.

Offline Carry-Over Effects

Another interesting line of research related to the Proteus Effect examines whether the attitudinal and behavioral changes experienced by users within a virtual environment have the potential to briefly "carry over" to subsequent offline behaviors. While a considerable body of evidence corroborates the Proteus Effect in virtual environments, the literature is much less clear on whether the effects demonstrated in the digital world can carry over to the physical offline world. Pena and Kim (2014) found evidence of this carry-over effect in desktop settings when it was discovered that female participants changed the intensity of their offline exercise behaviors based on the weight of their virtual avatar. Yee and Bailenson (2009) similarly found tentative support for a carry-over effect of avatar height on assertiveness in a negotiation task, such that participants who embodied tall avatars in a virtual environment made more self-favoring money splits in subsequent face-to-face negotiations. However, participants in this experiment were first placed into an immersive virtual reality environment that tracked their real-time physical movements and rendered them into a digital environment using sophisticated software and extensive hardware. It may be the case that the carry-over effects observed in this study were due in part to the substantial degree of immersion and virtual presence afforded by such technology (see Tamborini, Eastin, Skalski, & Lachlan, 2004). It is possible that the seamless integration between offline and online worlds made possible by the real-time tracking feature of this equipment amplified the Proteus Effect to the point that the effects were felt, at least momentarily, in subsequent offline interactions.

While technology such as this represents a new frontier for research on avatars and the Proteus Effect, it differs greatly from the technology typically used by the average person on a daily basis—at least for now. The generalizability of this carry-over effect to today's virtual desktop environments is therefore a question that remains to be answered by existing literature; additional research is needed to determine the scope and replicability of these effects. Given the mixed support for offline carry-over effects and the unknown generalizability of these findings to contexts involving avatar use in desktop virtual environments, the following research question is offered:

RQ1: Will manipulating the in-game labels ascribed to an avatar influence users' offline behaviors in a manner congruent with the stereotypes evoked by these labels?

Mechanism Behind the Proteus Effect

Although empirical support for the Proteus Effect has been generally consistent, different explanations of the underlying mental or neurological mechanisms driving the effect have been offered. In the following section, two prevailing explanations of avatar effects grounded in self-perception theory and priming theory are reviewed.

Self-Perception Theory

Yee and Bailenson (2007), who were first to theorize about and find evidence for the Proteus Effect, situated the phenomenon in the framework of self-perception theory (SPT; Bem, 1972). From this theoretical standpoint, users in virtual environments change their behaviors to match their avatars by examining the appearance of their avatars from the perspective of an imagined third party. In this view, behavioral consistency stems from the belief that avatar users must act in a manner consistent with the expectations they believe others will have about someone with their avatars' appearance (Yee, Bailenson, & Ducheneaut, 2009). Yee and Bailenson (2009) explain that the self-perception process of the Proteus Effect occurs in three distinct and sequential steps. Users first observe their avatar's appearance (e.g., "I am wearing a KKK uniform"). Users then make inferences about their disposition based on consideration of the expectations of an imagined observer (e.g., "Others view me as an aggressive person"). Finally, the expectations lead avatar users to alter their behaviors in a manner consistent with this disposition (e.g., "I will behave more aggressively"). As another example, users who perceive their avatar as tall will likely consider how others expect tall avatars will typically behave and then act in accordance with this expectation, which may involve behaving confidently and negotiating assertively.

It is important to note that in the self-perception perspective, users mindfully and deliberately adjust their behaviors in accordance with the imagined expectations others would have regarding their avatar's appearance. As Yee and Bailenson (2007) stated, "users make *inferences* about their expected dispositions from their avatar's appearance and then *conform* to the expected attitudes and behavior they believe others will expect them to have" (p. 293-294, emphasis added). Given that this process is characterized by active inference-making regarding expectations and the intentional conforming of behavior as a result of these inferences, it can be argued that this process involves a high degree of cognitive deliberation on behalf of the avatar user. In other words, avatar users' behaviors are consciously driven by the beliefs about how others expect them to act based on the avatars' appearance (Yee & Bailenson, 2009). As Sherrick, Hoewe, and Waddell (2014) state, "if [self-perception theory] is the relevant theoretical framework, individuals should be aware that they adapted their behaviors according to their avatars because [self-perception theory] assumes individuals consciously adjust their behavior based on the assumed expectations of others" (p. 20). After all, in order to adjust your behavior to match the expectations others have, you must first actively identify what the natures of these expectations are. In this way, high degrees of user effort and cognitive deliberation are defining features of the self-perception argument.

Priming Theory

A second view on the mechanism underlying the Proteus Effect is that the behavioral conformity is a byproduct of priming effects. Scholars arguing from this conceptual position (e.g., Pena, 2011, Pena et al., 2009) situate the Proteus Effect in the theoretical framework of the priming model of automaticity effects (Bargh, 1996). According to this view, the appearance of an avatar functions as a visual cue that activates neurological networks of associated concepts (i.e., mental representations) in the user's mind. These "primed" networks of interconnected concepts not only lead users to think in ways consistent with the cue, but also to experience subjective feelings and exhibit behaviors consistent with the cue. For example, early research demonstrated that priming individuals with the concepts of "reckless" or "adventurous" influenced their attitudes toward a risk-taking other in a manner consistent with the prime—evidence that cognitions and affect can be influenced by priming (Higgins, Rholes, & Jones, 1977). Crucially, later research expanded the effects of priming to include behavioral effects. For example, Bargh and his colleagues (1996) demonstrated that participants primed with concepts of old age and the elderly actually walked and spoke more slowly than participants not primed with such concepts. Taken together, the results from these studies strongly suggest that the effects of priming can span cognitive, affective, and even behavioral domains. Applying this framework to the Proteus Effect, it has been argued that certain appearance features of one's avatar serve as situational cues that activate a neurological network of learned associations among concepts and representations stored in users' memories—a process known as spreading activation (Collins & Loftus, 1975). This activation increases the likelihood that avatar users will act in accordance with these associations even without conscious deliberation (Pena, 2011). Behavioral change on behalf of the user is seen as a manifestation of these activated neural networks (Pena et al., 2009). For example, previous experiences may lead users to associate the color black with violence or negativity. When people are asked to then use an avatar with cloaks colored black, the color becomes a situational cue that activates previously stored networks of associations between black and semantic concepts such as violence. This activation can lead users not only to think and feel violently, but also to behave violently as well—producing the Proteus Effect. Similarly, an avatar resembling a doctor would activate a host of concepts that a user associates with doctors, some of which may involve benevolence or compassion. The increased neurological activation of these concepts then leads users to think, feel, and behave in a way consistent with notions of benevolence and compassion, resulting in the writing of stories with more affiliative themes. According to the priming explanation, it is this complex neurological phenomenon users experience when they see an avatar that then results in behavior consistent with the avatar's appearance.

