Personality, presence, and the virtual self: A five-factor model approach to behavioral analysis within a virtual environment

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PERSONALITY, PRESENCE, AND THE VIRTUAL SELF: A FIVE-FACTOR MODEL APPROACH TO BEHAVIORAL ANALYSIS WITHIN A VIRTUAL ENVIRONMENT

by

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A dissertation submitted in partial fulfillment of the requirements for

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ABSTRACT

Personality, Presence, and the Virtual Self: A Five-Factor Model Approach to Behavioral Analysis within a Virtual Environment

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For several decades, researchers have explored the existence of the virtual self, or digital embodiment of self found within an avatar. It was surmised that this new component of one's overall identity not only existed in conjunction with the public and private persona, but was replete with the necessary physical and psychological characteristics that facilitate a broad range of cognitive, cultural, and socio-emotional outcomes found within a virtual environment (e.g., Second Life, World of Warcraft). However, little is known with regard to whether these characteristics do indeed impact behavioral outcomes. For this reason, this study employed an observational assessment method to explore the virtual self as more than a set of characteristics attributed to an avatar, but rather as a relationship between personality (i.e., individual and avatar) and actualized behavior exhibited within a virtual environment. Further, presence measures were introduced to better understand whether feelings of immersion impact this relationship. Results indicated a burgeoning virtual self, linking personality with behavior along the domain of agreeableness. In other words, behavior is not solely the product of the environment but also is influenced by participant predispositions. Findings also
suggest that the construct presence may now need to incorporate variables that account for this virtual self. Implications for educators, instructional designers, and psychologists are discussed.
ACKNOWLEDGEMENTS

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CHAPTER ONE
INTRODUCTION

It has been argued that the human experience is social by nature and that one’s persona or character makeup is the conduit through which interaction occurs (Goffman, 1959). However, the context in which this interaction takes place has changed dramatically over time and continues to do so. Traditionally, people have interacted in physical locations like coffee shops and diners. Oldenburg (1997) described these as third places, or “public places that host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work” (p.16). However, many researchers have shown that physical spaces are no longer necessary to facilitate these regular, voluntary, and informal social interactions (Childress & Braswell, 2006; Cole & Griffiths, 2007; Martey & Stromer-Galley, 2007; Williams, Ducheneaut, Zhang, Yee, Nickell, 2006). Technological advancement has enabled virtual and electronic locations to become third places (Steinkuehler & Williams, 2006).

The advent of MUD (multi-user domain) software afforded those with access to networked computers a host of persistent virtual communities to share common interests and develop relationships. “The key element of “MUDding” from the perspective of “identity-effects” is the creation and projection of a “persona” into a virtual space” (Turkle, 1997, p.72). Participants were no longer represented by words on a screen (i.e., chat rooms) but rather as social agents defined by the physical and psychological attributes that characterize their online persona (Turkle, 1997).

Technological advancement continues to enhance this paradigm. The textual descriptions of early MUDs have long been supplanted by 3-dimensional visual
representations, and the online persona has given way to the virtual self. Participants are referred to by character name rather than given name, and have come to embody their digital likeness, “feeling psychologically connected to their character, often keeping the same one for months or years” (Bessiere, et al., 2007. p.530). Graphical renderings of emotions (e.g., smiling), nonverbal communications (e.g., hand gestures), and character actions (e.g., dancing) have shifted the experience away from traditional human-computer interaction, to interaction within the space and among social actors (Talamo & Ligorio, 2001).

This shift in interactivity has had an impact on the popularity of these spaces, as illustrated by the success of World of Warcraft and Second Life. Current estimates suggest that together, these two virtual worlds boast approximately 25 million inhabitants (Blizzard, 2007; Linden Labs, 2008a), brought together from physical locations across the globe. For example, residents of the World of Warcraft come from eight world regions (US/Canada, Australia/New Zealand, Europe, South Korea, China, Taiwan, Hong Kong, and Singapore) (Vivendi Games, 2006), while Second Life draws its community from more than 100 countries (Linden Labs, 2008b). Within each environment, participants have developed a subculture comprised of distinct languages (e.g., pugs, pick up groups) and community structures (e.g., guilds found in World of Warcraft) that are generated and sustained by its populace. Members devote significant amounts of time to their respective environment, averaging approximately 22 hours per week (Griffiths, Davies, & Chappell, 2004). Their excitement, engagement, and motivation for the virtual worlds they inhabit are illustrated by countless informational Web sites (e.g., www.wowwiki.com), blogs (e.g., www.secondlifeherald.com), forums (e.g.,
http://wow.allakhazam.com/forum.html), and videos (e.g., www.watchtheguild.com) that have been developed to share knowledge and extend communities.

This shift from a technologically simplistic form of interaction (e.g., the MUD) to a highly dynamic and immersive world (e.g., World of Warcraft) has fostered interest that extends far beyond the gaming community. For example, mental health clinicians have promoted the benefits of virtual therapy (Protivnak, 2005). Businesses have explored how leadership skills translate from cyberspace to workplace (Brown & Thomas, 2006). Numerous virtual environments (VE) have been utilized as educational environments in both K-12 and higher education (see Table 1). Even the U.S. House Subcommittee on Telecommunications and the Internet (2008) simulcast its hearings within a virtual world. However, psychologists, employers, and educators in each scenario have placed a heavy reliance upon the virtual self or avatar as the primary facilitator of human behavior. This 3-dimensional visual representation acts as a bridge between the physical and virtual world, affording its user tools for verbal communication (e.g., text and voice chat), nonverbal communication (e.g., emotes such as hugging and waiving), environmental navigation (e.g., running and swimming), in addition to an enormous set of interactions ranging from fighting to opening a door. Interestingly, even the word avatar, which has come to represent these online personas, means reincarnation in the Hindi language (Talamo & Ligorio, 2001).
Table 1.1

<table>
<thead>
<tr>
<th>Virtual Environment</th>
<th>Educational System</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whyville</td>
<td>K-12</td>
<td>Numedeon, 2007</td>
</tr>
<tr>
<td>Quest Atlantis</td>
<td>K-12</td>
<td>Indiana University</td>
</tr>
<tr>
<td>Rivercity</td>
<td>K-12</td>
<td>Harvard University, 2007</td>
</tr>
<tr>
<td>Second Life</td>
<td>Higher Education</td>
<td>Childress &amp; Braswell, 2006</td>
</tr>
</tbody>
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Research Problem Description

Such a heavy reliance upon a single construct as an avatar to facilitate behavior raises a fundamental question regarding efficacy. How does the interaction between physical and virtual realities embodied in the virtual self, influence behavioral outcomes? Nearly 15 years of research supports the existence of a relationship between oneself and the digital embodiment. For example, Reid (1994) found that “MUD characters are much more than a few bytes of computer data—they are cyborgs, a manifestation of the self beyond the realms of the physical” (p. 69). Turkle (1997) established that online personas created by participants came to represent an externalization of self. Moreover, even in cases where multiple personas existed, these were not fragmented or disconnected from each other, but pieces of a collective self. Gee (2003) suggested that the virtual self has become a new component of one’s overall identity, existing in conjunction with the public and private persona. While Bessière, Seay, and Kiesler (2007) found that psychologically well-adjusted inhabitants of the virtual world entitled World of Warcraft (WoW) do appear to model their virtual self upon the characteristics of their actual self.

Despite this reconceptualization of self, social scientists have primarily focused their attention upon the identification of ecological structures and the explication of behavioral
constructs within these environments. Significant effort has gone into demonstrating the existence of virtual communities (Blanchard, 2008), their cultures (Williams, 2007), and social structures (Steinkuehler, 2005; Williams et al., 2006). Further, researchers have tackled a multitude of subject areas ranging from intrapersonal collaboration (Steinkuehler, 2005) and social norms (Martey & Stromer-Galley, 2007) to prosocial behavior (Wang & Wang, 2008). In each case, system affordances appear to also facilitate the necessary participant behavior that occurs in immersive and integrated social systems, as well as rules of conduct within the VE.

However, a substantial gap still exists within this body of literature. Instantiated social systems are the product of mediated interaction between participants, through an avatar that bridges physical and virtual realities. Searches conducted within general, communications, and psychological databases using key words pertaining to this topic (e.g., avatar, virtual self, identity, and virtual worlds) have yielded no research that explored this interconnection. Although a tremendous amount of work has been done to understand the content, activities, and social structures of virtual environments, it appears there is little understanding with regard to the complexities of this mediated relationship and the influence it may exert on behavior.

Psychologists of differing perspectives have long supported the idea of identity effects, or one’s conceptualization of self directly impacting behavior. Erikson (1968) suggested that psychosocial development (i.e., socio-emotional development) was a staged process, which required the successful resolution of a crisis at each stage. How an individual resolves each crisis impacts identity formation and subsequent behavior. For instance, if a 4 year old who is attempting to resolve the psychosocial crisis initiative
versus guilt, is provided ample parental support, he or she will develop determination, and therefore be able to set productive goals and ways to achieve them. Alternatively, Mischel (1968; 1973; 2004) argued that one’s personality is the result of repeated exposure to life situations, producing a consistent behavioral pattern. The field’s predominant perspective, the five factor model (FFM), characterizes one’s identity or persona as a set of personality traits and dispositions that explain individual differences in behavior. Moreover, the FFM has taken the argument that one’s conceptualization of self directly impacts behavior one step further. It has been shown to predict juvenile delinquency (John, et al., 1994), leadership skills (Watson & Clark, 1997), and academic achievement (Digman & Takemoto-Chock, 1981). Clearly, these are relevant constructs in relation to emerging VE applications.

Nevertheless, the social sciences appear to have adopted the gaming model, which looks to maximize entertainment rather than psychological, developmental, or educational outcomes. This raises an interesting question, how do system designers accurately assess the effectiveness of constraint/affordance alignment in meeting system objectives when little is known regarding the relationship between physical and virtual worlds? Specifically, how does personality regulate, and/or shape behavior in these environments?

To further complicate matters, a covariant behavioral factor known as presence, which is defined as “a psychological state in which human interaction with media and simulation technologies are experienced as actual objects in either sensory or non-sensory ways”, figures prominently to influence behavioral outcomes (Lee, 2004, p.27). Since Minsky (1980) first described telepresence, computer mediated communication (CMC)
researchers have come to argue that a feeling of “being there” within mediated environments has a direct impact upon performance (Welch, 1999). Once again, little is known about how the virtuality/personality paradigm influences presence or if current systems are missing integrated avatar/personality design structures that would better facilitate presence. Yet, by illuminating the interplay that exists between personality and behavior, one can begin to determine the efficacy of these virtual spaces as psychological, business, and educational systems.

Because VE are commonly used, but the research community has yet to fully understand them, this research project was designed to explore the interplay between physical and virtual realities embodied in the virtual self. Specifically, this study merged existing personality research with the virtual world, using presence as one mechanism to understand engagement and interaction within that space. Ultimately, this study attempted to illustrate that valid behavioral models can be applied within these spaces. Further, designers and developers can leverage these models to more effectively align constraints and affordances with system objectives and outcomes.

Research Questions

The following set of research questions addressed the relationship among personality, presence, and behavior that exists within the virtual space.

1. Is there a relationship between an individual’s personality and behavioral patterns within a virtual environment? This was measured through behavioral observation and individual personality assessment using the NEO-FFI (Costa & McCrae, 1992b) personality instrument.

2. How much of one’s virtual behavior can be attributed to an individual’s personality
versus the personality of the avatar? This was measured through behavioral observation and individual/virtual personality assessment using the NEO-FFI (Costa & McCrae, 1992b) personality instrument.

3. What is the relationship between personality and behavior when accounting for presence? This was measured through a combination of behavioral observation, individual personality assessment using the NEO-FFI (Costa & McCrae, 1992b) personality instrument, and a presence measure entitled the revised ITC – Sense of Presence Inventory (Lessiter, Freeman, Keogh & Davidoff, 2001).

Measures

Four instruments were employed in the study, including: (a) NEO-FFI Personality Inventory Short Form (Costa & McCrae, 1992b), (b) behavioral assessment using partial interval recording (PIR), (c) ITC – Sense of Presence Inventory (Lessiter, Freeman, Keogh & Davidoff, 2001), and (d) participant demographic/interview questionnaires (see Appendices A and B).

1. The NEO-FFI short form is an abbreviated version of the NEO-PI-R (Costa & McCrae, 1992b) a five-factor model of personality inventory constructed to assess personality traits in participants 18 and older. This self-report inventory measures the degree or probability that an individual’s personality domains (i.e., identifying characteristics) will show distinctive features when compared to other individuals that fall within the normal distribution (Costa & McCrae, 1992b). These domains include: neuroticism (e.g., depressed, impulsive), extroversion (e.g., assertive, warm), openness (e.g., willing, curious), agreeableness (e.g., trusting, altruistic), and conscientiousness (e.g., capable, self-disciplined) (Costa & McCrae, 1992b).
2. Behavioral assessment was carried out using partial interval recording (PIR), including a predefined scorecard of conduct associated with domain facets (e.g., helpful or unselfish behaviors related to altruism). Partial interval recording is defined as a sampling method “in which an interval is scored as one occurrence if a response occurs in any portion of it” (Murphy & Harrop, 1994, p.169). In other words, observers reviewed video recorded participant data and recorded on the scorecard (i.e., counted) whether behaviors associated with each domain facet occurred during each interval (i.e., 20 seconds) (McCreery & Krach, 2008).

3. ITC – Sense of Presence Inventory (Lessiter, Freeman, Keogh & Davidoff, 2001) is a four factor, media independent, questionnaire designed to measure a participant’s presence when interacting with source media. These factors include: physical space (i.e., a sense of being there), engagement (i.e., psychological involvement in the environment), ecological validity (i.e., believability of the environment), and negative effects (i.e., adverse psychological reactions to the system).

