A sense of self: The role of presence in virtual environments

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A R T I C L E   I N F O

Article history:
Available online 6 March 2013

Keywords:
Presence
Virtual self
Personality
Observed behaviors
Virtual environments
Avatar
Massively multiplayer online games

A B S T R A C T

Several factors contribute to an individual’s experiences in computer-based environments. Previous research shows one such factor, the degree to which users feel connected to a virtual environment, influence the actions of individuals within the environment (Banos et al., 2008; Welch, 1999). Additional factors, such as people’s personality and the personality of their avatar, influence behaviors in virtual environments (McCreery, Krach, Schrader, & Boone, 2012). The current study focused on the role of presence as it affects behavior within the virtual environment. Presence has been defined as the psychological state where virtual experiences feel authentic. However, the degree to which presence acts as a mediating variable in virtual environments is not well understood. The current study employed a combination of survey instruments and direct observation to explore the relationships among personality of self and avatar, presence, and behaviors within a virtual environment. Findings indicated that participant scores in the domain of agreeableness were a significant predictor of agreeable behavior in the virtual environment. However, with the exception of negative effects (e.g., dizziness), presence does not appear to influence behavior. Overall implications for these findings are discussed.

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1. Introduction

“Most of the images of reality on which we base our actions are really based on vicarious experience.”
– Albert Bandura (1986)

Many philosophical questions have roots in the notion of reality. Questions about what is real, unreal, or perceived and how humans come to know the world have been hotly debated for millennia, across classical (e.g., Plato Aristotle), early modern (e.g., Berkely, Descartes, Kant), and modern eras (e.g., Turvey, Shaw) (see Boring, 1950; Reed, 1982; Turvey & Shaw, 1979). For the sake of simplicity, reality may be described as that which can be sensed or perceived. Researchers differ widely on the manner in which humans sense and perceive, what mechanisms might be involved, and whether or not that experience must be direct (e.g., Gibson, Piaget, Skinner, Wertheimer). From a more modern lens, virtual environments and vicarious experience invite a wealth of new questions and alternative perspectives (Flach & Holden, 1998; Sheridan, 1999; Zahorik & Jenison, 1998). While this paper does not attempt to answer these ontological questions, it does address vicarious experience and how technology may influence our notion of reality.

Minsky (1980) characterized the ability of humans to vicariously experience the world as relating to a sense of “being there”, or presence. Since this initial description, presence has been defined in numerous, yet subtly distinct ways. Presence has been depicted as a sense of social awareness, the sense of physical transportation, and as a sense of immersion with a diminished awareness of one’s immediate surroundings (Bulu, 2012; Lee, 2004). For example, a reader of a particularly good book may lose focus on the real world around them and become engrossed in the story. This ability to be “transported” to or feel present in a setting other than one’s own reality is analogous to numerous modern technologies (e.g., social media, immersive spaces, virtual games, remote communications), which also rely on users’ ability to perceive virtual information within these remote settings directly as an extension of their own experiences and senses (Bente, Ruggenberg, Kramer, & Eschenburg, 2008; Flach & Holden, 1998; Zahorik & Jenison, 1998).

Although researchers debate the nature of presence, they typically agree that each definition follows the ontologies on which it is based (Mantovani & Riva, 1999). Regardless, this sense of connection to remote settings does not appear to be limited to feelings of presence. Since the early 1990s, researchers (Curtis, 1992; Reid, 1994; Turkle, 1997) have reported players feeling connected to the
avatars they create. Gee (2003) describes this as the virtual self. Not unlike our public or private personas, the virtual self is a form of identity in which the player connects psychologically with his or her avatar (Bessiere, Seay, & Kiesler, 2007). In this way, virtual representations (e.g., avatars) act as a bridge between physical and virtual worlds (McCreery, 2011).

The potential overlap between these psychological constructs drives new questions about behavior within virtual worlds. For example, when users interact with a world via their avatar, how does presence influence their actions? Alternatively, does feeling present indicate that users’ real-world attributes predict their actions in virtual environments? The current study was conducted to illuminate these relationships.