Furthermore, the effects of priming are said to extend beyond spreading activation. Not only are concepts consistent with a particular cue activated when primed, but concepts inconsistent with the cue are deactivated and inhibited (Anderson & Spellman, 1995). This *spreading inhibition* will result in the suppression of users' behaviors inconsistent with the primed associations (Neely, 1977). In line with this idea, users of black-robed avatars not only developed more aggressive intentions but also reported less group cohesion than users of white-robed avatars (Pena et al., 2009). In summarizing the priming position, Pena (2011) stated, "the priming approach proposes that the attributes of one's avatar will automatically elicit learned responses but also inhibit actions that are inconsistent with the prime" (p. 155).

In contrast to the self-perception explanation, a defining feature of the priming model is automaticity, or a lack of conscious deliberation in the link between avatar appearance and user behavior. The automaticity model used to explain the Proteus Effect emphasizes how perception-behavior links "become automatized, chronically accessible, and hard-wired with no necessary act of will" (Pena et al., 2009, p. 840). As Pena (2011) explains, "the connection between social perception and the activation of internal representations of the outside world is thought of as an automatic response with no involvement of human volition" (p. 152). In this view, avatar appearance acts as a perceptual input that is translated automatically into behavioral outputs with no involvement of motivation, intention, or conscious deliberation (see Chartrand & Bargh, 1999). In this way, automaticity and a lack of cognitive deliberation are hallmarks of the priming explanation.

Measurement Issues Involved in Previous Research

Despite the many differences between the two theoretical frameworks, no studies to date have uncovered a defensible method for detecting the separate mechanisms. Yee and Bailenson (2009) sought to test the relative influence of self-perception and priming mechanisms on avatar users' behaviors by teasing apart embodiment in an avatar (i.e., a visual stimulus) from mere exposure to that stimulus. They reasoned that if the priming perspective were valid, exposing participants to the appearance of the avatar from a third-party perspective would lead to the same behavioral effects as having participants embody the avatar. This was argued because both conditions involved exposing participants to the same stimulus (i.e., the attractive avatar). In the study, participants either viewed their avatars in a virtual mirror (i.e., where their real movements were tracked live and reflected back to them) or viewed the same avatar from the perspective of another in the immersive virtual environment. Although the virtual mirror condition led to larger changes in users' behaviors consistent with avatar appearance than the third-person condition, this alone does not serve as strong evidence against the priming explanation. Merely exposing participants to an avatar from the perspective of another may not draw enough awareness to the avatar's appearance cues to activate the necessary neural networks required for priming to occur. It may be that an individual is required to actually use an avatar for the avatar's appearance cues to play a role in activating learned associations in the individual's mind. In other words, it may be that two concepts must be primed simultaneously and relatedly (e.g., *attractive person* and *me*) in order for the full effect of priming to emerge.

Thus, through the methodological conflation of both mechanisms within experimental manipulations, initial efforts in detecting the separate mechanisms fall short of this goal.

Other attempts to detect the presence of one mechanism over the other have failed to yield conclusive evidence despite claims of support for a particular position. For example, previous research has also attempted to discriminate the two conceptual perspectives for the Proteus Effect by examining the phenomenon of spreading inhibition, which was predicted exclusively in the priming perspective. Pena et al. (2009) argued that using an avatar with a KKK costume would not only lead to more aggression but also inhibit affiliative thoughts than those asked to use an avatar with no distinct costume (i.e., those in the control group). Likewise, individuals using doctor avatars were more likely to inhibit aggressive thoughts when compared to plain-clothed avatars. Although the authors claimed support for spreading inhibition, they only found that avatars with KKK outfits induced fewer affiliative thoughts in comparison to doctor avatars, not the control group. To support the existence of spreading inhibition, the group asked to embody the KKK avatar should have differed in written affiliative language from the control group, which they did not. The comparison of the two experimental groups confounded activation with inhibition mechanisms and led to ambiguous support for the detection of the priming mechanism over the self-perception mechanism.

In a different attempt to lend credence to the priming explanation, Pena (2009) measured participants' self-reported awareness of the influence of avatar appearance on their behavior. Awareness was examined because, as previously mentioned, the two perspectives are said to diverge on the basis of how mindful users are of the cognitive processes underlying the Proteus Effect. The self-perception process is argued to be more deliberate and mindful while the priming phenomenon is believed to be automatic and unconscious. Because avatar users did not report awareness of any influence of avatar appearance on their behaviors, Pena et al. (2009) argued that the priming perspective better explained the Proteus Effect. Nevertheless, this conclusion is tenuous given that participants often cannot overtly explain or report on the causes of their behaviors (Nisbett & Wilson, 1977; see Jacoby & Kelley, 1987), which calls into question the validity of the evidence that ostensibly distinguishes these perspectives.

Taken together, the aforementioned limitations attest to the difficulty in teasing apart these two explanations and provide a compelling argument in favor of a more stringent means of detecting these mechanisms. In pursuit of this latter goal, the present study uses the contrasting views held by each perspective regarding an observable and theoretically-relevant variable to explore a new technique for detecting the mechanisms underlying the Proteus Effect. In so doing, both mechanisms are experimentally induced by prompting users to form appraisals about their avatar from either their own perspective or from the perspective of an imagined other. While the present study cannot make any claims as to which mechanism is responsible for the Proteus Effect as it occurs naturally (i.e., without experimental induction), the hope of this endeavor is to provide an objective assessment technique through which the mechanisms can at least be detected.