4. The participant demographic/interview questionnaire (Schrader & McCreery, 2007) incorporates Likert and open-ended question design to gather participant demographic data (e.g., age, gender), participant motives, technology experience, gaming experience, and online social affiliations.

Variables

Nineteen variables were included in the study. The first ten variables consisted of each participant’s individual and avatar personality domain scores (i.e., personality and virtual self assessment variables for each domain, neuroticism, extroversion, openness,
agreeableness, and conscientiousness) taken directly from the NEO-FFI. The following five variables were the actualized behavioral scores for each domain represented by the NEO-FFI (i.e., Behavioral Assessment Variables). The last four variables contained participant scores for each factor of the presence questionnaire ITC – SOPI (i.e., level of immersion for physical space, engagement, ecological validity, and negative effect).

**Practical Significance**

The utility of the virtual environment is no longer limited to social networking and entertainment. An evolution appears underway as therapeutic professional and pedagogical applications begin to emerge. As innovation continues to blur the line between physical and virtual realities, the virtual self embodied within one’s avatar appears to be a central figure that links these two realities together creating an unusual dynamic. Yet, for all of the enthusiasm surrounding these new applications, little is known about the fundamental interplay between personality and behavior within virtual environments.

For software developers, instructional designers, and content experts, understanding the relationship between personality and behavior has a direct impact on how new systems are designed. Avatar creation systems can be honed to better facilitate social agency, role adoption, and personae integration. Links between behavioral patterns and personality can be applied as guidelines to focus system constraints and affordances on targeted behaviors and skill sets. This allows the role of system themes to expand to include integrated assessment components. This critical design shift would facilitate targeted iterative design processes, as well as provide psychologists, educators, or other interested parties with important participant information.
In applied settings, psychologists could potentially use these environments to conduct scenario-based behavioral assessments and interventions. Educators could devise lessons that integrate content with activities that strengthen social interaction, collaboration, and cooperative learning in distance education settings. Further, understanding the role personality plays in these systems could lead to numerous new applications including more personalized forms of communication for those who use adaptive technology. However, to achieve such potential one must begin by illuminating the interplay between personality, presence, and behavior that exists within the virtual space.
CHAPTER TWO
REVIEW OF RELATED LITERATURE

What does it mean to possess strength of character, or to describe a colleague as bright? To suggest someone is full of potential or he has never lived up to it? Social constructs, descriptors of thought, behavior, and feeling permeate the human experience affording society a unique ability to bridge perception and understanding. However, such characterizations are not without issue. Socio-cultural complexities, genetic and environmental determinants, as well as ontological perspectives have led philosophers and scientists alike to debate the very essence of humanity. These questions have resulted in numerous conceptualizations of the self (Allport & Odbert, 1936; Freud, 1915/1970; Erikson, 1968; Mischel, 1973).

A recent review of a personality textbook (Cervone & Pervin, 2008) revealed there exist over 15 theoretical perspectives that address one or more aspects of personality. However, only a limited number of these have been developed as exemplars of personality in an attempt to coalesce concepts of human universals with idiosyncratic behaviors characterized as individual differences. As a result, it is necessary to examine the main theoretical models as they have developed over time, particularly as they shape our recent understanding of personality as a psychological construct.

The Birth of a Discipline

According to Jones (1868), the earliest attempt to explain the human disposition was found among the writings of the ancient Greek physician Hippocrates, who attributed the stability of personality and any subsequent differences to a theory of humorism, or the physical equilibration of four fluids (e.g., black and yellow bile, blood, and phlegm).
within the human body. Although today we recognize the absurdity of such a model, it was not until the end of the 19th century that questions of character, motive, and mind began to shape what would become the field of personality psychology.

At the turn of the 19th Century, Freud’s theory of psychodynamics began to gain prominence. Although typically regarded as theory of mind rather than personality, his work offered the first structured descriptor of the self, based on underlying mental structures and processes (Freud, 1915/1970). Freud used an observational methodology known as free association in which subjects reported whatever came into their minds. As a result of his observations, Freud (1923/1960) theorized that the mind was made up of three coexisting functions (i.e., id, superego, and ego), which defined one’s behavior and subsequent personality. The id accounted for the instinctive nature of humans where achieving pleasure was top priority. Alternatively, the superego represented moral stability or the internal representation of societal rules and codes. The ego was defined as the balancing function that strived to help the id achieve gratification without overstepping the constraints of the superego.

Freud’s (1923/1960) conceptualization of the self could easily have been mistaken for a set of homunculi (i.e., a group of little men inside one’s head) acting in unison to facilitate behavior were it not for his explanation of the instinctual drives of life and death. He postulated that instincts for life (i.e., survival) and death (i.e., aggression) drive humanity on a biological level. Everyone is born with these instinctual processes, which are manifested in various forms (e.g., hunger, thirst, brutality). Moreover, due to the subconscious nature of these instinctual drives, behavioral variability as opposed to broad behavioral consistency is the norm. This suggests that individual differences are
embodied within the context in which they occur rather than stable characteristics that are carried across situations (Mischel, 1973). This premise has endured and led to divergent models of personality.

Although the American Psychological Association (APA) considers Freud the third most eminent psychologist of the 20th Century (Dittmann, 2002), his work has come under immense scrutiny. The scope of his theoretical perspective offers a complete explanation of human behavior without the need for evidentiary support, as illustrated by the theory’s lack of standardized procedures and objective measures. This lack of definable constructs and a focus on mental states and instincts rather than human universals and individual differences reduces its effectiveness as a theory of personality. Further, exclusive reliance upon free association as the sole data gathering technique rather than employing a triangulation methodology limits the viability of psychodynamics as a formal scientific theory. Nevertheless, one could argue that Freud’s (1915/1970) theory of mind was a necessary catalyst for further exploration (Mischel & Shoda, 1995). However, the ensuing debate over its accuracy and falsifiability may have overshadowed another insightful glimpse at personality as a definable and measurable construct.

Sir Francis Galton had been studying human intelligence through the exploration of parental-offspring hereditary factors and life histories of twins. Publishing the outcome of his studies in one of the most widely regarding scientific journals of the time, the Fortnightly Review, Galton (1884) suggested “… that the motives of the will are mostly normal, and that the character which shapes our conduct is a definite and durable something” (p. 181). Using Roget’s Thesaurus, Galton went on to hypothesize that language possesses the necessary information for measuring individual differences in
character. This became the fundamental lexical hypothesis (Goldberg, 1990) and the most widely used and empirically tested theoretical paradigm in personality psychology: the trait approach (Eysenck & Eysenck, 1980; John & Srivastra, 1999; McCrae & John, 1992).

**Human Behavior Reconceptualized**

With the proposal of a lexical hypothesis came the first real glimpse of personality as a definitive, measureable construct. However, interest in human behavior was not limited to this informal premise. Environmental and genetic determinants as well as ontological perspectives shaped alternative theories of human behavior. For some researchers, behavior was defined as little more than the response to repeated stimuli (Skinner, 1971) or an evolutionary outcome (Buss, 1995). Yet for others, behavior was defined as the embodiment of the human experience. This resulted in three alternative explanations to the character trait paradigm: behavioral, evolutionary, and phenomenological.

Throughout the 20th Century, *behaviorism* was psychology’s dominant theory. Founded on the philosophical principle of determinism, which held that all physical and mental phenomena are caused by prior events and/or patterns of association, behaviorism emphasized prediction and control as a means of generating a lawful understanding of behavior (Delprato & Midgley, 1992). Adaptation of these principles resulted in the functional analysis of behavior where environmental variables are connected to behavioral variables (Delprato & Midgley, 1992). Ensuing research explored the influence that specific stimuli had on the production of new response patterns, and concluded that repeated exposure to environmental stimuli resulted in behavioral change.
Consequently, some researchers began to argue that behaviorism was the framework through which personality development was best understood (Delprato & Midgley, 1992; Gormly, 1982; Nagpal & Gupta, 1979). Human personality was seen as little more than a set of stimulus-induced behavioral outcomes rather than an integrated set of character traits influenced by thoughts, feelings, and attitudes. This however, contradicted a core theoretical constraint of the theory as seen in Skinner’s (1971) Beyond Freedom & Dignity, “…we do not need to try and discover what personalities [or] traits of character… are in order to get on with a scientific analysis of behavior” (Skinner, 1971, p. 15). Nevertheless, even if one were to disregard Skinner’s remark, the principle of determinism would suggest considerable variability in behavior due to differing rewards and punishments. However, personality characteristics have been shown to produce behavioral consistency (McCrae & John, 1992).

According to this view, human universals and individual differences are not strictly relevant to behaviorist theory, because they are the result of learning through experience. Human universals are seen as little more than common response patterns to standardized environmental stimuli, while individual differences are attributed to selection preferences based on previous experience (Delprato & Midgley, 1992). Consequently, behaviorism has little application to the field of personality. It would be difficult to measure and predict the impact of constructs that are disregarded by theory.

As issues continued to stem from the growing theoretical incongruence between branches of psychology, researchers began to argue for unification based on biological underpinnings (Buss, 1995). To achieve such a lofty goal, theorists attempted to merge human evolutionary theory with psychological principles that resulted in a new
metatheoretical paradigm. Today, that framework is known as evolutionary psychology and is defined by the following core set of principles (Buss, 1995).

1. All behavior depends on underlying domain-specific psychological mechanisms working in conjunction with contextual input. Without these mechanisms no behavior can occur;

2. Evolved psychological mechanisms are a result of natural selection and without this process humans could not channel their actions to solve adaptive problems;

3. Social groups and culture are selection environments that result in within-group similarities and between-group differences.

These fundamental principles act as building blocks for other branches of psychology. Take the logical associations between these tenets and personality theory as suggested by David Buss (1995):

1. The stability of human personality is just a result of exposure to species-typical mechanisms;

2. The dimensions illustrated in the five-factor model of personality are a summary of “the most important features of the adaptive landscape [and] provide a source of information for answering important life questions” (p. 22);

3. Individual differences are caused by each person’s unique exposure[s] to different adaptive problems;

4. Human universals are a product of the maximizing fitness quality of natural selection.

Unfortunately, problems exist with the explanation of personality from the perspective of evolutionary psychology (Cervone, 2000). Similar to behaviorism,
evolutionary psychology relies on the interaction between environmental inputs and innate mechanisms. However, when genetic determinism is applied within a social context, serious issues result. Social interaction does not possess the same imposed constraints as a laboratory experiment. It is often ambiguous, forcing participants to make complex behavioral choices based on a limited understanding of the situation. Moreover, it reduces the likelihood that researchers are able to identify the innate mechanisms necessary to predict behavioral outcomes.

To complicate matters further, humans do not always behave in ways that maximize fitness in situate. For example, people make altruistic choices (e.g., pulling someone out of a burning building) rather than always applying specific behavioral strategies that coincide with the appropriate environmental inputs (e.g., running away from the fire). This means that one must rely on inference made a posteriori, which has limited usefulness as a predictor of behavior when applied in social contexts. Researchers would have to gather countless iterations of the same situation before behavioral patterns could emerge, and then apply this on a massive scale before enough data would be available to generate a descriptive model of personality. This is a critical problem for personality theorists who look to predict behavior as it naturally occurs. Ultimately, it is unclear whether evolutionary psychology will possess the necessary tools for the assessment of personality as it occurs. However, in its current form, an inability to manage contextual complexities (e.g., a virtual environment in which a participant is physically removed) as well as associated methodological problems limits its effectiveness as a framework for exploring the intricacies of human personality.
Resulting from the rise of behaviorism, some psychologists (Maslow, 1954; Rogers, 1951) questioned the accuracy of a theoretical framework that excluded thoughts, feelings, and attitudes when measuring human behavior. They argued that people possess a developing self-concept, influenced by acts of free will and best understood through the internal examination of conscious sensations, feelings and self-perceptions (Patterson, 1965). This was a clear distinction from behaviorism’s deterministic approach, which viewed humans as mere machines controlled by unconscious forces and understood through external examination. In this reconceptualization of behavior “the response define[d] the stimulus, rather than the stimulus defining the response” (Patterson, 1965, p. 997). As a result, a new theoretical approach known as phenomenological psychology was established in which an individual’s subjective perception or the phenomenal field became the basis on which all manner of conduct was studied (Rogers, 1951).

Although not intended to specifically explicate the construct of personality, the introspective nature of phenomenological psychology offered many alternative ways for exploring the human potential. At its core resides the self-concept “about which [self] perceptions are organized” (Patterson, 1965, p. 1008). These perceptions are said to determine how one thinks and feels about his or her self, which directly influences how one behaves. For example, someone who views himself as shy may find it more difficult to make friends. To assess self-concept, psychologists began using a technique called the Q-sort, having participants organize a set of cards containing personality characteristics from most like me to least like me (Stephenson, 1953). When applied to both actual and ideal self-concepts, this technique provided psychologists with a set of markers for
increasing the congruence between these selves in client-centered therapy sessions (Butler & Haigh, 1954).

Despite a great deal of success within therapeutic settings, phenomenological psychology has gained little ground as a research paradigm over the subsequent 60 years. Complete exclusion of biological influences ran contrary to the general understanding of behavior. Further, it did not account for of how human universals and individual differences were related to self-concept. The theory’s primary focus was on the explanation of the self in terms of growth as an individual rather than the prediction of behavior. Thus, it has limited usefulness as a framework for personality research.