2. Review of the literature

2.1. The virtual environment

A fundamental design structure that has emerged in contemporary virtual environments is the pseudo-realistic environment. That is to say, designers build environments that are not photorealistic, but rather incorporate elements of the real world. For example, anyone who has jumped off a cliff within a video game has experienced that “pit of your stomach” feeling as he or she has made the leap. These features provide a foundation on which imagination can take shape and has been shown to be effective in producing feeling of presence (Lessiter, Freeman, Keogh, & Davidoff, 2001; Li, Daugherty, & Biocca, 2002; Pootka, 1995). Moreover, these environments have become designed experiences where participants work within a paradigm of doing and being (Squire, 2006). They are not only required to navigate a three-dimensional space and interact with artificial intelligence in order to solve problems, but also exist within the confines of player developed social systems (Allmendiger, 2010; McCreery, Schrader, & Krach, 2011; Park, Kim, & Barnett, 2004).

As a result of these characteristics, immersive environments have stimulated considerable interest among researchers and the public, as demonstrated by the numerous forums, blogs, and videos that have emerged to support their inhabitants (McCreery, 2011). In particular, virtual worlds continue to increase in complexity, providing limitless opportunities for the imagination, and garnering considerable attention from members of the media as well as from research communities across disciplines (Barnett & Coulson, 2010; Brown & Thomas, 2006; Cole & Griffiths, 2007; Terdiman, 2006). In particular, researchers have asserted that immersive environments like Massively Multiplayer Online Games (MMOGs) or Multi-User Virtual Environments (MUVEs) have the potential to captivate and engage (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; McConigal, 2011; Yee, 2006). It is this potential to captivate and engage that has lead researchers to explore how connections with these environments subsist as a product of virtual-real world interaction.

2.2. Defining presence

Presence has been characterized in a variety of ways, from distinct ontologies, and from different domains of human experience (i.e., personal, social, and physical) (Lee, 2004; Mantovani & Riva, 1999; Sheridan, 1999). As a result, existing research suffers from inconsistent, nonsystematic, and ill-defined operational uses of presence (Lee, 2004; Sheridan, 1992; Zahorik & Jenison, 1998). Presence has been described as a feeling of suspended disbelief (Lee, 2004), of being connected to others (Bente et al., 2008), of being there together (Schoedler, 2002), or even depicted as an out-of-body experience (Lee, 2004). However, all operational definitions infer that the term “presence” describes a psychological state of being transported to another setting (Minsky, 1980; Sheridan, 1992). Even in Minsky’s (1980) terms, a sense of “being there” stipulates a psychological state in which your experiences are related to an environment different than the one in which you physically reside. It is important to note that this transportation of self does not necessarily rely on technology to produce a high-fidelity environment. Although technology may facilitate a user’s sense of experiencing the virtual world directly, it is not strictly necessary.

Of the many epistemological, ontological, and psychological perspectives available in the literature, Lee (2004) provides the most inclusive conceptualization, particularly in relation to presence in virtual environments. Specifically, Lee (2004) defined presence as “a psychological state in which the virtuality of experience is unnoticed” (p. 32). Further, Lee (2004) posits that presence may be divided into three important domains based on the ways humans experience the world: physical, social, and self. It follows that users interact within virtual worlds through one or more of these domains. As a result, their experiences extend from their sense of presence as they relate to each of these domains (e.g., physical, social, and self). Regardless of its operational definition, one thing is clear; presence research focuses on the virtuality of experience.

There is ample research that examines the role of presence in virtual environments and overall these studies show positive relationships between presence and the user’s experience. For example, presence has been shown to impact participant performance (Welch, 1999), emotional reactions (Banos et al., 2008), brand recognition and purchasing behavior (Li et al., 2002). Similarly, presence also plays an important role in increasing the efficacy of virtual psychotherapy (Gaggioli, Mantovani, Castelnuovo, Wiederhold, & Riva, 2003). While in education, researchers have not only examined presence directly for purposes of learning online (Annard, 2011; Chen, Warden, Tai, Chen, & Chao, 2011; Kim, Kwon, & Cho, 2011; Lee & Nass, 2005) but have also shown it appears to mediate learning (Bulu, 2012) and course satisfaction in distance education (Lyons, Reysen, & Pierce, 2012).