Role of Cognitive Mediation

It may be possible to detect which mechanism is driving a particular instance of the Proteus Effect by assessing differences in cognitive mediation. As mentioned earlier, one key difference between the self-perception and priming explanations centers on user mindfulness and deliberation. According to self-perception theory, avatar users must first cast themselves in the mind of an imagined third party, make a decision about the expectations this imagined other has about the avatar, and then behave in a manner consistent with these expectations (Yee & Bailenson, 2007). This sequential process assumes several stages of mindful deliberation (i.e., cognitive mediation) by avatar users. One corollary prediction of this perspective is that the process of thinking about one's avatar, others' perceptions of that avatar, and reaching a conclusion regarding expected behavior should be reflected in how much time it takes to reach that conclusion. This is because users actively think about adjusting their behaviors to reflect the expectations held by others before they can come to a conclusion about how they should act. In other words, the link between avatar appearance and user behavior involves the retrieval of concepts and associations that may not be deeply ingrained into users' mental networks, and thus require a certain degree of user mentation. Cognitive deliberation has been empirically demonstrated to link to particular variables, one of which is user response time. Indeed, research on second-language acquisition often uses processing speed and response time as a proxy measure for cognitive mediation when comparing the strength of word-concept associations across different languages (e.g., Kotz & Elston-Güttler, 2004; McElree, Jia, & Litvak, 2000).

In contrast, the mental networks of related concepts activated through priming and the behavioral effects of this activation are believed to be more automatic and happening outside of users' awareness (Pena, 2011). This is because the priming mechanism relies on an external cue or stimulus activating networks of related concepts that already exist in a user's mind. These networks exist at a neurological level, and do not rely on cognitive processes for activation. For example, a doctor avatar can lead users to behave more benevolently because the link between doctors and benevolence was already established in the user's mind through past experience, and was simply activated in response to exposure to a stimulus. Because this explanation postulates that individuals are simply biased in favor of existing associations from memory rather than potentially forging new associations, it follows that this phenomenon is characterized as happening across a relatively shorter amount of time. Consistent with this idea, research on implicit attitudes and semantic priming has demonstrated that processes requiring little cognitive deliberation occur more quickly than processes requiring higher levels of mentation (e.g., Fazio, Powell, & Williams, 1989; Greenwald, McGhee, & Schwartz, 1998). Given that the self-perception and priming mechanisms are characterized by different levels of cognitive mediation and because cognitive mediation can be accurately assessed via response time, it is therefore hypothesized that:

> H2: Users reporting their own perceptions of their avatar will do so more quickly than users asked to report perceptions that others have about the users' avatar.

CHAPTER 2. METHODS

Overview

A laboratory experiment involving a desktop computer was conducted. Participants were randomly assigned to operate an avatar labeled as either mesomorphic or endomorphic, and navigated through a virtual world as this avatar. Participants then completed a survey about their judgments of the avatar and its traits. These trait ratings were compared across label conditions to examine the effects of role labels on stereotype-relevant avatar interpretations. To manipulate the perspective through which users formed judgments of their avatar, the wording of the items was modified such that participants in the other-perspective condition were asked to respond from the perspective of an imagined observer when rating the avatar, while participants in the self-perspective condition were asked to respond with their own judgments. The result was a **2** (*Label*: Mesomorph/Endomorph) **x 2** (*Perspective*: Self/Other) experimental design. By measuring the total time taken for participants to answer these questions, researchers assessed whether the pathways postulated by the two explanations can successfully be differentiated through proxy measures of cognitive mediation (i.e., response time). Finally, to test for carry-over effects relevant to the stereotypes, participants squeezed an apparatus measuring grip intensity.

Stimulus Materials

Avatar. Users operated a three-dimensionally rendered male avatar in a desktop virtual environment. The avatar was intentionally designed to be amorphously large and bulky in appearance (see Appendix A) so that the role labels used to describe it would remain reasonably believable. To ensure that avatar appearance was sufficiently amorphous, a pretest was conducted on a separate group of individuals (N = 15) whom were blind to the hypotheses. This pretest consisted of four 7-point semantic-differential items (α = .78) assessing perceptions of the avatar's body, with endpoints corresponding to endomorphic and mesomorphic descriptions (e.g., plump—muscular, extremely unfit—extremely fit) (see Appendix B). Results indicated that the responses clustered near the midpoint of each item (M = 3.81, SD = 0.52), thereby suggesting that the avatar was not perceived as particularly mesomorphic or endomorphic by default.

Avatar Role Labels. To influence user interpretations of the avatar, in-game avatar role labels were manipulated to describe the avatar as either mesomorphic or endomorphic. Through the different labels, participants in one condition were led to interpret the bulkiness of their avatar as representing mesomorphism, while participants in the other condition were led to interpret the bulkiness as representing endomorphism as its associated traits (see Appendix C, Fig. 1). In the mesomorph condition, participants received avatar labels "bodybuilder." In the endomorph condition, participants received avatar labels of "overweight." It is worth remembering that while the semantic nature of these labels changed, the physical appearance of the avatar remained unchanged across conditions.

Perspective. To prompt users to evaluate the traits of their avatar through their own perspective or through the perspective of an imagined other, the survey items involved slight variations in wording based on the condition to which participants were assigned. Participants in the other-perspective condition were asked to respond from the perspective of an imagined observer when generating ratings of the avatar, while participants in the self-perspective condition were asked to respond with their own judgments (see Appendix D). In doing so, researchers induced participants into engaging in the processes processes characteristic of the self-perception and priming mechanisms. A screenshot of the avatar was included with each survey item for participant reference.

Participants

Participation in this study was limited to males (N = 74). This was done in an effort to circumvent potential issues associated with creating an equally amorphous female avatar for female participants and to avoid the confound of gender on grip strength. Participants ranged in age from 18 to 28 (M = 20.93, SD = 2.56) and were of variegated ethnic backgrounds, with the most common being Asian (37.9%), followed by Mixed (21.6%), Caucasian (18.9%), Pacific Islander (6.8%), Hispanic (4.1%), and African American (2.7%). The remaining participants (8.1%) were of ethnicities not provided as options.

Procedures

Recruitment. Participants were recruited using a variety of methods. These included recruitment flyers posted on the campus of a large public university on the west coast of the United States, online social media advertisements, and verbal solicitations of participation from public areas such as shopping malls and libraries. Interested participants scheduled an appointment with the researcher and arrived at the research laboratory at their specified time.