The Emergence of a Trait Model

Although many conceptualizations of self have existed (e.g., behavioristic, evolutionary, phenomenological), none have had as much influence on the understanding of personality as the trait approach (i.e., a set of dispositions or behavioral tendencies). The crux of this model stems from a long-standing biological method of plant and animal classification (John, Angleitner, & Ostendorf, 1988). Rather than examining what could amount to thousands of individual characteristics, trait theorists attempted to coalesce individual differences and human universals into a taxonomic structure. Such a structure by definition “is a systematic framework for distinguishing, ordering, and naming types and groups within a subject field” (John, et al., 1988, p. 172). In addition, it offers a process for acquiring and managing the accumulation and communication of empirical findings (John & Srivastra, 1999).

Beginning with the premise that “most socially relevant and salient personality characteristics have become encoded in the natural language” (John & Srivastra, 1999,
Allport and Odbert (1936) set out to extract the relevant personality descriptors found within the second edition of *Webster’s Unabridged Dictionary of the English Language*. This resulted in an inventory of approximately 18,000 terms. From this list, Allport and Odbert semantically classified the terms into four categories: (a) personality traits, (b) temporary states and moods, (c) evaluative judgments, and (d) physical characteristics (John & Srivastra, 1999). Although their work was of little functional significance from a taxonomic perspective, this immense task became the field’s initial lexical structure and foundation for an empirical representation of personality (John & Srivastra, 1999).

To achieve such a representation, Cattell (1943) began an exhaustive search of the psychological literature of the day for personality variables that had not been included in the initial lexical structure. Seeing such characteristics as dynamic, he paired each trait with its antonym thus reducing the initial list to a set of 171 bipolar clusters. This structural change allowed Cattell the opportunity to use empirical data to reduce these clusters into more inclusive variables (John et al., 1988). Obtaining cluster ratings from 100 adults, he then computed 14,535 correlations (John et al., 1988). A review of the matrix, based on corollary strength, resulted in 35 *trait* variables. Subsequently, Cattell conducted several additional factor analyses, which eventually led to the creation of the first multidimensional model of personality and a 16 Personality Factor Questionnaire (Cattell, Eber & Tatsuoka, 1970).

Cattell’s (1943; 1970) pioneering contributions have had substantial influence upon the field. Human mannerisms and conduct were characterized as hierarchical (e.g., behavioral domains down through simple traits) and measured in terms of strength (e.g., a
bipolar continuum as opposed to dichotomous). However, numerous attempts to validate Cattell’s model were unsuccessful (Barrett & Kline, 1982; Digman & Takemoto-Chock, 1981). When orthogonal methods of factor analysis were reapplied to these variables, three and five-factor structures began to emerge (Eysenck & Eysenck, 1985; Norman, 1967, respectively).

Although Cattell’s (1943) representation of personality as hierarchical, bipolar measures remained, divergent factorial structures sparked intense debate. Chiefly, it centered on whether two of the broad dimensions (e.g., agreeableness and conscientiousness) found in the “Big 5” (Norman, 1967) five-factor structure were actually comprehensive measures of personality or were better accounted for by a single broad dimension (e.g. psychoticism) contained within the psychoticism, extroversion, neuroticism (PEN) three-factor model (Eysenck & Eysenck, 1985). Eysenck (1992) cited the strong correlation of -.85 between the existing PEN factor psychoticism and the combined Big 5 factors of agreeableness and conscientiousness suggested inclusivity rather than discrete major dimensions. Yet, convergent findings based on factor analytics, theoretical questionnaires, self-reports, and peer ratings suggested otherwise (Goldberg, 1990; John, 1990; John & Srivastra, 1999). As a result, debate regarding the inclusion of these factors lessened and the Big 5 personality dimensions of surgency, agreeableness, conscientiousness, neuroticism, and culture became the most recognized model of personality that “accounts for the structural relations among personality traits” (John & Srivastra, 1999, p. 33).

The five-factor model (FFM), as it is most often referred to today, has become the primary exemplar for the explanation and prediction of behavior. Although in some
instances factor labels have changed, the underlying composition is unchanged (John & Srivastra, 1999). It remains a taxonomic structure derived from factor analytics consisting of five bi-polar dimensions that categorize the fundamental facets (traits) of human personality. Represented here by the acronym OCEAN, examples of trait characteristics are:

1. O Openness (was Culture) – curious, imaginative, artistic
2. C Conscientiousness – efficient, organized, thorough
3. E Extroversion (was Surgency) – sociable, energetic, enthusiastic
4. A Agreeableness – forgiving, warm, sympathetic
5. N Neuroticism – tense, irritable, moody

An extensive body of work based on this model has substantiated its validity (Costa & McCrae, 1993) and propelled its application well beyond personality psychology to areas including: counseling, clinical psychology, well being, behavioral genetics, and aging. Cross-instrument convergence of short form inventories (e.g., Trait Descriptive Adjectives Goldberg, 1992; Big Five Inventory, Wiggins, 1995; NEO-FFI, Costa & McCrae, 1992b) in addition to replicated empirical findings across subjects, raters, and data sources (i.e., lexical and questionnaire) have further cemented the FFM as the primary descriptive research model (John & Srivastra, 1999).

Although the FFM is arguably the most comprehensive model of personality, it does have limitations. Numerous issues have been cited regarding the narrow focus of the model including: (a) the failure to provide causal explanations (McAdams, 1992), (b) lack of account for situational (Mischel, 1968) or motivational influences (Dweck & Leggett, 1988), and (c) the reliance on self-report instrumentation (McAdams, 1992).
However, it is the only model to date that when integrated into personality instrumentation (e.g., NEO-PI, NEO-PI-R, NEO-FFI, BFI, TDA), has consistently provided both psychometric (Botwin, 1995; Costa & McCrae 1992b; John & Srivastra, 1999), and predictive (Digman & Takemoto-Chock, 1981; Wiggins & Pincus, 1989) evidence regarding human personality.

**The Situated Nature of Personality**

The emergence of a multidimensional model brought about a critical juncture in personality psychology. For the first time, theorists and practitioners alike had a taxonomic structure for categorizing human behavior. However, social cognitive theorists questioned whether personality could be accurately assessed in terms of overall behavioral tendencies represented by an individual’s average trait levels. Instead, they suggested that patterns of variability seen between situations offered a more precise accounting of one’s personality (Mischel, 1973). This reconceptualization of personality challenged two fundamental assumptions on which the FFM was built, the grouping of behavior into broad dimensions and the underlying lexically-based taxonomic structure.

To the social cognitivist, the FFM’s grouping of behavior into broad dimensions appeared to be a completely artificial characterization of personality. The idea that individual differences in behaviors could be “conceptualized in terms of behavioral dispositions or traits that predispose individuals to engage in relevant behaviors” seemed erroneous because it assumed the “basic qualities of the person [were] independent of, and unconnected with, situations” (Mischel, 2004, p.3; Mischel & Shoda, 1995, p.246). Rather than characterizing individual differences on a global level (e.g., the more
neurotic one’s is, the more neurotic one behaves), patterns of behavior are situationally specific (e.g., whenever confronted, the individual behaves aggressively).

Social cognitivists argued that not only did this paradigm shift make sense from a theoretical perspective, but it also had specific and intended methodological consequences (Mischel & Shoda, 1995). Researchers could finally gain an accurate picture of an individual’s situated personality rather than an estimated “true score” generated through data aggregation, a process that “treats variations in the individual’s behavior across situations as an unwanted or uninformative variance or as measurement error” (Mischel & Shoda, 1995, p.247). More importantly, they contended that the model accounted for the behavior of what an individual actually does, rather than what an individual might do (Mischel, 1973). This presented a critical shift intended to elucidate the true patterns of invariance found within an individual’s fine-grained behavioral decisions. However, the use of a lexical structure precluded this type of identification because “these dispositions are not directly observed but are inferred from behavioral signs (trait indicators)” (Mischel, 1973). In order to address this issue, social cognitivists merged concepts of social learning (see Bandura & Walters, 1963) and theory of mind (see Freud, 1923/1960). This resulted in a new personality exemplar known as the cognitive-affective processing system (CAPS) (Mischel & Shoda, 1995).

Within the CAPS system, human universals (e.g., broad domains such as neuroticism, conscientiousness) are not represented. Instead, it outlines how complex schemas consisting of cognitive-affective units, which are perceptual representations of people, places, things, goals, expectations, and affect help people build mental models of the world that when triggered in situate produce behavioral signatures (Mischel, 2004).
example, a student enters a new classroom, he or she brings a conceptualization of what constitutes a classroom (i.e., teacher, desks, other students), a set of beliefs, feelings and goals regarding school based on previous experience and perception, in addition to a set of competencies. Dynamic interaction occurs among these cognitive-affective units as well as creates a reciprocal relationship with the environment, resulting in student conduct (i.e., behavioral signatures). These are the stable patterns of invariance (i.e., individual differences) that characterize one’s personality. According to the CAPS system, to ascertain such patterns, one must define the global behaviors in question, identify the salient contexts in which they occur, and then over time conduct multiple iterations of direct observation within each of those situations.

The simplicity of CAPS (Mischel & Shoda, 1995) might suggest a parsimonious framework in which to explore personality, but a number of issues reduced support for the model. To start, an in situate model based solely on behavioral signatures runs counter to approximately 100 years of genetic evidence stemming from multiple monozygotic-dizygotic twin studies. These studies have consistently supported the existence of global dispositions and the significant role heredity plays in their development (Eysenck & Eysenck, 1980; Galton, 1884; Shields, 1973). Furthermore, the analysis of situationally specific behavioral signatures requires a massive data archive of participant activities. Even Mischel (2004) concedes this is “extremely costly and time-consuming to obtain but also require[s] voluminous data gathering and analysis” (p.7). Such cumbersome requirements represent a serious constraint for resource strapped researchers. In the end, although many psychologists (Dweck & Leggett, 1998; Mischel, 2004) think cognitive variables influence behavior and behavior occurs in situate,
mounting evidence suggested there is little need to expend the resources necessary to capture the finite details required of this framework (John & Srivastra, 1999).

**Describing Personality: A Question of Context**

There is little doubt among those in the scientific community that a significant relationship exists between one’s personality and his or her subsequent behavior. Numerous findings from diverse subject areas including, monozygotic/dizygotic twins (Shields, 1962), maladaptive behaviors (John et al., 1994), and motivation (Dweck & Leggett, 1998), have documented this link. However, conflict arose when Mischel (1968) began to argue that any model of personality would be incomplete without the inclusion of context as a contributing factor in behavioral outcomes. This argument resulted in two divergent explanations of human personality, an idiosyncratic approach (e.g., cognitive-affective processing system) and a nomothetic approach (e.g., five-factor model). From an idiosyncratic standpoint, personality is the manifestation of an individual’s perceptually influenced cognitive system, which can only be understood through in situate behavioral observation (Mischel, 1968; Mischel, 2004; Mischel & Shoda, 1995). Whereas, the nomothetic position is decontextualized, it frames human personality as the composition of enduring dispositions (i.e., character traits), which are inferred from generalized patterns of behavior (Costa & McCrae, 1991; John & Srivastra, 1999).

One might be inclined to argue for the evaluation of personality using an in situate structure. It makes intuitive sense that behavior is the result of a bi-directional relationship between an individual’s personality and the context in which he or she lives. However, despite inherent limitations, the trait approach (FFM) integrates thought, behavior, and emotion, with biological correlates (e.g., heritability, physiology)
(Hartman, 2005) and has consistently been found a valid and reliable model for evaluating personality (Costa & McCrae, 1992; see Costa & McCrae, 1993 for an extensive bibliography of studies). Further, under the cognitive-affective processing system (CAPS), personality is the result of one’s perceptually influenced cognitions, thus limiting generalizability beyond the individual. In contrast, the FFM represents the covariation of trait characteristics across individuals, offering a generalized understanding of human personality (John & Srivastra, 1999). Additionally, behavioral predictability in the CAPS model is limited to the specified situation. In order to increase the scope of prediction, new assessments related to each scenario must be conducted. Alternatively, the taxonomic structure of the FFM offers users a hierarchy with levels of abstraction that can be applied to a multitude of scenarios, based on “the degree of descriptive detail and accuracy deemed desirable” (John, et al., 1988, p.197).

Although contextual or situational influences may play a role in one’s personality development, the structure of the current idiosyncratic model (i.e., CAPS) limits its application as a research framework. Its single subject, in situate, composition is much better suited for case study than experimental and quasi-experimental designs. The contextualization of personality limits predictive power to only the subject in question within the specified situation. There are also substantial resource costs associated with the collection and analysis of the enormous data archives required to identify behavioral patterns in situate. These costs limit its effectiveness with large subject pools, a serious problem even its creator acknowledged (Mischel, 2004).

Alternatively, decontextualization appears to lend itself well to research. There is growing evidence to suggest the FFM is a universal personality structure. It has now been
validated in research with children, college students, and adults (Digman & Inouye, 1986, Goldberg, 1990, Costa, McCrae, & Dye, 1991, respectively). Additionally, non-English taxonomic projects have reproduced these factors in Dutch, German, Italian, and four other languages (John & Srivastava, 1999). However, despite the model’s overall success, replicability issues still exist for the factor openness (i.e., aesthetics, values) among non-Western cultures and languages. This issue is currently attributed to flaws in research design, specifically the factoring of etic (translation based) rather than emic (culturally specific) content within a factor that was at one time curiously named culture (John & Srivastava, 1999). Nevertheless, the FFM has come to typify how personality is evaluated, translating well into instrumentation. This is best illustrated through a biographical analysis of the NEO-PI-R (Costa & McCrae, 1992). Currently, the instrument is available in 34 languages, while work is ongoing to validate it in an additional 11 languages. Further, approximately 1250 studies have been conducted ranging from personality structure and assessment, to behavioral genetics, aging, and organizational psychology. Ultimately, the decontextualized nature of the FFM appears to provide researchers the necessary descriptive power to successfully evaluate human personality. Validation across diverse age groups, cross language support, and substantial corroboration derived from its instrumentalization suggest that although inclusion of context may make intuitive sense, it is an unnecessary complexity for those interested in a sample size greater than one.