2.3. The virtual self as a sense of being

Although there are many existing and emerging views on the topic, the overall goal of presence as a construct is to characterize, at least partially, the ways humans experience a world beyond their physical reach (Bente et al., 2008; Lee, 2004; Minsky, 1980). A parallel line of research has suggested that the virtual self (i.e., the digital embodiment of self within an avatar) may also serve as the fulcrum for this type of experience. In this context, the virtual self acts as a bridge between physical and virtual environments (Gee, 2003; McCreery et al., 2012; Turkle, 1997). The ways in which people interact within virtual environments as well as the nature of the mechanisms they employ to do so are both central questions in modern psychology research.

From this modern lens, virtual environments have become increasingly complex spaces for social interaction (Williams et al., 2006). Although virtual spaces lack many of the affordances of physical interactions, the behavioral makeup of these environments is similar to the real world. This includes single-oriented (i.e., individualistic), community-oriented (i.e., social), and off-world (i.e., anti-social) interaction archetypes that players exhibit (Whang & Chang, 2004). In terms of behavior, these interactions are diverse and appear to produce a reciprocal relationship between the participant and the social system that he or she inhabits. Individuals and groups interact with each other to integrate real-world norms (Gaimster, 2008) with environmental goals and system constraints (Martey & Stroemer-Galley, 2007). This results in a normative structure that supports social continuity.
(Pankoke-Babatz & Jeffrey, 2003) and exerts pressure upon the participant in turn, thereby influencing his or her perception of self (Utz, 2003).

However, underlying these complex systems lies a very real feeling that one's self exists within a virtual environment (Reid, 1994; Turkle, 1997). Customizable avatars now possess tools for both verbal and non-verbal communication as well as emotive abilities (Talamo & Ligorio, 2001). They also afford players the opportunity to distinguish themselves, not only in terms of appearance, but also on the basis of communication and social behavior (Bessiere et al., 2007; Martey & Stromer-Galley, 2007). Ultimately, immersive worlds provide their owners with a meaningful framework in which to interact with others (McCreery, 2011; Turkle, 1997). No longer are players simply manipulating a character on a screen, now they are interacting within a sociocultural environment and among its inhabitants (Talamo & Ligorio, 2001).

With the emergence of complex social systems and customizable avatars, the virtual self appears to no longer be a simplified form of self-representation (Reid, 1994; Turkle, 1997) rather it appears to be a structure that supports players individual differences. Specifically, researchers have begun to see connections between players and avatars among the five-factor model of personality, specifically that players rated their actual selves and avatars the same along the domain of agreeableness (Bessiere et al., 2007). One might argue that this is just a more complex form of self-representation (Reid, 1994; Turkle, 1997) as it appears to be a structure that supports players individual differences. Specifically, that players rated their actual selves and avatars the same along the domain of agreeableness (Bessiere et al., 2007). One might argue that this is just a more complex form of self-representation, however, research conducted by McCreery et al. (2012) appears to suggest otherwise. In this study, behavioral analysis was conducted in conjunction with NEO-FFI personality assessment (Costa & McCrae, 1992). Results indicated that players not only rated themselves similar to their avatars along the lines of agreeableness but how they rated themselves was a predictor of behavior within the virtual environment (i.e., World of Warcraft).

From these lines of research, one may conclude that the nature of interactions within virtual environments and the mechanisms by which individuals interact via an avatar would bear significantly on our understanding virtual environments. Further, there may be an important relationship between presence and one's connection to their avatar. As a result, participants' experience of presence may relate directly to their avatar's behavior within a virtual space. Based on the potential relationship between presence and the virtual self as well as the recent findings laid out above, this research set out to answer two questions:

Q1: What is the relationship between individuals' personality and their behavior in a virtual environment when mediated by a sense of presence?
Q2: What is the relationship between avatars' personality and their behavior in a virtual environment when mediated by an individuals' sense of presence?

3. Materials and methods

3.1. Research context

Following the design and procedures outline by McCreery et al. (2012), World of Warcraft (WoW) was selected as the virtual environment. WoW is a Massively Multiplayer Online Game (MMOG), employs user-controlled avatars, and allows video recording, which was instrumental to this research. Each participant played for 2 h while video-capture software recorded their avatar's behaviors. Behaviors were not tied to specific quests or external objectives. This allowed participants to experience WoW and behave naturally.