Laboratory procedures. Upon arrival, participants read a consent form (see Appendix E) were asked to provide informed consent by signing the form. After consenting to participate, participants were directed to a desktop computer monitor. Displayed on this desktop was an amorphously bulky avatar situated within the social virtual world *The Sims* (see Appendix C, Fig. 2). This game is not bound by any goal-driven premises and allows users to explore the virtual environment free from any concerns about fulfilling extraneous objectives. This was done to minimize the likelihood of participants disregarding the cues of their avatar in pursuit of game-related objectives. *The Sims* was chosen for this study given its popularity among virtual world users along with the ease of and malleability in creating avatars and constructing physical locations in the game. Participants were given 15 minutes to operate the avatar within the virtual environment. This time period was based off previous avatar studies that used similar exposure lengths (e.g., Sherrick, Hoewe, & Waddell, 2014; Yee & Bailenson, 2009).

After using the avatar for 15 minutes, participants were redirected to a different computer displaying a survey administered via DirectRT. This survey contained a total of 20 items measuring the nature of users' judgments about the avatar and its stereotype-relevant traits, researchers can examine whether these labels successfully biased user ratings of their avatar in a manner consistent with these labels. The wording of the survey items varied slightly across conditions, such that half of users answered items assessing their own views on the traits of their avatar (i.e., self-perspective condition), while the other half answered items assessing the views participants believed a typical other person might have about the traits of their avatar (i.e., other-perspective condition). To avoid the potential confound of word count on user response time in answering survey items, the number of words contained within survey items across the two perspective conditions was kept constant. Differences in the amount of time taken to respond to these items were measured by DirectRT and was used to detect predicted variations in user cognitive mediation. By including survey items measuring the nature of users' judgments about the avatar and its stereotype-relevant traits, researchers can examine whether these labels successfully biased user ratings of their avatar in a manner consistent with these labels.

After completing the computerized survey, participants were asked to squeeze an apparatus known as a handgrip dynamometer as forcefully as possible. This apparatus then recorded the intensity of their grip. These measures operationalize offline behaviors indicative of physical activity and strength, and are intended to assess the potential offline behavioral carryover indicative of the Proteus Effect (see Yee & Bailenson, 2009). Study duration totaled to about 20 minutes.

Instruments

Ratings of avatar physical activity level. User ratings of avatar physical activity were measured using an adapted version of the physical activity subscale (see Appendix F) contained within the broader Self-Control Scale created by Grasmick, Tittle, Bursik, and Arneklev (1993). Items in this scale were rated on a 7-point Likert scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale contained five items, including "My avatar seems to have more energy and a greater need for activity than most other people his age" and "If my avatar had a choice, he would almost always rather do something physical than something mental." These five items were summed to form a single physical activity measure (α = .94). Higher scores on this measure indicate that users rated their avatar as possessing mesomorph-consistent traits.

Ratings of avatar industriousness. User ratings of avatar industriousness were measured using an adapted version of the industriousness subscale (see Appendix G) contained within the broader Conscientiousness Scale developed by McCann, Duckworth, and Roberts (2009). Items in this measure were rated on a 7-point Likert scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale contained five items, including "My avatar seems like he accomplishes a lot of work" and "My avatar seems he pushes himself very hard to succeed in whatever he is doing." These five items were combined to form a single industriousness measure (α = .86). Larger values on this measure indicate that users rated their avatar as possessing mesomorph-consistent traits.

Ratings of avatar social support. User ratings of avatar social support were measured using an adapted version of the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988) (see Appendix H). Items in this measure were rated on a 7-point Likert scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale contained three items, including "My avatar seems like someone who can count on his friends when things go wrong" and "My avatar seems like he has people with whom he can share his joys and sorrows." These three items were combined to form a single social support measure (α = .73). Larger values on this measure indicate that users rated their avatar as possessing mesomorph-consistent traits.

Ratings of avatar self-restraint. User ratings of avatar self-restraint were measured using an adapted version of the impulsivity subscale (see Appendix I) of the broader Self-Control Scale (Grasmick et al., 1993). Items in this measure were rated on a 7-point Likert scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale contained four items, including "My avatar is more concerned with what happens to him in the short run than in the long run" and "My avatar often does whatever brings him pleasure here and now, even at the cost of some distant goal." These four items were reverse-coded and combined to form a self-restraint measure (α = .88). Larger values on this measure indicate that users rated their avatar as possessing mesomorph-consistent traits.

Ratings of avatar career satisfaction. User ratings of avatar career satisfaction were measured using an adapted version of the Career Satisfaction scale (see Appendix J) created by Greenhaus, Parasuraman, and Wormley (1990). Items in this measure were rated on a 7-point Likert scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale contained three items, including "My avatar seems like he is satisfied with the success he has achieved in his career" and "My avatar seems like he is satisfied with the career advancement he has achieved in his job." These three items were combined to form a single career satisfaction measure (α = .77). Larger values on this measure indicate that users rated their avatar as possessing mesomorph-consistent traits.

Offline carry-over effects. To assess potential offline carry-over effects associated with stereotypes related to mesomorphism and endomorphism, users used a handheld apparatus known as a handgrip dynamometer (see Appendix K). This apparatus acted as a proxy measure for physical strength by recording the intensity of users' handgrip pressure, measured in pounds-per-square-inch (psi). Larger values on this measure indicate that users are engaging in offline behaviors reflecting mesomorphic qualities.

User response time. Variations in cognitive mediation were measured by recording users' response times to survey items via the software program *DirectRT*. In addition to administering survey items, DirectRT also measures how much time respondents take in answering each item, in milliseconds. Response times for individual items were combined into a single aggregate score and divided by the number of survey items, thereby providing the average amount of time users took to answer each item. Average response times were then converted from milliseconds to seconds for subsequent analyses and reporting.

CHAPTER 3: RESULTS

Hypothesis 1 predicted that users of mesomorph-labeled avatars would rate their avatar as having more stereotypically mesomorphic traits while users of endomorph-labeled avatars would rate their avatar as having more stereotypically endomorphic traits. This hypothesis was tested using a series of independent-samples t-tests comparing the mean scores on each trait-relevant scale across the two label conditions.

Hypothesis 1a predicted differences in ratings of avatar physical activity level, such that users in mesomorph conditions would rate their avatar as being more physically active than would users in endomorph conditions. Results were consistent with the hypothesis. Subjects in mesomorph conditions rated their avatar as significantly more physically active (M = 5.71, SD = 0.80) than subjects in endomorph conditions did (M = 2.56, SD = 0.77), $t(72) = 17.25$, $p < .001$, $d = 4.07$.