Predicting Behavior: Structure and Application of the Five-Factor Model

The five-factor model summarizes commonalities found among theorists into a scalable, three-tiered structure that balances generalizability with fidelity (John &
Srivastra, 1999). This structure examines personality in terms of human universals and individual differences. At the uppermost tier, each dimension (factor) of personality is characterized at the broadest level of behavioral abstraction, sacrificing fidelity for generalizability. For example, one cannot pinpoint how helpful or unselfish someone is based on his or her score on agreeableness, but can gain insight into how good-natured one is in general. At the intermediate tier, specificity begins to increase and dimensions are replaced by facets. One still cannot pinpoint how helpful or unselfish someone is, however, these and other related selfless behaviors are now grouped together and are represented under the facet of altruism, a feature of agreeableness. At this lowermost tier, fidelity reaches its highest point. Facets are replaced by character traits and one can now review a more circumscribed set of behaviors including helpfulness and unselfishness (John, Hampson, & Goldberg, 1991). This accuracy of language results in a descriptive model that targets the variables that account for behavioral regularities rather than an explanatory model meant to address inferred processes (John & Srivastra, 1999).

For this reason, the FFM transitions well from conceptual to applied settings. Prior to its development, little was understood regarding the typology of personality. Researchers were finally able to empirically substantiate the existence of generalized personality types by identifying coherent trait patterns within individuals and among groups of individuals (John & Srivastra, 1999). For example, individuals characterized as resilient, “showed a high level of adjustment and effective functioning on all five factors” (p.39) raising the question of whether trait groupings might influence or predict behavior.

As a result, researchers began to explore this possibility, targeting important social and developmental issues including academic achievement (Digman & Takemoto-Chock,
1981) and juvenile delinquency (John, et al., 1994). Subsequent findings suggested
conscientiousness was a predictor of academic performance and the factors,
agreeableness and conscientiousness, were predictors of juvenile delinquency. More
recently, application of the model has extended to include such areas as leadership
(Watson & Clark, 1997), creativity (McCrae, 1996), and helpfulness (Graziano &
Eisenberg, 1997). In each case, a single factor (i.e., extraversion, agreeableness and
openness, respectively) was found to be a predictor of behavior.

One hundred and twenty-five years after Galton (1884) conceptualized the original
lexical theory, its evolution has generated a descriptive taxonomy with predictive power,
thus achieving Allport and Odbert’s (1936) original purpose, to “distinguish the behavior
of one human being from another” (p. 24). However, even with this major advancement,
psychology’s understanding of personality has been with few exceptions (Bessiere, Seay,
& Kiesler, 2007; Poznanski & Thagard, 2005) limited to the physical world. Yet
technological advancement continues to push the boundaries of how the self is defined.
Where the individual once consisted of the public and private persona, he or she now may
possess a virtual self (Gee, 2003), an extension of one’s personality beyond the physical
realm to simulated environments found within networked computer systems.

Networked Systems and the Rise of Virtual Environments

Elegant solutions to difficult problems are often born not out of desire but the
complexities of the world in which one lives. The 1960’s were complicated. Immense
social and cultural change was underway. Cold War fears and more benign motives drove
two sides of a project that became known as the Advanced Research Projects Agency
Network (ARPANET) or the foundation of today’s Internet (Rosensweig, 1998). For Paul
Baran an engineer at the RAND Corporation, there was genuine concern for how the U.S. government would communicate in the event of a nuclear war. Telecommunications systems at the time were centralized and sent messages in their entirety, thus offering little security in the event of an attack. He argued for a decentralized model that consisted of multiple communications channels (i.e., network nodes) that passed messages not as a single entity but as discrete packets of information that could be reassembled at its endpoint (Rosensweig, 1998). In the event there was a disruption in a node, the packets could be redirected through other available nodes and still reach the intended target.

During this same time frame, Advanced Research Projects Agency (ARPA) a technology research division of the U.S. Defense Department had run into a problem. The group had multiple computers and mainframes through which they conducted their research, however incompatibility of operating systems and computer languages made it impossible to share information (Rosensweig, 1998). However, Leonard Kleinrock of MIT convinced the group at ARPA that communication between a group of computers was possible if they would move away from a traditional telecommunications model that relied on a completed circuit (e.g., two paper cups connected by a string) and begin using a networked design that relied on packet switching (e.g., a freeway system that provides many options to arrive at the same destination) (Leiner et al., 1997).

Although the philosophical grounds on which they began were markedly different, a convergence of ideas was occurring between Paul Baran and ARPA group. As a result, in 1969 the first set of decentralized computers were remotely connected (i.e., networked) to each other at University of California, Los Angeles and Santa Barbara, University of
Utah, and the Stanford Research Institute for the purpose of information sharing (Reid, 1994).

As the implementation of ARPANET was drawing to a close sometime around 1972, the first applications for this network began to arrive. File transfer and remote login emerged, followed by Email and the development of Ethernet technology (i.e., the dominant computer communications language) created by Bob Metcalfe at Xerox PARC in 1973 (Leiner, et al., 1997). To this point, efforts had focused on the development, stabilization, and utility of the network. However, the mid-1970s brought the introduction of a new form of computer game entitled *Adventure*. *Adventure* was a single player text-based game inspired by the paper and pencil, fantasy role-playing game, *Dungeons and Dragons* (Waters & Barrus, 1997. p. 23).

In 1976, the first networked multiuser game entitled *Mazewar* was introduced, in which participants could run around a maze and shoot one another. Other networked games would quickly follow. Inspired by *Adventure*, the games *Wizard*, and then *Sceptre* integrated fantasy role-playing features of *Adventure* with the networked, multi-player capabilities of *Mazewar*. This further extended this new genre by introducing new system affordances including user-to-user communication, team collaboration, and token economies (Reid, 1994). Despite its limited popularity, the work of Roy Trubshaw and Richard Bartle entitled *Multiuser Dungeon* or *MUD* would come to define this genre of user-computer interaction (Reid, 1994; Waters & Barrus, 1997).

Multiuser Dungeons represented a distinct change. Prior to their development, computer users played single user, text-based video games (e.g., *Adventure*), which consisted of pre-defined goals, and a beginning, middle, and end. Although still strictly
text-based, MUDs had a unique set of features that redefined user-computer interaction as illustrated by Pavel Curtis (1992) of Xerox PARC:

1. “A MUD is not goal-oriented; it has no beginning or end, no `score', and no notion of `winning' or `success'. In short, even though users of MUDs are commonly called players, a MUD isn't really a game at all.

2. A MUD is extensible from within; a user can add new objects to the database such as rooms, exits, `things', and notes. Certain MUDs, including the one I run, even support an embedded programming language in which a user can describe whole new kinds of behavior for the objects they create.

3. A MUD generally has more than one user connected at a time. All of the connected users are browsing and manipulating the same database and can encounter the new objects created by others. The multiple users on a MUD can communicate with each other in real time.” (p. 2)

This was a significant shift from the existing model of user-computer interaction. It was no longer constrained to a linear and solitary endeavor. The MUD emerged as a user-defined socio-cultural environment (Reid, 1994).

As a result, persistent (i.e., they remained on at all times) virtual communities reminiscent of third places found within the physical world began to spring up and their inhabitants appeared to treat them as if they were real (Reid, 1994). Rather than meeting each other at the park to play chess, participants logged on and met within these virtual spaces. The neighborhood just expanded to anyone with a computer and a network connection. Social interaction and the expression of emotion through emotes (e.g., hugging) became the norm, and traditional socio-cultural events such as weddings and
parties began to emerge within these environments (Curtis, 1992).

The 1980s brought about another significant shift in network design, transmission control protocol (TCP) and internet protocol (IP) better known as TCP/IP, was adopted by the defense community as its networking standard (Leiner, et al., 1997). Transmission control protocol significantly enhanced a network’s ability to pass packets of information across the network with reduced packet loss (i.e., reduced errors), while IP gave computers residing on the network an address similar to a house address where mail or in this case digital information could be sent. Moreover, the adoption of TCP/IP led to the separation of military and non-military communities (Leiner et al., 1997). This was a significant structural shift in ARPANET architecture, which helped the Internet to emerge. As a result, by 1985 the Internet had become an integral component of an extensive community of researchers and developers through which daily communication could occur by email and text-based chat programs. However, it was the significant cost reduction of personal computers (PC) and workstations that cemented the utility of the Internet. Homes and businesses began to connect and what started as a small group of computers centralized within a research community, expanded to over 50,000 networks that extended to all seven continents (Leiner, 1997).

Through the early 1990s, as the Internet grew, so did the popularity MUDs. The list of these virtual environments had reached approximately 300, with the busiest hosting as many as 200 simultaneous inhabitants (Curtis & Nichols, 1994; Turkle, 1994). Once limited to fantasy themes, new MUDs began to emerge which focused on social (e.g., TinyMUD) and academic (e.g., BioMOO for biologists) activities, shifting their emphasis towards world creation, community building, and inhabitant communications (Reid,
Although these MUDs were exclusively text-based, the emergence of more realistic, animated first-person shooter games (e.g., Castle Wolfenstein, Doom) in the early 1990’s led to a shift in the structure and content of VEs (Waters & Barrus, 1997). Although games like *Doom* (ID Software, 1993) were more similar to *Adventure* (i.e., linear and goal oriented) than a MUD, they now afforded multiple players the opportunity to interact from remote locations over the Internet within a game space drawn on a computer screen using a graphics engine internal to the game. Players could now see what was going on rather the imagining the interaction through textual descriptions.

In 1995, Korean game company Nexon introduced *Kingdom of the Winds*, an online role-playing game, which introduced customizable avatars, graphically-based digital representations of one’s self (Chung, Shearman & Lee, 2003). Although these avatars were simple representations, they allowed players to customize the eyes, nose, and hairstyle. However, a series of games were released over the subsequent years that reconceptualized the virtual environment, merging the fundamental components of MUDs with customizable avatars, and driven by increasingly robust graphics capabilities.

Although *Meridian 59* is believed to be the first of this new genre know as massively multiplayer online games (MMOG), the release of *Ultima Online* in 1997, sparked contemporary interest in the genre. Similar to its precursor the MUD, MMOGs are persistent virtual environments that exist even when participants are not logged in the play space. These worlds also contained a unique set of features that separated them from the popular first person shooters of the time.

1. MMOGs are a mixed goal-orientation; they have no beginning or end, no score, instead these environments have merged the socio-cultural components of MUDs
with the momentary excitement found within first-person shooters. Inhabitants can socialize, build relationships, and develop cultural artifacts central to the play space or take part in a token economy, which reward accomplishments upon the completion of tasks or perhaps overcoming an opponent in battle.

2. MMOGs are pseudo-extensible; a user does not add new objects to the system database in the traditional sense of a MUD, instead he or she can instantiate a room, or object (e.g., sword or armor) from predefined list of content.

3. MMOGs are multiplayer; all participants must connect to the same remote computer that houses the virtual environment in order to interact within the play space.

4. MMOGs are persistent; the virtual environment continues to exist and narratives evolve regardless of whether participants are connected.

The integration of these characteristics with a user-defined, and modified, 3-dimensional avatar had significant impact upon the advancement of VEs, as evidenced by the success of the 1999 release of *Everquest* (EQ). A MMOG with a fantasy theme, EQ was very popular and boasted sales in excess of 1.5 million copies (Morales, 2002). Although its popularity has since declined, EQ is now in its 12th year and has seen 17 expansions to the original world, making it the longest running, commercial virtual environment to date. However, Blizzard Entertainment’s (2004) release of *World of Warcraft* (WoW) brought the enthusiasm and excitement for such environments to a new level. Within 4 years of its launch, WoW was reported to have achieved a subscriber base of 10 million players (Blizzard, 2008).

With the development of titles like EQ and WoW, interest in VEs outside the gaming
community increased. Researchers explored these simulated spaces with increased frequency. A search using the term “virtual environment” within the database Academic Search Premier (see Table 2.1), demonstrates the trend from 1975 to the time of this writing:

Table 2.1

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</tbody>
</table>

Investigations were spread across domains, ranging from human factors and computer science to linguistics. However, the social sciences took a particular interest in VEs. “No longer [were people] simply external observers of images on a screen, but active participants within a computer-generated, three-dimensional virtual world” (Riva, 1997, p.1). This interactivity, constrained by the programmed structure of the environment was key. It offered researchers a new instrument that more accurately mimicked real world activities, without the confounds experienced in a typical public setting. For example, psychologists explored the effectiveness of VEs as a device for assessing phobias (Botella, et al., 1998; Carlin, Hoffman, & Weghorst, 1997; Riva, 1997), schizophrenia (Ku, et al., 2006), and anxiety (James, et al., 2003; Parsons & Rizzo, 2008). In each case the use of a simulated space was shown to be an effective psychotherapeutic tool.

However, VE research was not limited to with-virtual environment studies. As the socio-cultural component found within these spaces was becoming increasingly complex,
within-virtual environment studies began to emerge with more frequency. These spaces were found to possess their own languages, cultures, and norms (Steinkuehler, 2005; Williams, et al., 2006; Yee, et al., 2007), while reliance on a digital body (i.e. an avatar) both broadened and constrained in world behavior (Martey-Stromer & Galley, 2007). The programmed structure of the spaces encouraged the development of social structures (e.g., guilds) that aided in maintaining and reinforcing relationships both inside and outside of the VE (William et al., 2006). This same structure afforded participants the opportunity to develop a social identity (e.g., individualistic, social, anti-social) within these spaces (Whang & Chang, 2004).