3.2. Participants

Participants were recruited through an email solicitation sent to all students, faculty, and staff at a university in the southwestern part of the United States of America. In order to be included in the sample, individuals must have had a World of Warcraft character with a minimum level of 80. This was done to ensure some level of familiarity with the game.

Forty participants took part in the study. However, one participant was excluded due to a corrupt video file. The demographics of the participants as defined by the United States Census Bureau (2000) were as follows: 35 participants reported they were White, two Asian, one Hispanic, and two indicated they were multi-racial. The sample consisted of 9 females (23.1%) and 30 males (76.9%), ranging in age from 18 to 49, with a mean age of 29, and a standard deviation of 7 years.

3.3. Measures and instrumentation

Four instruments were employed in the study: the NEO-FFI Personality Inventory Short Form (Costa & McCrae, 1992); the ITC – Sense of Presence Inventory (Lessiter et al., 2001); the Behavioral Assessment Matrix (McCreery et al., 2012); and a demographic questionnaire.

The NEO-FFI Personality Inventory Short Form is an abbreviated version of the NEO-PI-R, a five-factor model of personality inventory constructed to assess personality traits in participants 18 and older. This self-report inventory measures the degree to which an individual's personality shows distinctive features when compared to other individuals that fall within the normal distribution (Costa & McCrae, 1992). These domains include: Neuroticism (e.g., depressed, worried), Extraversion (e.g., assertive, energetic), Openness (e.g., creative, inventive), Agreeableness (e.g., trusting, kind), and Conscientiousness (e.g., thorough, reliable). Results from the NEO have shown it to be an accurate indicator of personality with studies indicating strong convergent and discriminate validity as well as reliability coefficients from .86 to .95. (Botwin, 1995; Costa & McCrae, 1992).

The revised ITC – Sense of Presence Inventory (Lessiter et al., 2001) is a four-factor, media independent questionnaire designed to measure a participant's presence when interacting with source media. These factors include: (a) physical space (i.e., a sense of being there), (b) engagement (i.e., psychological involvement in the environment), (c) ecological validity (i.e., believability of the environment), and (d) negative effects (i.e., adverse psychological reactions to the system). Scoring of the ITC-SOPI consisted of generating mean scores for each factor per participant media experience. The ITC-SOPI has also been shown to have sound construct validity based on results from a factor analysis and strong reliability based on internal consistency coefficients ranging from .77 to .94 (Lessiter et al., 2001).

The behavioral assessment checklist (McCreery et al., 2012) is a behavioral observation protocol or scorecard derived from the five-factor model of personality that is used to categorize behavior into one of five dimensions (i.e., neuroticism, extraversion, openness, agreeableness, and conscientiousness). Content validity of the instrument was established through defining items associated with domain facets (e.g., helpful or unselfish behaviors related to altruism) on these five dimensions (McCreery et al., 2012). The reliability correlation coefficient was .69 when analyzing raw scores across all five domains.

Partial interval recording was chosen as the data collection technique to reduce random error in the design and increase validity of the instrument (Harrop & Daniels, 1986; Murphy & Harrop, 1994). Following the scoring procedures outline by McCreery et al. (2012), reviewers applied the partial interval recording technique to reduce random error in the design and increase validity of the instrument (Harrop & Daniels, 1986; Murphy & Harrop, 1994).
technique to video recorded participant data. In other words, behaviors associated with each of these personality dimensions were cataloged (i.e., counted) during each 20-s interval over the length of the 30-min video. Further, because behavior related to a personality dimension falls along a continuum, valenced scoring (+1 or −1) was applied, with aggregated normal behavior approaching zero.

3.4. Design and procedures

This study involved three phases in which a trained doctoral student collected the data. During the initial phase, participants completed a demographic questionnaire and the NEO-FFI personality inventory on themselves. This phase lasted approximately 20 min in duration.