Hypothesis 1b predicted differences in ratings of avatar industriousness, such that users in mesomorph conditions would rate their avatar as being more industrious than would users in endomorph conditions. Results were consistent with the hypothesis. Subjects in mesomorph conditions rated their avatar as significantly more industrious (M = 4.81, SD = 0.83) than subjects in endomorph conditions did (M = 3.19, SD = 0.74), $t(72) = 8.87$, $p < .001$, $d = 2.09$.

Hypothesis 1c predicted differences in ratings of avatar social support, such that users in mesomorph conditions would rate their avatar as being more socially-supported than would users in endomorph conditions. Results failed to confirm the hypothesis. Subjects in mesomorph conditions did rate their avatar as having higher levels of social support (M = 4.49, SD = 0.84) than subjects in endomorph conditions did (M = 4.20, SD =

0.70), though the difference did not reach significance, $t(72) = 1.60$, $p = .11$, $d = 0.38$.

Hypothesis 1d predicted differences in ratings of avatar self-restraint, such that users in mesomorph conditions would rate their avatar as having more self-restraint than would users in endomorph conditions. Levene's test of homoscedasticity indicated unequal error variances ($F = 4.32$, $p = .04$), so degrees of freedom were adjusted from 72 to 62 in the analysis. Results were consistent with the hypothesis. Subjects in mesomorph conditions rated their avatar as significantly more self-restrained ($M = 4.21$, $SD = 1.20$) than subjects in endomorph conditions did ($M = 3.15$, $SD = 0.78$), $t(62) = 4.51$, $p < .001$, $d = 1.15$.

Hypothesis 1e predicted differences in ratings of avatar career satisfaction, such that users in mesomorph conditions would rate their avatar as being more satisfied with his career than would users in endomorph conditions. Subjects in mesomorph conditions did rate their avatar as being more satisfied with its career ($M = 4.23$, $SD = 0.63$) than did subjects in endomorph conditions did ($M = 3.93$, $SD = 0.70$), though the difference bordered significance, $t(72) = 1.97$, $p = .05$, $d = 0.46$.

Research question 1 explored whether operating mesomorphic- and endomorphic-labeled avatars could influence users' offline behaviors in a manner consistent with these labels. To test for potential carry-over effects, an independent-samples t-test was used to compare users' mean grip strength scores across label conditions. Results failed to demonstrate any influence of avatar label on users' offline behavior. The average grip strength of subjects in mesomorph conditions ($M = 92.14$ psi, $SD = 17.62$ psi) did not significantly differ from that of subjects in endomorph conditions ($M = 90.70$ psi, $SD =$ 15.20 psi), $t(72) = 0.38$, $p > .05$, $d = 0.09$.

Hypothesis 2 predicted that users asked to assess the traits of their avatar from their own perspective would answer avatar-related items more quickly than users asked to assess the traits of their avatar from the perspective of an imagined other. This hypothesis was tested using an independent-samples t-test comparing the average time it took users to respond to avatar-related items across the two perspective conditions. Results from this test were consistent with the hypothesis. Subjects in self-perspective conditions displayed a significantly shorter average response time (M = 6.36 sec., SD = 2.59 sec.) in answering avatar-related items than did subjects in other-perspective conditions (M = 7.82 sec., SD = 3.04 sec.), $t(72) = 2.21$, $p < .05$, $d = 0.52$.

CHAPTER 4. DISCUSSION

Previous research has demonstrated that avatar-related cues can influence user attitudes and behaviors, though the mechanism responsible for this effect is debated. The first purpose of this study was to examine whether role labels—in-game semantic descriptors attached to an avatar—can bias user interpretations of their avatars in label-consistent ways, and potentially lead to changes in users' offline behaviors. The second purpose of this study was to test a technique for detecting the mechanisms underlying the Proteus Effect proposed by two prominent theories through assessing user response time when answering questions about their avatar. Support was found for the effect of role label on user assessments of their avatars; these labels biased users' assessments of their avatars such that users rated their avatars as possessing higher levels of 3 of 5 traits stereotypically consistent with the labels, and an additional trait (career satisfaction) bordered significance. No support was found for the presence of offline carry-over effects on user behavior consistent with the role labels. Finally, results indicate the variable of response time may hold potential as a proxy measure for detecting the two proposed mechanisms of the Proteus Effect. In the following sections, key findings and their implications are explored in greater detail. Limitations of the current study are then provided, and directions for future research are offered.

Key Findings and Implications

Previous research on the Proteus Effect (e.g., Pena, McGlone, Jarmon, & Sanchez, 2009) has demonstrated that assigning role labels to avatars with stereotypical appearance cues can bias users toward generating label-consistent thoughts beyond the effects of appearance cues alone. The findings from this study extends this line of research by demonstrating the effect of role labels in generating label-consistent avatar ratings in contexts involving an avatar of an ambiguous appearance. The finding that role labels can influence user perceptions of an avatar without stereotypical appearance cues suggests that these labels can act as a sole stimuli source that biases user interpretations of their avatars in and of themselves. These findings contribute to a nascent body of evidence suggesting that semantic role labels, much like the straightforward avatar appearance cues used in previous studies, may constitute one of several avenues through which avatar cues can influence user cognition and behavior. In other words, in contexts involving avatars with appearances that do not translate readily into dispositional expectations, the semantic descriptors contained within role labels can become the stimulus source that functions to guide user interpretation of their avatar. Of course, avatars as they exist in reality involve a complex combination of cues that may be visual, semantic, and social in nature. The findings from this study simply highlight the unique effects that semantic role labels have in influencing user attitudes, thereby illustrating how other types of cues beyond visual appearance cues can similarly engender the Proteus Effect.

One key implication of this finding is that the Proteus Effect is not necessarily limited to cases involving visual appearance cues. It is noteworthy that participants' evaluations of the avatar contrasted so markedly due to only a label manipulation. Despite the preponderance of existing research focusing on how appearance cues of an avatar can influence users, appearance cues may actually represent one subset of a larger group of avatar-related cues that can similarly function to influence users' attitudes and behaviors. As avatar customization possibilities continue to grow and avatars become increasingly complex in their visual appearances, it is possible that these appearances are not as clearly linked to particular stereotypes as has been the case in initial Proteus Effect studies. For example, a Second Life avatar may have some appearance cues reminiscent of a supermodel, while simultaneously possessing other cues linked to academic life. In these situations, where consulting the appearance of an avatar alone is insufficient in determining the relevant expectations of avatar disposition, role labels may become an increasingly important source of influence in biasing user interpretations and expectations of their avatars.