This advancement in technology offered a new direction for both distance education and groupware systems (i.e., software designed to facilitate collaborative work over a network). Virtual environments became “malleable space, a space in which to build and utilize shared places for work” (Churchill & Snowdon, 1998, p.7). Because of this shift, participants were no longer seen as caricatures on a screen, but rather as an avatar afforded with a sense of spatial and social awareness (Churchill & Snowdon, 1998). Proximity (e.g., two avatars standing next to each other) and informational (e.g., emotes) cues offered situational context and promoted interaction. These spaces offered new opportunities to establish communities of practice (Esteves et al., 2009). Computer-based learning could now successfully include cooperative learning techniques (e.g., think/pair/share or jigsaw activities) (Childress & Braswell, 2006). While for others, VEs were a place to explore cognition through the social construction of knowledge (Delwiche, 2006; Steinkuehler, 2004).

In each of these scenarios, psychologists, researchers, and educators have placed a
heavy reliance upon the digital embodiment (i.e., avatar) of the user, as the primary facilitator of human behavior. This 3-dimensional visual representation acts as a bridge between the physical and virtual world, affording its user tools for verbal communication (e.g., text and voice chat), nonverbal communication (e.g., emotes such as hugging and waiving), environmental navigation (e.g., running and swimming) in addition to an enormous set of interactions ranging from fighting to opening a door. However, the avatar is far more than an instrument for manipulating virtual spaces. These characters represent the virtual self, “a manifestation of the self beyond the realms of the physical” (Reid, 1994, p. 69).

**The Virtual Self: Multiplicity or Singularity of Being**

As the Internet gave rise to networked systems, the development of multi-user domain (MUD) software gave birth to the avatar. In its earliest form, textual descriptions personified these digital embodiments, for example the “macho, cowboy type whose self-description stresses that he is a ‘Marlboros rolled in the tee shirt sleeve kind of guy’” (Turkle, 1997, p. 74). Such a characterization was thought to provide an identity or persona that was characterized by physical and psychological attributes that afforded its owner a meaningful framework in which to interact with others (Turkle, 1997). However, if each avatar was imparted with its own identity, rather than infused with aspects of a participant’s identity, it assumes that multiple identities (i.e., multiplicity) are possible (Reid, 1994; Turkle, 1994, Turkle, 1997). This runs contrary to the field’s current understanding of self. Regardless of the term used (i.e., self-concept, individuality, identity), self is a universal descriptor that in a broad sense, “gives the person a feeling of continuity, uniformity over time, and over different situations, which produces coherence,
that is, a cohesion between all the different experiences in all aspects of life” (Roesler, 2008, p. 422). Moreover, not only does multiplicity imply a discontinuity with the self, it suggests that participants can casually move from one identity to another when in cyberspace. Yet as Webb (2001) suggests, the constraints of the environment coupled with the typical interactions across systems would better suit the exploration of facets of identity rather than the creation of new identities. Ultimately, it is the singularity of self within these spaces that provides the continuity necessary for consistent actualization of behavior.

**Digital Embodiment**

Technological advancement continues to enhance this paradigm. The textual descriptions of early MUDs have been supplanted by increasingly complex 3-dimensional visual representations. Participants are referred to by character name rather than given name (Bessiere, et al. 2007). Often they embody their digital likeness, becoming possessive of its name (Curtis, 1992), and feeling “psychologically connected to their character, …keeping the same one for months or years” (Bessiere, et al., 2007, p.530). However, there appears to be a number of factors that contribute to this connectedness.

Avatars are now easily customizable, allowing participants a broad spectrum of choices (e.g., gender, skin color, hair length) to distinguish themselves from other inhabitants. This has led to physical appearance becoming increasingly important, and the perception that one’s digital body is the desired rendition of self (Williams, 2007; Yee & Bailenson, 2007). Further, many users place their avatars in public spaces to be admired for the equipment they have gained (Ducheneaut, et al, 2006). However, beauty and
affluence not only impact social status within virtual environments (Reid, 1994), but appearance in general has been shown to influence behavior within these spaces. For example, Yee and Bailenson (2007) found the more attractive that one perceives his or her avatar to be, the more likely he or she is willing to be intimate with a stranger in a virtual space.

Similar to appearance, gesture seems to play a defining role for the avatar within these environments (Williams, 2007). Graphical renderings of emotions (e.g., smiling), nonverbal communications (e.g., hand gestures), and character actions (e.g., dancing) have shifted the experience away from traditional user-computer interaction, to interaction among social actors (Talamo & Ligorio, 2001). Further, emotes created by participants allow for subtle variations in expression (Mortensen, 2006). All of these are necessary components for providing dispositional similarity and individual differences among people.

As in the real world, nuanced characteristics provide the basis for individuality, while system affordances and constraints provide the structure and tools for overall behavior. The avatar no longer represents a simple tool or mechanism manipulated in cyberspace. Instead, it has become the individual’s bridge between the physical and virtual world, a conduit through which to express oneself among other social actors. As a result, complex social and normative components have arisen within these environments to further influence the development of the virtual self.

By design, virtual environments are intended to be social and it has been suggested they produce both a sense of empowerment (Krotoski, 2004) and social anxiety (James, Lin, Steed, Swapp and Slater, 2003). Graphical user interfaces (GUI) often include friend
lists, tools for scheduling group activities and ways to search for others with similar interests. Many activities are centered on groups both large (e.g., guilds) and small (e.g., pick-up groups) (Williams et al, 2006). In fact, in recent years researchers have begun to argue these spaces are the new third places (Steinkuehler & Williams, 2006; Williams et al, 2006). A concept first described by Oldenburg, (1999), in which coffee shops and beauty parlors among other public places have become community centers where locals meet to share about their personal lives, socialize, and teach one another.

For many inhabitants, the virtual space is a new avenue for friendship. This allows for the building of (Cole & Griffiths, 2007; Williams et al 2006) friendships that often translate beyond cyberspace into the real world (Cole & Griffiths, 2007). Mutual attraction among participants is not uncommon within these environments (Cole & Griffiths, 2007) and has on many occasions led to virtual marriages (Reid, 1994; Terdiman, 2006;Turkle, 1997). However, although much has been reported regarding positive social outcomes, it appears that as with the real world behavior, virtual behavior is best characterized along a continuum. Bartle (1996) described MUD inhabitants as achievers, explorers, killers, and pure socializers, while Mortenson (2006) interjected griefers, participants who play to ruin the fun of others. Moreover, a large-scale study of more than 4,750 participants of the virtual environment known as Lineage (Whang & Chang, 2004) suggests a similar behavioral makeup including, single-oriented (i.e., individualistic), community-oriented (i.e., social), and off-world (i.e., anti-social) players.

As with the physical world, the impact of behavioral diversity within a virtual space appears to extend beyond the individual to the broader social system. This produces a reciprocal relationship with the individual and the social system in which he or she
inhabits. Individuals and groups interact, communicate, and collaborate with each other as they integrate established real-world norms (Gaimster, 2008) with environmental goals and system constraints (Martey & Stromer-Galley, 2007; Squire & Steinkuehler, 2006). This results in a normative structure that affords social continuity through shared meaning and understanding, as well as guidelines for interpersonal interaction and social identification (Pankoke-Babatz & Jefferey, 2002). In turn, these guidelines exert pressure upon the participant, which influences his or her self-concept (Utz, 2003).

Illustrations of these pressures can be seen across environments and on multiple levels. Basic standards of politeness and adherence to game/environmental rules appear to be required for all individuals regardless of the environment in which they reside (Martey & Stromer-Galley, 2007; Pankoke-Babatz & Jefferey, 2002; Reid, 1994). By contrast, once someone chooses to identify or affiliate with an organization, it begins to exert its own influence. For example, (a) group membership (i.e., guilds) within World of Warcraft defines another level of acceptable behavior through its primary purpose, (b) social guilds focus on player well-being, (c) while raid guilds focus on the betterment of the group as a whole (Williams et al, 2006). Yet, in Sims Online, differences in social structures (i.e., houses rather than guilds) require a global environment that encourages “appropriate behavior that parallels offline behavior” (Martey & Stromer-Galley, 2007, p. 327). This is similar to participants within Second Life, who are interested in experiencing a virtual marriage, where a great deal of activity has been dedicated to reproducing the marriage tradition including dress creation and accessories (Brookey & Cannon, 2009).

However, while norms may offer social continuity between the physical and virtual
world, they also reaffirm negative belief structures and subsequent behavior. It is not uncommon for new players to experience bullying or for inhabitants to report griefing (i.e., player-on-player harassment) and abuse (Curtis, 1992; Reid, 1994; Salt, Atkins, & Blackall, 2008; Whang & Chang, 2004). Both Sony Entertainment, the developers of *Everquest*, and Blizzard, the developers of *World of Warcraft*, created Player versus Player (PVP) servers to try and deal with this issue (Mortensen, 2006). Females continue to be objectified and in some cases have resorted to swapping genders to avoid harassment (Brookey & Cannon, 2009). Additionally, lesbian, gay, bi-sexual, and transgendered (LGBT) identities within these spaces continue to be marginalized through heteronormative practices including isolation, slurs, and violence (Brookey & Cannon, 2009). Ultimately, “virtual environments are accessed from an off-line world and become part of participants ‘lived dimension’ … virtual existence is merely an extension of what people normally do” impacting both broad social development and the individual concepts of self (Webb, 2001, p. 564).

**Presence of Being**

Underlying these complex social structures and bound together through both interpersonal interaction and social identification lies a very real feeling of immersion, or the perceived reality that oneself exists within the computer-mediated environment (Lee, 2004). This sense of “being there” was originally described as telepresence by Minsky (1980) and referred to a sensory system that afforded human operators the feeling of existing within a remote work environment. Since then, terms including *virtual presence* – a sense of being present within a virtual environment (Lee, 2004), *copresence* - “a sense of being together” (Schroeder, 2002, p.3), and *social presence* - the feeling of being
connected to other humans within a mediated environment (Bente et al, 2008) have been used both interchangeably and noninterchangeably to describe this perceptual quality.

However, Lee (2004) offered a unified reconceptualization that accounts for the physical, self, and social orientations of the construct. At its core, presence is “a psychological state in which objects are experienced as actual objects in either sensory or nonsensory ways” (Lee, 2004, p.27). This suggests that the mediating environment may not be the critical component under which presence occurs, but rather it is the interaction between oneself and a para-authentic (i.e., human controlled) or artificial (i.e. computer controlled) object, supported by incoming stimuli and the imagination. For example, whether interaction occurs with an avatar on the screen or a robot in the room, participants become social actors that elicit social responses from each other and not from the developers who created the system (Lee, 2004). Therefore, it is connections such as these that result in a heightened sense of presence. Moreover, research appears to support this conclusion, as feelings of presence have been found in both low-tech (Qing et al, 2007) and high-tech (Lessiter, Freeman, Keogh & Davidoff, 2001) environments. Ultimately, “the illusion of reality lies not in the machinery itself, but in the users’ willingness to treat the manifestation of their imaginings as if they were real” (Reid, 1994, p.3).

The virtual self is no longer the musings of science fiction (Gibson, 2000). The rise of 3-dimensional virtual environments has afforded its inhabitants the opportunity to engage in increasingly complex physical and social behaviors. Psychological ownership of one’s avatar is occurring (Bessiere, et al. 2007), complex social structures have emerged (Williams et al, 2006), and virtual world behavior appears to mimic that of the real world.
(Martey & Stromer-Galley, 2007). Further, as the possibility for interaction continues to
grow, this should undoubtedly have an impact on presence within these spaces. However,
little is known about the relationship between who a person is and the avatar he or she
creates. Is it another self that has been created to manage mediated environments and fits
alongside one’s public or private personas as suggested by Gee (2004)? Or, perhaps it is
merely the similarities and individual differences of human personality manifest under a
new set of constraints and affordances.
Once thought of as products of science fiction, virtual environments have come to
encapsulate and often mimic the social, cultural, and economic realities found within the
physical world. Virtual marriages are now commonplace (Terdiman, 2006). Virtual
currency, items, and property are now bought and sold for real currency (Liu, 2006).
Even the U.S. House Subcommittee on Telecommunications and the Internet (2008)
recently simulcast its hearings within a virtual world. Virtual environments are no longer
simplistic forms of entertainment; they are highly dynamic and immersive worlds
growing in societal influence.

Researchers, psychologists, educators, and participants alike have come to embrace
the utility of these environments and recognize their influence. For example, research and
advocacy organizations (i.e., policy institutes) have been created to address public policy
issues within these spaces, including financial transactions and governance frameworks
(Virtual Policy Network, 2008). Researchers have explored the potential of virtual worlds
as places for psychological assessment (Gaggioli, et al, 2003) and educational endeavors
(Squire, 2006; Young, Schrader, & Zheng, 2006). While, computer-mediated
communications (CMC) theorists have broadened the scope of immersion (i.e., presence)
research to include these environments. Unfortunately, no research was found that links
these three areas specifically to explicate the relationships among the virtual self,
personality, and presence with their behavioral outcomes.

In each scenario, heavy reliance has been placed on an avatar or digital representation
of oneself to facilitate behavior. Yet, little is known about this virtual self, the underlying
influences that impact its maturation, and how that may influence behavioral outcomes within these spaces. If we are to take full advantage of the affordances virtual environments can offer, we must begin to elucidate these relationships, which raises the following set of research questions:

1. Is there a relationship between an individual’s personality and behavioral patterns within a virtual environment?

2. How much of one’s virtual behavior can be attributed to an individual’s personality versus the personality of the avatar?

3. What is the relationship between personality and behavior when accounting for presence?

**Predicted Outcomes**

Q1: Is there a relationship between an individual’s personality and behavioral patterns within a virtual environment?