For the next phase, participants were asked to play World of Warcraft for 2 h. Participants sat in a university-based computer lab at alternating computer systems (approximately three to five feet apart), and each wore an audio headset. These computers were identical iMacs (Intel Core 2 Duo 2.4 GHz processor, 2 GB of Ram, Intel high definition audio, ATI Radeon HD Pro 256 mb video card, two-button mouse, and a 32-bit color 1920 × 1200 LCD monitor), each loaded with a full version of World of Warcraft. Players were allotted 15 min to make any necessary modifications to their user interface (UI) to help promote natural and authentic interactions within WoW. The internal video capture feature of WoW was then turned on and avatar interactions were recorded for the first 30 min during this 2-h play session. The additional 90 min of game play was necessary in order to let WoW’s internal video recording program compile the movie file.

After the 2-h play session came to an end the final phase commenced. In this phase, participants were given the ITC-SOPI and then asked to read the instructions and complete each part of the instrument. No additional instructions beyond what comes with the instrument were given. After completion of the ITC-SOPI participants were then asked to complete a NEO-FFI as it pertained to the personality of their avatars. This phase lasted approximately 20 min in duration.

4. Results

From the instruments, the following variables were derived: real-world personality variables (NEO-RW), virtual personality variables (NEO-VW), virtual behavioral variables (VB) and presence variables (P). A simultaneous multiple regression approach was then used to answer the first question (i.e., Q1). This paired the real-world personality and presence variables with virtual behavior (see Table 1). Results indicated that each model was not a predictor of behavior within this virtual space.

Turning to the second question (i.e., Q2), which paired virtual personality and presence variables with virtual behavior (see Table 2), results indicated that four of five models were not predictors of behavior (i.e., neuroticism, extraversion, openness, and conscientiousness). However when the agreeableness model was examined, the five predictors (i.e., virtual personality – agreeableness, physical space, engagement, ecological validity, and negative effect) accounted for 32% of the variance in agreeableness behavior within this virtual space, $R^2 = .320$, $F = 471$, $F_{5,33} = 3.101$, $p < .05$. This simultaneous solution indicated that the virtual personality – agreeableness (NEO-VW: Agreeableness) was a significant predictor of agreeableness behavior, $b = .316$, $\beta = .416$, $t(33) = 2.430$, $p < .05$.

A follow up analysis employing a simultaneous regression approach was then conducted that examined the larger model for the domain of agreeableness (see Table 3). These six predictors were found to account for 39.2% of the variance of agreeableness behavior $R^2 = .392$, $F = 645$, $F_{5,33} = 3.443$, $p < .05$. This simultaneous solution also indicated that the virtual personality – agreeableness (NEO-VW: Agreeableness) was the significant predictor of agreeableness behavior, $b = .326$, $\beta = .400$, $t(32) = 3.023$, $p < .05$, followed by the presence variable – negative effects (P: Negative Effective) $b = 4.435$, $\beta = .429$, $t(32) = 2.430$, $p < .05$.

5. Discussion and conclusions

Although there are some commonalities among early ideas regarding presence, each researcher’s view frames it differently (Bente et al., 2008; Lee, 2004; Lessiter et al., 2001; Mantovani & Riva, 1999; Minsky, 1980; Schroeder, 2002; Sheridan, 1999). Some describe presence in terms of media attributes (Lessiter et al., 2001). Others assert that presence is a psychological connection to distal experiences (Biocca & Delaney, 1995; Palmer, 1995). In general, researchers agree that the construct relates to a sense of being there or being connected. According to the majority of views, the mode of human experience (i.e., physical, social, and/or personal means) defines how presence emerges and is detected by the user. However, these views typically elevate one mode of experience over the others, regarding it as critical, vital, or singularly instrumental in developing a sense of presence.

By contrast, Lee (2004) described presence in terms of a user’s awareness of separation between the physical and virtual environment. Specifically, presence represents “a psychological state in which the virtuality of experience is unnoticed” (Lee, 2004, p. 32). Lee’s definition suggests that presence is not a property attributed to the media or mode, but rather is a property of the

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participant that ebbs and flows. Individual differences working in conjunction with dynamic content, both in the physical and virtual space, results in experiences that can promote or inhibit one’s sense of presence. Based on this psychoexperiential perspective, variables in this study were operationalized and examined in ways that are consistent with this view of presence. Consequently, these findings provide some insight into the relative importance of each state of experience (i.e., physical space, engagement, ecological validity, negative effects).