In addition to avatar cues engendering cue-consistent user attitudes and in-game behaviors, early Proteus Effect studies (e.g., Yee & Bailenson, 2007; 2009) offer preliminary evidence that the influence of these cues can briefly "carry over" and subsequently affect users' offline behaviors. However, the results from this study failed to demonstrate any differences in users' offline behaviors consistent with the role labels assigned to their avatars. One can speculate that these contrasting findings may be partially explained by the differing levels of user immersion and embodiment afforded across individual studies. For example, Yee and Bailenson (2007, 2009) found evidence for the carry-over effect of avatar height on offline confidence when using an immersive virtual environment (IVET) with real-time movement tracking capabilities. The high degree of correspondence between the offline and online selves made possible by this technology may have resulted in participants experiencing higher levels of immersion or embodiment within the avatar (see Ash, 2015). This heightened degree of avatar embodiment may have, in turn, led to Proteus Effects so pronounced that they continued to linger momentarily in subsequent face-to-face interactions. The potentially critical factor of avatar embodiment is further underscored by a study by Sherrick, Hoewe, and Waddell (2014), which found that assigning participants to

2D avatars (which produced low levels of user immersion in and identification with the avatar) not only did not produce avatar-consistent behavioral changes, but actually produced changes *contrary* to those expected from avatar appearance. It may be the case that a certain level of user embodiment within an avatar (e.g., controlling its movements in real-time as opposed to simply seeing it on-screen) is required before avatar-consistent changes in users' offline attitudes and behaviors will emerge. The implication of this finding is that carry-over Proteus Effects should not be regarded as a natural extension of in-game changes in user attitude and behaviors; rather, these carry-over effects are a unique set of outcomes that potentially only emerge when a particular set of antecedent conditions are met.

Finally, previous efforts aimed at testing the mechanisms underlying the Proteus Effect have involved methodological limitations due to the lack of a stringent detection tool capable of differentiating between them. This study addresses this limitation by experimentally inducing both mechanisms and measuring differences in user response time in generating assessments of their avatars. The finding that statistically significant differences emerged in user response time across the two perspective conditions provides initial evidence attesting to the utility that this variable can have in the context of Proteus Effect research. The potential use of response time is further bolstered by the fact that response time represents behavioral data, as opposed to self-report data, thereby circumventing several concerns arising from response biases and social desirability effects.

Limitations and Directions for Future Research

Despite its contributions, this study is not without limitations, and these limitations should be kept in mind when interpreting the results of this investigation. First, while this study was able to successfully establish a technique for measuring the two proposed mechanisms, this study remains unable to shed any light on the question of which mechanism is actually responsible for the Proteus Effect. Because the perspective users' adopted when forming assessments of their avatars was experimentally manipulated by researchers via the wording of the survey items, no claims can be made about which perspective(s) is being used as the phenomenon occurs naturally. In other words, in an effort to test a way to measure the two mechanisms, the central debate as to which mechanism is valid in the context of the Proteus Effect is set aside. Future research should seek to use response time (and potentially other variables) to detect the presence of the two mechanisms in contexts of avatar use that do not involve researcher intervention. In this way, scholars can gain a better understanding of the mechanism responsible for the influence of avatars on user attitude and behavior.

Although this is mere speculation, it may be that both mechanisms are at play in producing the Proteus Effect, albeit in different circumstances. Rather than being mutually exclusive, the self-perception and priming mechanisms may operate uniquely depending on a multitude of situational factors. For example, the degree to which the stimulus avatar is ambiguous in its appearance may potentially cause one explanation to be more relevant than the other. It may be that when users are provided with unambiguous avatars clearly linked to stereotypes, the ease with which spreading activation takes place results in the priming mechanism being responsible for the Proteus Effect. However, in contexts involving amorphous avatar appearance cues not so easily linked to stereotypes, users might resolve this ambiguity by cognitively deliberating about how the avatar is likely to be perceived by another, thereby engaging in a process more akin to the self-perception argument.

Despite being conjecture, this notion of the non-mutual-exclusivity of the two mechanisms is consistent with several psychological models on schema activation. For example, the theory of cognitive structure activation (Sedikides & Skowronski, 1991) explains that people make sense of the world by relating their immediate experience to knowledge they have accumulated in the past. This knowledge is believed to be organized into cognitive structures (i.e., mental representations of objects or ideas). Individuals possess a large number of cognitive structures that could potentially be applied to any new stimulus. As Sedikides and Skowronski stated, “many people, objects, and events are multifaceted: They can be understood in terms of a variety of cognitive structures” (p. 170). Given the large network of associative pathways tying together various cognitive structures, novel stimuli in one’s periphery are interpreted through the activation of existing familiar cognitive structures. In the case of the Proteus Effect, avatars’ appearance cues are the stimuli observed by their users. The mechanisms involved with self-perception and priming may represent cognitive structures that are seemingly similar but still distinct. The mechanisms are similar in that they both operate to influence users’ behaviors in a manner consistent with the cues of the avatar, but they differ in the source of the expectations guiding this behavior. In the self-perception explanation, other-generated expectations guide behavior, whereas behaviors are guided by self-generated expectations according to the priming perspective. Consistent with the law of cognitive structure activation, the cognitive structure (i.e., self vs. other expectations) that will be used to process the avatar’s appearance will depend on whichever structure is most accessible in a user’s mind. This may depend on a variety of factors, such as how ambiguous and easily interpretable the appearance cues of the avatar are. This structure is then used to interpret the stimulus; the emergence of attitudes and behaviors consistent with the structures activated by this processing is the Proteus Effect. Future research should consider the possibility of both mechanisms operating under different circumstances, and begin to explore some of the antecedent factors that may lead to one mechanism being relevant over the other.

Another limitation of the present study is that the variable of participant experience with the relevant video game was left unassessed. This represents a weakness because the level of participant familiarity with *The Sims* may have influenced the strength and presence of the Proteus Effect; controlling for this variable is therefore a worthwhile endeavor. For example, it is possible that users who were less familiar with the game needed to spend additional time getting accustomed to the game controls, thereby giving them less time to fully appreciate the avatar and all of its cues and characteristics compared to participants who were familiar with the game and were able to jump right in to the avatar and his daily life. Future studies should control for the effects of prior video game experience in order to circumvent these potential concerns.