Approximately 3 decades of personality research have produced several valid and reliable scales to measure personality (John & Srivastava, 1999). These inventories have been constructed based on the theoretical framework of the five–factor model (FFM) of personality which suggests the dimensions of neuroticism (i.e., emotional stability versus maladjustment), extraversion (i.e., outgoing versus reserved), openness (i.e., unconventional versus conventional), agreeableness (i.e., altruistic versus antagonistic), and conscientiousness (i.e., purposeful versus compulsive) are components of a universal personality structure that can be found across observers (McCrae & Costa, 1987), age groups (Digman & Inouye, 1986, Goldberg, 1990, Costa, McCrae, & Dye, 1991), and languages (De Raad et al., 1998). Among those available, the most widely used and
verified is the Revised NEO Personality Inventory (NEO-PI-R) and its short form the NEO Five Factor Inventory (NEO-FFI) (1992b). “[T]he scales of the NEO-PI-R and the NEO-FFI measure traits that approximate normal, bell-shaped distributions” and can be employed in both clinical and research settings (Costa & McCrae, 1992, p.13). This would then suggest that because the FFM is a descriptive taxonomy of individual differences in behavior (John & Srivastava, 1999), participant behavioral profiles should breakdown along the same approximate lines as that normal distribution. Further, the structure of the FFM as a nomothetic explanation of personality suggests that individual differences are stable in nature and not situationally specific (John & Srivastava, 1999). As a result, it was predicted that general patterns of participant behavior within a virtual environment should align with their corresponding factor scores. For example, those who exhibit higher levels of conscientious behavior with World of Warcraft (WoW) should score higher on the NEO-FFI factor of conscientiousness.

**Q2: How much of one’s virtual behavior can be attributed to an individual’s personality versus the personality of avatar?**

Previous comparative research that explored the relationships among actual, virtual, and ideal selves (Bessière et al, 2007) using a FFM instrument entitled the *Big Five Inventory*, found the avatars (i.e., the virtual self) that participants created were viewed as more similar to their ideal selves on the domains of neuroticism, extraversion, and conscientiousness. Further, there was no difference in participant agreeableness ratings between the self and their avatar’s while openness appears to be more unimportant due to the lack of creative roles within WoW. This would suggest that overall, the virtual self would play a larger role in the behavior exhibited. Therefore, it was predicted that for the
domains of neuroticism, extraversion, and conscientiousness, a larger portion of shared variance would be attributed to an individual’s conceptualization of the virtual self. Whereas, for the domains Agreeableness and Openness, a significant portion of shared variance would be attributed to an individual’s personality.

Q3: What is the relationship between personality and behavior when accounting for presence?

Although many definitions of presence have existed (e.g., telepresence, social presence, virtual presence), a unified interpretation has recently emerged, which characterizes the construct as “a psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways” (Lee, 2004, p.27). This psychological state has been shown to impact participant performance (Welch, 1999) and emotional reactions (Banos, et al., 2008), as well as playing an importance role in increasing the efficacy of virtual psychotherapy (Gaggioli, et al., 2003). According to Lessiter and colleagues (2001), presence within a mediated environment which is measured using the ITC-Sense of Presence Inventory (ITC-SOPI) consists of four interconnected variables including: (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), that influence immersion within the environment. However, research (Lessiter, et al., 2001) suggests that physical space and engagement are the critical factors that increase presence within computer games, a key component of this study. Further, it appears that ecological validity and negative effects have limited influence on presence within a computer game. For these reasons it was predicted that
actualized behavior and NEO-FFI factors scores would be more closely align as the physical space and engagement scores increase, while ecological validity and negative effects would have little to no effect on the comparison of actualized versus reported behavior.

**Environmental Description**

Massive multiplayer online games (MMOG) are immersive virtual environments in which participants generate and employ avatars to engage in activities including exploration, social networking, questing, and warlike behavior (Bessiere et al., 2007). By design, these systems and environments exist independent of the user. As a result, past behaviors shape future experience and even when a participant is not logged in, worlds continue to change, narratives evolve, and new lore is created. For the purposes of this study, *World of Warcraft* (WoW) was selected due to its MMOG design and integrated video recording capabilities.

**Avatar Overview**

The basis for all interaction within the environment stems from the employment of a participant-controlled avatar. Each avatar (i.e., digital likeness) is unique to the individual and is defined using a set of characteristics internal to the character-creation tool. The formation process involves choices regarding character name, physical appearance (e.g., gender, hair color), race (e.g., dwarf, orc), and class (e.g., warrior, mage). Subsequently, these determinants affect participant experiences within the environment including (a) where in the virtual world they begin, (b) the availability of quests, and (c) whether or not other inhabitants attack them.
Participants

A power analysis (PA) was conducted employing Cohen’s (1992) methodology for the behavioral sciences and sample size was assessed for medium and large effect sizes (i.e., .15, .35, respectively). According to Cohen (1992) a medium effect size represents “an effect likely visible to the naked eye by a careful observer,” while the large is only slightly bigger and is often used when sample size exceeds a researcher’s available resources (p. 156). Power analysis for multiple regression was conducted using the largest number of independent variables in a single model (i.e., 5), the standard coefficients power = .80 and $\alpha = .05$, then applied to both medium and large effect sizes. The results of the analysis indicated that 42 subjects (i.e., large effect) were appropriate for the most complex question (i.e. question three) of the study.

In order to recruit sufficient participants, an email was sent out to all students and staff at a southwestern university. Each participant was notified that involvement in the study required the usage of his or her own avatar (i.e., digital embodiment) within the World of Warcraft. The selection criterion included expertise within WoW as defined by having at least one character that had reached level 70. This was the maximum level available to players after the release of The Burning Crusade, the first World of Warcraft expansion pack. Due to ongoing environmental changes only players who had current, active accounts were selected.

Forty participants took part in the study, however one was excluded due to technical problems with the video. The resulting 39 participants ranged in age from 18 to 49 with a mean age of approximately 29 and a standard deviation of approximately 7 years. Using the demographic categories defined by the United States Census Bureau (2000), 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%).

**Design and Procedures**

To prevent distraction within the lab environment, participants sat at alternating computers systems and wore an audio headset. An identical iMac computer system that contained an Intel Core 2 Duo 2.4 Ghz processor, 2 GB of Ram, Intel high definition audio, ATI Radeon HD Pro 256mb video card, and a 32-bit color 1920x1200 LCD monitor was used in the study. In addition, the system was equipped with a full version of WoW and a two-button PC mouse. To increase the opportunity for interaction with the virtual environment, participants played a character level 70 or greater on its established game server and were provided 15 minutes to make any necessary modifications to their user interface (UI). World of Warcraft’s internal video capture software designed to record each subject’s activities within the virtual environment was employed. Recording of all content began after the 15-minute UI modification period was over. Video data were assessed using partial interval recoding (PIR) a behavioral analysis methodology that scores participant conduct using predefined scorecard (see Appendix D).

The study consisted of the following six-step procedure (approximate duration: 3 hours):

1. Participants completed a demographic/interview questionnaire on themselves (approximate duration: 10 minutes).
2. Participants completed the NEO-FFI personality inventory on themselves (approximate duration: 15 minutes).
3. Participants played World of Warcraft (duration: 2 hours, video recording 30 minutes).
4. Participants completed the revised ITC-SOPI presence questionnaire (approximate duration: 10 minutes).

5. Participants completed a demographic/interview questionnaire on their avatar (approximate duration: 10 minutes).

6. Participants completed the NEO-FFI personality inventory on their avatar (approximate duration: 15 minutes).

**Measures**

Four instruments were employed in the study, including: (a) NEO FFI Personality Inventory Short Form (Costa & McCrae, 1992b), (b) behavioral assessment using partial interval recording (PIR), (c) ITC – Sense of Presence Inventory (Lessiter, Freeman, Keogh & Davidoff, 2001), and (d) participant demographic/interview questionnaires (see Appendices A and B).

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 or probability that an individual’s personality domains (i.e., identifying characteristics) will show distinctive features when compared to other individuals that fall within the normal distribution (Costa & McCrae, 1992b). These domains include: neuroticism (e.g., depressed, worried), extroversion (e.g., assertive, energetic), openness (e.g., creative, inventive), agreeableness (e.g., trusting, kind), and conscientiousness (e.g., thorough, reliable).

Prior to the construction of the NEO-FFI, all factors contained within the parent instrument (i.e., NEO-PI-R) were keyed to a single scale, thus avoiding scaling issues
that might produce spurious correlations. Theory-guided analysis of domain-level validity
was conducted through a series of studies that focused on both convergent and
discriminate validity within each of the five broad domain characteristics. Factor
analytics were employed to determine whether each construct was measuring its specified
domain trait, and whether the factor was loading in a consistent manner across samples.
Results of this process supported the validity of the scales as accurate indicators of
personality assessment (Botwin, 1995; Costa & McCrae, 1992b).

The 240-item NEO-PI-R was subsequently pared down to a 60-item short form
known as the NEO-FFI. The resulting five domain scales were then compared back to
both the original NEO-PI and the revised NEO-PI-R. The correlates were as follows:

Table 3.1

<table>
<thead>
<tr>
<th>Factor</th>
<th>NEO-PI</th>
<th>NEO-PI-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>.75</td>
<td>.86</td>
</tr>
<tr>
<td>Extroversion</td>
<td>N/A</td>
<td>.77</td>
</tr>
<tr>
<td>Openness</td>
<td>N/A</td>
<td>.73</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>N/A</td>
<td>.68</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.89</td>
<td>.81</td>
</tr>
</tbody>
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Behavioral assessment was carried out using partial interval recording (PIR)
including a predefined scorecard of conduct associated with each domain (e.g., helpful or
unselfish behaviors related to agreeableness). Partial interval recording is defined as a
sampling method “in which an interval is scored as one occurrence if a response occurs in
any portion of it” (Murphy & Harrop, 1994, p.169). In other words, observers reviewed
video-recorded participant data and marked on the scorecard (i.e., counted) whether
behaviors associated with each domain facet occurred during each interval (i.e., every 20
seconds for the duration of the 30 minute video). Due to potential validity issues that may result from observer error, PIR was selected for two reasons: (a) rather than introduce random error into the design that would be difficult to account for, “systematic error is in-built since an interval may be scored as an occurrence when behavior occurs even for a tiny fraction of it” (Murphy & Harrop, 1994), and (b) when measuring rates of behavior, it has been shown the more conservative indicator of change (Harrop & Daniels, 1986).

The revised ITC – Sense of Presence Inventory (Lessiter, Freeman, Keogh & Davidoff, 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. No overall presence score existed at the time of this writing. Missing data was accounted for by mean score calculation and analysis was conducted at the individual factor level.

ITC-SOPI item stability was determined by comparing factor loading of the initial data set consisting of 604 completed respondent questionnaires with two randomized but representative subsamples (n = 325, n = 279) (Lessiter, et al. 2001). When items demonstrated inconsistencies in factor loading across the samples, they were excluded from the questionnaire. Internal reliability coefficients were then computed for each factor and items that reduced alpha were excluded. The results were as follows: physical space = 0.94; engagement = 0.89; ecological validity = 0.76; and negative effects = 0.77.
The participant demographic/interview questionnaire (Schrader & McCreery, 2007) incorporated Likert and open-ended question design to gather participant demographic data (e.g., age, gender), participant motives, technology experience, gaming experience, and online social affiliations.

**Variables**

Variable sets for the study were broken into three types: personality domain scores, actualized behavior scores, and level of immersion (i.e., presence) scores. The personality domain scores consisted of two variables sets, personality assessment variables (PAV) and virtual assessment variables (VAV). These were based on responses to the NEO-FFI as they assess their own personality and that of their avatar. The NEO-FFI consists of five 12-item scales, which measure neuroticism (i.e., emotional stability versus maladjustment), extraversion (i.e., outgoing versus reserved), openness (i.e., unconventional versus conventional), agreeableness (i.e., altruistic versus antagonistic), and conscientiousness (i.e., purposeful versus compulsive). Each of the PAV and VAV variables contained the raw score for their corresponding dimension and were calculated as follows: \[ \text{Raw score} = \sum \text{of responses to 12 domain items on the NEO-FFI questionnaire} \]

Actualized behavioral scores were represented by a single variable set known as behavioral assessment variables (BAV). These variables consisted of the behaviors captured on video during game play and correspond with the five domains found on the NEO-FFI (i.e., N, E, O, A, and C). For example, assuming a leadership role was a behavior associated with extroversion. To remain consistent with the NEO-FFI, BAV scores were constructed using +1 for each positive behavior exhibited and -1 for negative.
Total scores that approach zero were considered normal.