If one does not subscribe to Lee’s definition, then based on previous definitions, physical space (i.e., a sense of being there), engagement (i.e., psychological involvement in the environment), and ecological validity (i.e., believability of the environment) should promote or enhance presence and the associated behaviors. Specifically, as levels associated with each of these constructs increases, personality and behavior would more closely align. However, there was no such relationship in these findings. Instead, these data indicate that only negative effects (e.g., feeling of disorientation, headache, dizziness, tiredness) appear to impact the link between an avatar’s personality and their behaviors. This suggests that various mediating tools (e.g., mice, keyboards, interface design, and the rendering of the virtual space) may inhibit a sense of presence. Said another way, the user may or may not be able to establish a meaningful connection to the virtual world via their avatar if impediments result in negative physiological effects.

Another aspect of this study that may inform our understanding of presence relates to the user’s personal connection to the virtual experience. McCreery et al. (2012) have described this sense of psychological connectedness as an extension of one’s intent via a simulacra, or avatar. Such a relationship is personal, cerebral, and facilitated by the user’s imagination when combined with incoming stimuli. Those that engage in virtual spaces draw upon the avatar as a proxy for an emerging virtual persona (i.e., the virtual self; McCreery et al., 2012) similar to the way people possess a public and private persona that influences how they participate in various activities (Goffman, 1959).

Data from this study appears to confirm that a relationship between the user and their avatar influences behavior within the virtual space. Specifically, that the virtual personality variable agreeableness appears to influence social behaviors within the World of Warcraft (e.g., kind or aggressive). One explanation for this phenomenon suggests that although design factors are the impetus for in-world behavior, personality-behavioral alignment of presence “a psychological state in which the virtuality of experience is unnoticed” (p. 32), the link between agreeableness and social behavior may indicate that users’ have become “present” within WoW.

Further, as one considers what each domain of personality represents, any alignment between personality and behavior along the domain of agreeableness should not come as a surprise. Virtual environments like WoW are specifically designed to be highly social, goal-oriented spaces. As users communicate, share their ideas and experiences, this input is met with responses from other players and game-based artificial intelligence. As a result, a reciprocal relationship between the virtual self and social structures within the virtual environment emerges. Although more research is necessary to firmly establish this connection, the social link between environment and the user apparent in these data raises an interesting question: is it possible to design experiences in virtual worlds that exploit personality and behavioral alignments? For example, designers may be able to focus efforts on social activities as a way to directly and intentionally promote a participant’s sense of presence.

These findings also raise an interesting question related to how levels of experience with a virtual environment impact or shape feelings of presence. One could argue that physical space, engagement, ecological validity, and negative effects are the primary constructs that initially influence a sense of presence within a virtual space. However, considering the time the participants in this study have allocated to developing their characters, it is plausible that the connection to their characters “takes over” for some of the constructs (i.e., physical space, engagement, ecological validity). At some point, the sustained relationship between participant and avatar, cultivated through many hours of character advancement and socialization, supersedes the media and environmental characteristics as a factor in becoming present. Additional research is necessary to examine the link between users’ experience and these short-term vs. long-term factors. Such studies might include a longitudinal investigation that tracks feelings of presence over time to determine if and how this construct changes.

Although these data and inferences are thought provoking, there are a couple limitations to the current study. Based on these finding, existing presence measures may not represent the construct in its entirety (i.e., short-term and long-term) and a more accurate picture may evolve through the inclusion of additional psychological and/or behavioral measures. Further, there may be a legitimate barrier to one’s ability to experience presence. Just as limited cognitive resources influence the participant’s ability to continually monitor their own behavior, this may also result in their inability to feel present. This suggests that as technology continues to evolve and advance at a rapid pace, our understanding of how individuals experience the world beyond their physical reach must also expand. Examined collectively, the current findings illustrate that a participant’s behavior within a virtual environment is not adequately explained by traditional views on presence, that is to say, focusing on it as a property of the media or mode of experience. Rather, these findings support a view of presence that focuses on the user’s awareness of their experience.

References