Another important avenue for future research involves looking at the Proteus Effect across time, as opposed to in a single "snapshot" study. Previous media effects studies (e.g., Van Looy, Courtois, & De Vocht, 2010) have demonstrated the important moderating role of player-avatar identification in producing a variety of attitudinal and behavioral effects arising from virtual world usage. It may be that the Proteus Effect is the observable result of the slow and steady increases in player identification with their avatar that happen over a long period of time involving consistent use with the same avatar. In reality, it is admittedly quite uncommon for a user to be assigned an avatar for fifteen minutes only to never use it again. Instead, users typically revisit the same avatar on multiple occasions over time. Thus, these potential accumulation effects are unable to be assessed without a longitudinal or naturalistic study design. Future studies should employ such designs to better capture the presence of the Proteus Effect as it develops in ecologically valid scenarios.

A final direction for future investigation involves studying the Proteus Effect using mixed-sex samples. Although this study specifically examined males to obviate the need for creating a comparably amorphous female avatar and thereby avoid a potential confound of gender, future research should explore the possibility of sex differences in the attitudinal and behavioral effects of the Proteus Effect.

Conclusion

Avatars serve as unique levers for attitudinal and behavioral change on behalf of virtual environment users. Up until several years ago, virtual environments were limited to the borders of a computer screen. However, with the advent of virtual reality (VR) technology, the "virtual environment" is rapidly expanding into living rooms and classrooms around the globe. While avatars are fascinating, the broad implications of digital representations and their effects transcend video games and avatars. As the line between the virtual and corporeal continues to blur, the potential impact that these changes have on the human experience are profound and worth investigating. The results of this study show that the semantic role labels attached to avatars within a virtual environment can function similarly to stereotypical appearance cues in eliciting cue-consistent user attitudes. Additionally, this study provided initial evidence for the potential utility of measuring user response time in detecting the unique mechanisms believed to be responsible for the Proteus Effect. Although much more work needs to be done to further scholarly understanding of the complex ways that digital representations influence user cognition and behavior, this study represents a step forward in an area of literature that will only continue to grow in popularity in the coming years.

APPENDIX A
Avatar Appearance

Figure 1. Amorphously large male avatar

APPENDIX B

Pretest Questionnaire

On the scale below, please report your perceptions about the appearance of the avatar shown. Choose the number that best represents how you view the avatar.

1.	Extremely unfit	1	2	3	4	5	6	7	Extremely fit
2.	Plump	1	2	3	4	5	6	7	Muscular
3.	In poor shape	1	2	3	4	5	6	7	In excellent shape
4.	Unathletic	1	2	3	4	5	6	7	Athletic