Table 3.2

Variables Related to Each Personality Domain

<table>
<thead>
<tr>
<th>Personality Domain</th>
<th>Personality Assessment Variable</th>
<th>Virtual Self Assessment Variable</th>
<th>Behavioral Assessment Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>PAV-N</td>
<td>VAV-N</td>
<td>BAV-N</td>
</tr>
<tr>
<td>Extroversion</td>
<td>PAV-E</td>
<td>VAV-E</td>
<td>BAV-E</td>
</tr>
<tr>
<td>Openness</td>
<td>PAV-O</td>
<td>VAV-O</td>
<td>BAV-O</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>PAV-A</td>
<td>VAV-A</td>
<td>BAV-A</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>PAV-C</td>
<td>VAV-C</td>
<td>BAV-C</td>
</tr>
</tbody>
</table>

Presence (i.e. level of immersion) was represented by a single variable set known as level of immersion (LOI) variables. These variables correspond to the four presence factors, physical space (i.e., a sense of being there), engagement (i.e., psychological involvement in the environment), ecological validity (i.e., believability of the environment), and negative effects (i.e., adverse psychological reactions to the system) found in the ITC-SOPI. Each of the LOI variables contained the mean value for it’s corresponding factor and was constructed as follows:

Table 3.3

Variables Related to Each Presence Factor

<table>
<thead>
<tr>
<th>Presence Factor</th>
<th>Level of Immersion Variable</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Space</td>
<td>LOI-PS</td>
<td>M of 19 items</td>
</tr>
<tr>
<td>Engagement</td>
<td>LOI-E</td>
<td>M of 13 items</td>
</tr>
<tr>
<td>Ecological Validity</td>
<td>LOI-EV</td>
<td>M of 5 items</td>
</tr>
<tr>
<td>Negative Effects</td>
<td>LOI-NE</td>
<td>M of 6 items</td>
</tr>
</tbody>
</table>
Analysis

Data analysis for the study was broken into two parts: general descriptive analysis and question specific analysis. General descriptive analysis was conducted to gain a global understanding of whether participant behavior was consistent with a normal distribution. Specifically, it began by calculating the overall sample mean for each behavioral assessment score (i.e., BAV-N, BAV-E, BAV-O, BAV-A, BAV-C). Subsequently, standard deviation scores were calculated for each participant based on his or her individual behavioral assessment scores. An overall sample profile was generated through pattern recognition of standard deviation scores at, above and below the sample means.

To answer Question One, “Is there a relationship between an individual’s personality and behavioral patterns within a virtual environment?” a simple regression approach was applied to the personality assessment (PAV) and behavioral assessment (BAV) variable sets and assessed for statistical significance. Variable pairings for the analysis are shown in Table 3.4.

Table 3.4

<table>
<thead>
<tr>
<th>Domain</th>
<th>Variable Pairing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>PAV-N and BAV-N</td>
</tr>
<tr>
<td>Extroversion</td>
<td>PAV-E and BAV-E</td>
</tr>
<tr>
<td>Openness</td>
<td>PAV-O and BAV-O</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>PAV-A and BAV-A</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>PAV-C and BAV-C</td>
</tr>
</tbody>
</table>

Question Two, “How much of one’s virtual behavior can be attributed to an
individual’s personality versus the personality the avatar?” was answered by applying a standard multiple regression approach to examine the shared variance between personality assessment (PAV) and virtual assessment (VAV) variable sets when regressed on their corresponding behavioral outcomes (e.g., behavioral assessment (BAV) variables). Variable pairings for the analysis are shown in Table 3.5.

Table 3.5

Variable Pairings for Question Two

<table>
<thead>
<tr>
<th>Domain</th>
<th>Independent Variables</th>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>PAV-N and VAV-N</td>
<td>BAV-N</td>
</tr>
<tr>
<td>Extroversion</td>
<td>PAV-E and VAV-E</td>
<td>BAV-E</td>
</tr>
<tr>
<td>Openness</td>
<td>PAV-O and VAV-O</td>
<td>BAV-O</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>PAV-A and VAV-A</td>
<td>BAV-A</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>PAV-C and VAV-C</td>
<td>BAV-C</td>
</tr>
</tbody>
</table>

To answer Question Three, “What is the relationship between personality and behavior when accounting for presence?” a standard multiple regression approach was used to examine the shared variance among the personality assessment (PAV) and level of immersion (LOI) variable sets when regressed on the behavioral assessment (BAV) variable set. Variable pairings for the analysis are shown in Table 3.6.
Table 3.6

Variable Pairings for Question Three

<table>
<thead>
<tr>
<th>Domain</th>
<th>Independent Variables</th>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>PAV-N and LOI-PS, LOI-E, LOI-EV, LOI-NE</td>
<td>BAV-N</td>
</tr>
<tr>
<td>Extroversion</td>
<td>PAV-E and LOI-PS, LOI-E, LOI-EV, LOI-NE</td>
<td>BAV-E</td>
</tr>
<tr>
<td>Openness</td>
<td>PAV-O and LOI-PS, LOI-E, LOI-EV, LOI-NE</td>
<td>BAV-O</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>PAV-A and LOI-PS, LOI-E, LOI-EV, LOI-NE</td>
<td>BAV-A</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>PAV-C and LOI-PS, LOI-E, LOI-EV, LOI-NE</td>
<td>BAV-C</td>
</tr>
</tbody>
</table>

Summary

In recent years growing interest in virtual environments as places for therapeutic, business, and educational endeavors have placed a heavy reliance upon the avatar as the primary facilitator of human behavior. This 3-dimensional representation acts as a bridge between the physical and virtual world, yet little is known about its efficacy. Specifically, how does the interplay between personality, the virtual self, and immersion influence behavioral outcomes within these spaces? The aforementioned study was designed to illuminate these relationships and show that valid behavioral models can be applied within virtual environments. Further, creators of these worlds can leverage these models to more effectively align system constraints and affordances with their intended objectives and outcomes.
CHAPTER FOUR
DATA ANALYSIS AND RESULTS

Technology Usage

Participants were asked to report their technological usage, including general Internet (e.g., Web surfing, email, instant messenger), information exchange sites (e.g., forums, blogs, or wikis), and social networking (e.g., Facebook and MySpace). In all cases, participants indicated that technology was an integrated part of their lives, using the Internet every day. Ninety-seven point four percent reported using information exchange sites at least once a week, with 55.6% using it everyday. Only 10% responded they did not use social networking sites as opposed to 51.3% using it every day.

Data specific to World of Warcraft (WoW) indicated that 75% had played the game for at least 3 months, however the time span ranged from 16 to 1085 days. Sixteen days is striking considering the level requirement of 70 to participate in the study. Further, participants reported playtime ranged from four to 60 hours a week with a mean playtime of 22 hours a week. Ninety-four point nine percent reported either being proficient or an expert with their avatar and 92.3% suggested they were at least competent with MMOGs in general (see Appendix B for questionnaire).

General Participant Personality Profile

A combined male/female profile was generated based on the NEO-FFI personality inventory scores from 39 participants. Results of the profile are shown in Table 4.1.
Table 4.1

*General Participant Personality Profile Scores*

<table>
<thead>
<tr>
<th>Domain</th>
<th>Raw Score</th>
<th>T-Score</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>17.74</td>
<td>48</td>
<td>Average</td>
</tr>
<tr>
<td>Extroversion</td>
<td>28.59</td>
<td>51</td>
<td>Average</td>
</tr>
<tr>
<td>Openness</td>
<td>32.85</td>
<td>60</td>
<td>High</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>29.97</td>
<td>44</td>
<td>Low</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>30.74</td>
<td>43</td>
<td>Low</td>
</tr>
</tbody>
</table>

A summary of scores provided by the NEO-FFI Summary Feedback Sheet (Psychological Assessment Resources, Inc. (PAR), 1991) suggests that overall, participants were:

“Generally calm and able to deal with stress, but sometimes experience feelings of guilt, anger, or sadness; they are moderate in activity and enthusiasm, enjoy the company of others but also value privacy; open to new experiences, have broad interests and are very imaginative; hardheaded, skeptical, proud, competitive, and tend to express anger directly; easygoing, not very well organized and sometimes careless, they prefer not to make plans” (p.1).

**Female Participant Personality Profile**

A female profile was generated based on the NEO-FFI personality inventory scores from 9 participants. Results of the profile are shown in Table 4.2.
Table 4.2

**Female Participant Personality Profile Scores**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Raw Score</th>
<th>T-Score</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>17.78</td>
<td>46</td>
<td>Average</td>
</tr>
<tr>
<td>Extroversion</td>
<td>25.78</td>
<td>46</td>
<td>Average</td>
</tr>
<tr>
<td>Openness</td>
<td>31.44</td>
<td>57</td>
<td>High</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>29.67</td>
<td>42</td>
<td>Low</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>35.89</td>
<td>51</td>
<td>Average</td>
</tr>
</tbody>
</table>

A summary of scores provided by the NEO-FFI Summary Feedback Sheet (PAR, 1991) suggests that female participants are:

“Generally calm and able to deal with stress, but sometimes experience feelings of guilt, anger, or sadness; they are moderate in activity and enthusiasm, enjoy the company of others but also value privacy; open to new experiences, have broad interests and are very imaginative; hardheaded, skeptical, proud, competitive, and tend to express anger directly; dependable, moderately well-organized, generally have clear goals but are able to set work aside” (p.1).

**Male Participant Personality Profile**

A male profile was generated based on the NEO-FFI personality inventory scores from 30 participants. Results of the profile are shown in Table 4.3.
Table 4.3

Male Participant Personality Profile Scores

<table>
<thead>
<tr>
<th>Domain</th>
<th>Raw Score</th>
<th>T-Score</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>17.73</td>
<td>50</td>
<td>Average</td>
</tr>
<tr>
<td>Extroversion</td>
<td>29.43</td>
<td>54</td>
<td>Average</td>
</tr>
<tr>
<td>Openness</td>
<td>33.27</td>
<td>60</td>
<td>High</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>30.07</td>
<td>46</td>
<td>Average</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>29.20</td>
<td>42</td>
<td>Low</td>
</tr>
</tbody>
</table>

A summary of scores provided by the NEO-FFI Summary Feedback Sheet (PAR, 1991) suggests that male participants are:

“Generally calm and able to deal with stress, but sometimes experience feelings of guilt, anger, or sadness; they are moderate in activity and enthusiasm, enjoy the company of others but also value privacy; open to new experiences, have broad interests and are very imaginative; generally warm, trusting, and agreeable but can sometimes be stubborn and competitive; easygoing, not very well organized and sometimes careless, they prefer not to make plans” (p.1).

Normality

Prior to the execution of univariate or multivariate statistical procedures the dependent behavioral actualization variables (i.e., BAV-N, BAV-E, BAV-O, BAV-A, BAV-C) were assessed for normality using measures of skewness and kurtosis. Skewness and kurtosis refer to the symmetry and flatness or peakedness of the sample distribution. However, due to inconsistencies in the definition of the acceptable limits of skewness and kurtosis, which can range from an absolute value of 2.00 (Tabachnick & Fidell, 1996) to an approximation of acceptability (Richards & Gross, 2005), anything greater than an
absolute value of 2.00 and less than an absolute value of 3.00 was followed by a Kolmogorov-Smirnov (K-S) goodness-of-fit single sample test. The K-S goodness-of-fit test constructs a cumulative frequency distribution of the continuous variable in question and compares it to its cumulative probability distribution to assess whether a sample distribution is normal (Sheskin, 2004). Results showed that all variables with the exception of the BAV-N kurtosis measure (i.e., kurtosis = 2.219) fell within this range. However, a follow up K-S goodness-of-fit test confirmed the normality of BAV-N indicating that the sample distribution was normal and parametric techniques were warranted.

Table 4.4

Skew and Kurtosis Data

<table>
<thead>
<tr>
<th>Domain</th>
<th>Skewness Statistic</th>
<th>Skewness Standard Error</th>
<th>Kurtosis Statistic</th>
<th>Kurtosis Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>-1.149</td>
<td>.378</td>
<td>2.219</td>
<td>.741</td>
</tr>
<tr>
<td>Extroversion</td>
<td>1.136</td>
<td>.378</td>
<td>1.851</td>
<td>.741</td>
</tr>
<tr>
<td>Openness</td>
<td>.649</td>
<td>.378</td>
<td>-.521</td>
<td>.741</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>-1.020</td>
<td>.378</td>
<td>1.967</td>
<td>.741</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.579</td>
<td>.378</td>
<td>-.094</td>
<td>.741</td>
</tr>
</tbody>
</table>

Influence analysis employing casewise diagnostics was then conducted to determine the existence of any residuals (i.e., outliers) that may exert undue influence upon the regression coefficients. Data points that existed three standard deviations from the mean were flagged and assessed for their impact upon the analysis. Two data points were identified. However, in each case the datum exhibited low leverage and therefore should theoretically not impact the regression line (Fox, 1990). Confirmatory diagnostics were
conducted where each datum was removed. Significance remained unchanged therefore
the data were not deleted.

**Research Question One**

Is there a relationship between an individual’s personality and his or her general
behavioral patterns within a virtual environment?

Univariate regression using the simultaneous method was applied to the personality
assessment (PAV) and behavioral assessment (BAV) variable sets and assessed for
statistical significance. Results indicated that for each personality domain, the
corresponding personality variable (PAV) was not a predictor of behavior (BAV) within
the virtual environment.

Table 4.5

*Results of Question One*

<table>
<thead>
<tr>
<th>Domain</th>
<th>PAV</th>
<th>BAV</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>17.74</td>
<td>8.191</td>
<td>-4.67</td>
<td>7.703</td>
</tr>
<tr>
<td>Openness</td>
<td>32.85</td>
<td>5.733</td>
<td>6.87</td>
<td>5.312</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>29.97</td>
<td>5.204</td>
<td>1.00</td>
<td>6.266</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>30.74</td>
<td>7.326</td>
<td>7.69</td>
<td>5.212</td>
</tr>
</tbody>
</table>

**Research Question Two**

How much of one’s virtual behavior can be attributed to an individual’s personality
versus the personality of his or her avatar?

Multivariate regression analysis using the simultaneous method was applied to the
personality assessment (PAV), virtual assessment (VAV), and behavioral assessment (BAV) variable sets and assessed for statistical significance. Results indicated that the model associated with each of the personality domains (i.e., neuroticism, extroversion, openness and conscientiousness) was found not to predict behavior within World of Warcraft. However, with the domain of agreeableness, the two predictors (i.e., personality assessment variable – agreeableness and virtual assessment variable – agreeableness) accounted for 23.6% of the variance in agreeableness behavior within the system $R^2=.236$, $f^2=.309$, $F_{2,36} = 5.568$, $p < .05$. Further, the virtual assessment variable – agreeableness (VAV-A) was found to be a significant predictor within the model $b = .293$, $\beta = .386$, $t(36)=2.646$, $p < .05$.