APPENDIX C

In-Game Avatar Label

Figure 1. Mesomorphic avatar label

Figure 2. Avatar situated within social virtual world The Sims

APPENDIX D
Perspective Manipulation

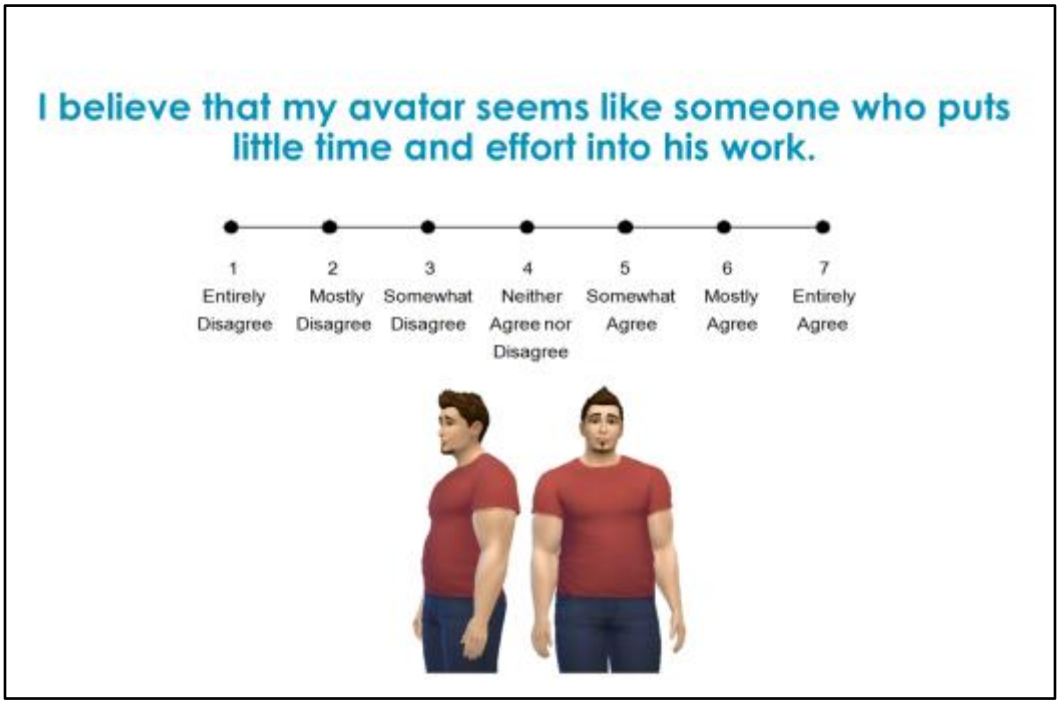

Figure 1. Example survey item for self-perspective condition

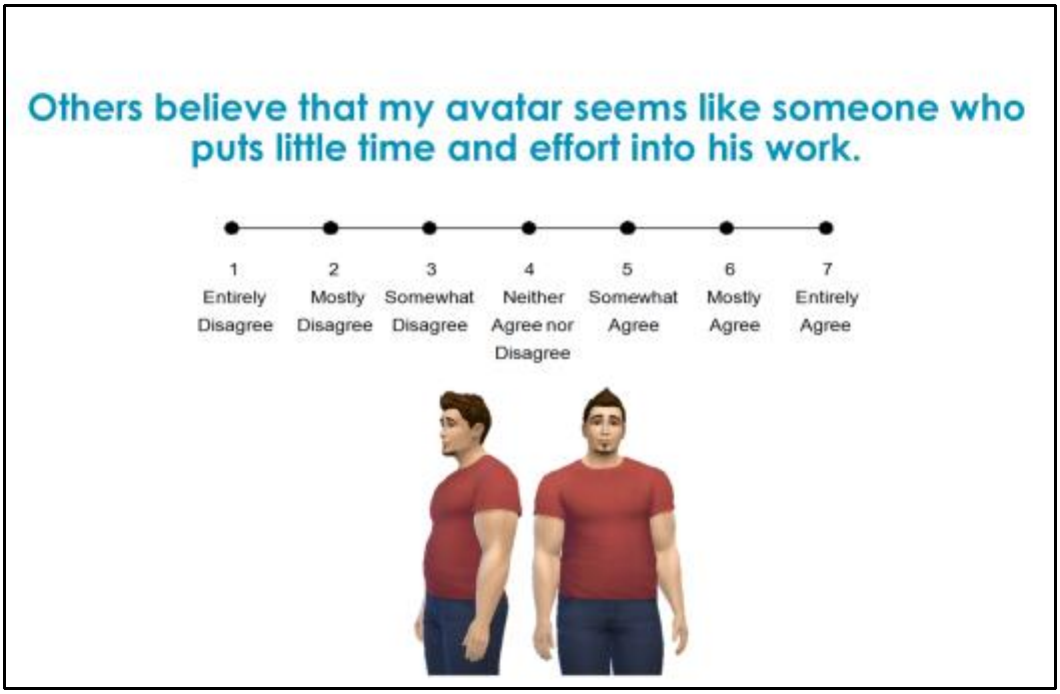

Figure 1. Example survey item for others-perspective condition

APPENDIX E

Consent Form

Consent to Participate in University of Hawai'i Research Project:

Virtual Environments Study

Dear University of Hawai'i at Manoa (UHM) Student:

Aloha, my name is Justice Quick, and I am a graduate student in the Department of Communicology at the University of Hawaii. I am conducting a research study in partial fulfillment of the requirements necessary for my graduate degree. The purpose of my study is to explore the effects of virtual environments on computer users. Below, I describe the protocol of my study in further detail. At the end, I ask for your permission (i.e., consent) to participate in this study.

Project and Description: This study will be conducted using a desktop computer in our laboratory. If you choose to participate in this study, you will first be directed to a virtual world through which you can navigate using an avatar. After interacting with the virtual world, you will be directed to a short computerized questionnaire. Upon completion of the questionnaire, you will be asked to use a grip apparatus provided in the laboratory. Your participation in the study will conclude upon usage of the apparatus. In total, this study should take no more than 20 minutes to complete. If you are currently enrolled in Communicology courses at the University of Hawaiʻi, you will be awarded .50 SONA credits for your participation. You will be one of at least 80 individuals who participate in this study.

Benefits and Risks: There will be no direct benefit to you by participating in this research study. However, the results of this project may help uncover information about the ways the virtual environments influence our behavior. I believe there is little risk to you in participating in this research project. It is possible, however, that you may become uncomfortable from using the lab equipment or answering the survey questions during the study. If you do become uncomfortable, you may skip the questions or discontinue participation. You can stop the study and withdraw from it altogether at any time without any penalty to you.

Privacy and Confidentiality: All information collected from you will remain confidential. No personal identifying information will be collected apart from your name. Your name will be disassociated from the data you provide, thereby removing any link between your identity and your responses. I will store all information on a password-protected computer locked in a safe location. Only myself and my thesis advisor, Dr. Robert Kelly Aune, will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawaii Human Studies Program has the right to review research records for this study. All electronic files containing the records will be destroyed at the completion of the project. When I report the results of my research project, your name will not be used.

Voluntary Participation: Participation in this project is completely voluntary. You may stop participating at any time. If you choose to withdraw from the study, there will be no penalty or loss to you. Your choice to participate or not participate will not affect your course grade or class standing. You can contact me with questions and concerns about this investigation by e-mail at justiceq@hawaii.edu. You can also contact my thesis advisor, Dr. Robert Kelly Aune, by e-mail at kaune@hawaii.edu.

Questions: For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the University of Hawaiʻi Human Studies Program at 1960 East-West Road, Biomedical Bldg, Room B-104, Honolulu, Hawaiʻi 96822. You may also call them at (808) 956-5007 or email them at uhirb@hawaii.edu.

Sincerely,

Justice Quick
Graduate Student
Department of Communicology
University of Hawaiʻi at Manoa
2560 Campus Rd., George Hall 323
Honolulu, Hawaiʻi 96822
E-mail: justiceq@hawaii.edu

By signing below, you acknowledge that you have read the information above and give your consent to participate in this study. Please take a copy of this consent form your personal records.

APPENDIX F

Physical Activity Subscale

(Grasmick, Tittle, Bursik, & Anreklev, 1993)

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

1. My avatar seems like someone who enjoys physical activity.
2. If my avatar had a choice, he would almost always rather do something physical than something mental.
3. My avatar almost always feels better when he is on the move rather than when he is sitting thinking.
4. My avatar likes to get out and do things more than he likes to read or contemplate ideas.
5. My avatar seems to have more energy and a greater need for activity than most other people his age.

APPENDIX G

Industriousness Scale

(McCann, Duckworth, & Roberts, 2009)

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

1. My avatar accomplishes a lot of work.
2. My avatar does just enough work to get by (R).
3. My avatar generally makes an effort in what he does.
4. My avatar pushes himself very hard to succeed.
5. My avatar puts little time and effort into his work (R).

APPENDIX H

Perceived Social Support Scale
(Zimet, Dahlem, Zimet, & Farley, 1988)

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

1. My avatar can count on his friends when things go wrong.
2. My avatar has friends willing to help him make decisions.
3. My avatar has others with whom he can share his joys and sorrows.

APPENDIX I

Self-Restraint Subscale
(Grasmick, Tittle, Bursik, & Anreklev, 1993)

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

1. My avatar often acts on the spur of the moment without stopping to think.
2. My avatar doesn't devote much thought and effort to preparing for the future.
3. My avatar is more concerned with what happens to him in the short run than in the long run.
4. My avatar often does whatever brings him pleasure here and now, even at the cost of some distant goal.

APPENDIX J

Career Satisfaction Scale
(Greenhaus, Parasuraman, & Wormley, 1990)

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

1. My avatar is satisfied with the success he has achieved in his career.
2. My avatar is satisfied with the income he has attained through his career.
3. My avatar is satisfied with the career advancement he has attained.

APPENDIX K

Offline Grip Strength Measure

Figure 1. Handgrip dynamometer measuring grip in psi

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