Table 4.6

*Results of Question Two*

<table>
<thead>
<tr>
<th>Domain</th>
<th>PAV</th>
<th>VAV</th>
<th>BAV</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>17.74 8.191</td>
<td>14.00 7.056</td>
<td>-4.67 7.703</td>
<td>.678</td>
<td>.514</td>
</tr>
<tr>
<td>Extroversion</td>
<td>28.59 6.034</td>
<td>33.38 5.369</td>
<td>8.97 14.899</td>
<td>.303</td>
<td>.741</td>
</tr>
<tr>
<td>Openness</td>
<td>32.85 5.733</td>
<td>25.15 6.201</td>
<td>6.87 5.312</td>
<td>.187</td>
<td>.830</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>29.97 5.204</td>
<td>26.56 8.246</td>
<td>1.00 6.266</td>
<td>5.568</td>
<td>.008</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>30.74 7.326</td>
<td>34.54 6.692</td>
<td>7.69 5.212</td>
<td>1.216</td>
<td>.308</td>
</tr>
</tbody>
</table>

Due to the lack of statistical significance found in question one and significant influence of agreeableness, a set of follow-up univariate analyses were conducted to answer whether there was a relationship between an individual’s virtual personality and
the corresponding behavioral patterns within the virtual environment. This required the pairing the virtual assessment (VAV) and behavioral assessment (BAV) variable sets. Results indicated that the assessment of virtual personality for the domains (i.e., neuroticism, extroversion, openness, and conscientiousness) was not predictive of subsequent behavior in the virtual space. However, 15.6% of the variance in agreeableness behavior within this virtual space was predicted by the virtual assessment variable – agreeableness (VAV-A) ($F_{1,37} = 6.850, p < .05$).

Table 4.7

*Results of Question Two Follow-Up*

<table>
<thead>
<tr>
<th>Domain</th>
<th>VAV</th>
<th>BAV</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>14.00</td>
<td>7.056</td>
<td>-4.67</td>
<td>7.703</td>
</tr>
<tr>
<td>Extroversion</td>
<td>33.38</td>
<td>5.369</td>
<td>8.97</td>
<td>14.899</td>
</tr>
<tr>
<td>Openness</td>
<td>25.15</td>
<td>6.201</td>
<td>6.87</td>
<td>5.312</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>26.56</td>
<td>8.246</td>
<td>1.00</td>
<td>6.266</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>34.54</td>
<td>6.692</td>
<td>7.69</td>
<td>5.212</td>
</tr>
</tbody>
</table>

**Research Question Three**

What is the relationship between personality and behavior when accounting for presence?

A simultaneous multiple regression approach was used to examine the shared variance among the personality assessment (PAV) and level of immersion (LOI) variable sets when regressed on the corresponding behavioral assessment (BAV) variable. Results indicated that each model was not a predictor of behavior within this virtual space.
However, due to findings of significance in Question Two related to both the individual virtual assessment variable – agreeableness and the overall agreeableness model, two follow up analyses were conducted.

The first analysis examined the virtual assessment variable – agreeableness (VAV-A) and level of immersion variables (i.e., LOI-PS, E, EV, and NE) as a variable set regressed on its corresponding behavioral assessment variable (BAV). The five predictors (i.e., virtual self assessment – agreeableness, physical space, engagement, ecological validity, and negative effect) accounted for 32% of the variance in agreeableness behavior within this virtual space, $R^2 = .320$, $f^2 = .471$, $F_{5,33} = 3.101$, $p < .05$. This simultaneous solution indicated once again that the VSA-A was a significant predictor of agreeableness behavior, $b = .316$, $\beta = .416$, $t(33) = 2.818$, $p < .05$.

The second analysis examined the larger model for the agreeableness domain including the personality assessment variable – agreeableness (PAV-A), virtual assessment – agreeableness (VAV-A) and level of immersion (i.e., LOI-PS, E, EV, NE) variables as a set, regressed on the behavioral assessment variable – agreeableness. These six predictors were found to account for 39.2% of the variance of agreeableness behavior $R^2 = .392$, $f^2 = .645$, $F_{6,32} = 3.443$, $p < .05$. This simultaneous solution also indicated that the VAV-A was the significant predictor of agreeableness behavior, $b = .326$, $\beta = .400$, $t(32) = 3.023$, $p < .05$, followed by negative effects $b = 4.435$, $\beta = .429$, $t(32) = 2.430$, $p < .05$.

**Summary of Results**

Results indicated that for the domains neuroticism, extroversion, openness, and conscientiousness, personality (personal or virtual) and level of immersion (i.e., presence)
were not predictors of the actualized behavior within the virtual space. However for the domain of agreeableness, the bivariate and two multivariate models accounted for significant levels of variance in agreeableness behavior (i.e., 23.6%, 32.0%, and 39.2% respectively). Although negative effects influenced behavior within the largest of the three models, the virtual self variable for agreeableness was consistently found across models to be the significant predictor of behavior.
CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Goffman (1959) argued that the human experience is social by nature and it appears to hold true for more than physical spaces, as there is a growing body of literature that demonstrates this principle within a virtual context (e.g., Steinkuehler, 2005; Williams, et al., 2006; Yee, et al., 2006). However, previous research has suggested that the connection with one’s avatar may also significantly impact this experience. No longer is the avatar simply a tool for manipulating the digital environment (e.g., Castle Wolfenstein, Doom), but rather it has become the digital embodiment of the individual. For example, Turkle (1997) argued that participants in these spaces are social agents defined by the physical and psychological attributes that characterize their online persona. Reid (1994) found that even text-based avatars “are much more than a few bytes of computer data—they are cyborgs, a manifestation of the self beyond the realms of the physical” (p. 69). This connection to one’s avatar has often resulted in participants becoming possessive of their likeness name (Curtis, 1992) and feeling “psychologically connected to their character, …keeping the same one for months or years” (Bessiere, et al., 2007. p.530). Yet despite these postulations and the support for identity effects, (i.e., one’s personality predicting behavioral outcomes; Digman & Takemoto-Chock, 1981; Graziano & Eisenberg, 1997; John, et al., 1994; McCrae, 1996; Watson & Clark, 1997), little is known about how this psychological connectedness to an avatar influences behavior within these spaces or to what extent it may even be possible.

Moreover, computer-mediated communications (CMC) research suggests an additional level of complexity exists due to the layer of abstraction (i.e., computer and
input device) that physically separates the participant from his or her behavior. Described as *presence*, “a psychological state in which human interaction with media and simulation technologies are experienced as actual objects in either sensory or non-sensory ways“ (e.g., deeper immersion within any mediated system leads to more naturalistic behavior) (Lee, 2004, p.27); this construct has been suggested to not only influence behavioral outcomes (Lee, 2004) but directly impact performance (Welch, 1999).

Although previous research suggested the existence of burgeoning virtual self, replete with the characteristics necessary for a substantive identity (i.e., physical and psychological attributes, feelings of connectedness both to the avatar and socio-cultural artifacts) and potentially actualized by a deepening sense of immersion in the environment, this study begins to explain the relationship between how participants perceive themselves, their avatars and the behaviors produced.

**Discussion**

By design, the massively multiplayer online game (MMOG) is largely social, offering an infinite number of interactions. In the case of the virtual environment (VE) used in this study (i.e., *War of Warcraft* [WoW]), it offers participants cities to congregate within small and large group activities, affordances for grouping (e.g., looking for group tool), and additional rewards for these activities (e.g., currencies for in-game items). Therefore, it should not come as a surprise that findings of avatar agreeableness (e.g., interpersonal tendencies related to self-interest, concern for others, and social harmony) appear to translate into this virtual space. The constraints and affordances of the VE, activities, and socio-cultural structures appear to facilitate this transition. However, based on NEO-FFI scores for agreeableness and their corresponding behavioral scores, participants appeared
to be aware of the interpersonal tendencies of their avatar and how these tendencies manifest within the VE. This suggests that behavior within this domain is not solely the product of the environment but is also influenced by the participant’s predisposition or desire for pro-social or anti-social agreeableness behaviors. For example, individual participants communicated through the questionnaires (see Appendices A and B) the need to “be nice because WoW is a social game”, “help others out”, and “be cooperative”. Alternatively, others conveyed the need to “be better than others”, “compete for loot” or “not want to handhold less experienced players” and their behavior supports these conclusions. This lends credence to earlier assumptions that role adoption is possible (Reid, 1994; Turkle, 1997). However, although personal agreeableness scores alone were not a predictor of behavior ($p=.067$), their impact on the second model ($p=.008$ with, $p=.013$ without), third model ($p=.01$ with, $p=.021$ without) and previous research (Bessiere et al., 2007), which indicates no difference between actual and virtual agreeableness scores, suggests the potential for congruence across domain applications. In other words, there is a potential direct connection between the players, their avatar, and the behavior exhibited within the environment.

Alternatively, the lack of significant findings across the other four domains (i.e., neuroticism, extroversion, openness, conscientiousness) indicate that although participants may feel psychologically connected to their avatar, the scope and the subsequent manifestation of behavior is limited. A central reason for this may be the content and purpose of the VE. Constraints and/or affordances of the system are designed to manage and facilitate behavior in order for participants to achieve internal system-related goals. Thus, unimportant content and behavior that would directly relate to facets
of personality are stripped out of the design. For example, while other VEs (e.g., Second Life) possess opportunities to show art appreciation and participate in role-play (i.e., aesthetics and fantasy respectively, which are facets of openness to experience), the main purpose of interaction within WoW is character advancement. Consequently, because much of this advancement centers on group activities (i.e., guild, group, and partnership formation), it is not surprising that the majority of observed behavior would result from and within these activities. This resulted in regular conduct related to cooperation or antagonism, rather than activities such as art appreciation.

Further, the lack of behavioral authenticity (i.e., how the system portrays behavior as opposed to its rules) may also limit the transference of personality-related behaviors. Virtual environments often possess an impoverished set of communication tools (i.e., text chat) and limited ability to express spontaneous behaviors (e.g., emotes), which forces participants to explain how they feel or what they are thinking through text. This may limit behaviors such as the expression of positive and/or negative emotions (i.e., neuroticism), social conversation (i.e., extroversion), as well as problem-solving discussion (i.e., openness). This conclusion appears to be supported by numerous occasions in which participants’ deleted complex statements rather than completing their thoughts.

Interestingly, even with the inclusion of the psychological construct presence (i.e., sense of being there; physical space, engagement, ecological validity, and negative effects) the alignment of personality and behavioral constructs was limited to the domain of agreeableness. Further, instead of seeing an alignment between a behavioral outcome and its corresponding personality score as physical space and engagement scores
increased, negative effects (i.e., feeling of disorientation, headache, dizziness or
tiredness) was shown to be the only mediating factor between avatar personality and
behavioral actualization. This raises an interesting point regarding presence as a
construct. Study findings lend credence to Lee’s (2004) reconceptualization of presence,
which suggested the mediating environment is not the critical component but rather the
interaction between oneself and a para-authentic (i.e., human controlled) or artificial (i.e.
computer controlled) object, supported by incoming stimuli, and the imagination. For this
reason, presence may be best understood in terms of its short-term and long-term impact.
The sample assessed participants who had a long-standing connection to their avatar. It is
possible that the mediating environment was the short-term factor, which lead to feelings
of presence, rather than being an ongoing factor that drives participant immersion. Over
the long-term, it appears that the presence factors (with the exception of negative effects),
which may have once helped to establish connection with the environment, now have
limited influence. Instead, it appears that the relationship between participant and avatar
(i.e., the virtual self) that has been cultivated through many hours of character
advancement and the development of social connections, has potentially taken its place.

**Implications**

As technology continues to advance, the distance between the physical world and its
virtual counterpart is closing. Participants have reported feeling a connection to their
avatar for many years (Curtis, 1992, Turkle, 1997). This may be due in part to time spent
developing a digital construct within a system that is rooted in socio-cultural constructs
(i.e., cities, grouping, guild participation). These early textual descriptions have now been
replaced with a 3-dimensional visual representation (i.e., avatar) that acts as a bridge
between the physical and virtual world, affording its user an enormous set of interactive possibilities (e.g., verbal and nonverbal communication, environmental navigation). This bridge appears to no longer be a caricature but an emerging virtual self, which may over time, manifest enough psychological characteristics of its owner to shift presence away from an environmentally based construct to a product of identity effects.

However, results of this study raise an interesting question about how to characterize such a broad term as the virtual self. It has been described (Gee, 2003) as a copy of or an extension of oneself, replete with all necessary psychological components of the physical equivalent. Yet, findings from this study suggest otherwise. Although the existence of a virtual self appears likely, it is not an equivalent persona but rather a projection of psychological characteristics (e.g., personality traits) that are necessary to work in conjunction with the content, purpose, constraints, and affordances of the environment in which the avatar exists. Therefore, it would seem prudent to limit not only how the construct is defined, but also conclude that the virtual self may differ from environment to environment based on the intended outcomes, goals, and system structures of the environment in question.

Further, the emergence of a virtual self as a psychological component of VE software has substantial implications for developers, instructional designers, and content experts. By examining the relationship between psychological characteristics (e.g., personality traits) and behavioral patterns, design and development efforts can better align the avatar’s attributes with system constraints and affordances in order to better facilitate social agency, role adoption, and personae integration. These links can be used as guidelines to develop targeted behaviors and skill sets designed to help participants reach
intended outcomes. For example, developers interested in increasing social agency within an environment might assess how design choices encourage or inhibit the transfer of psychological characteristics onto an avatar in order for participants to experience more than a superficial connection to one another.

The inclusion of psychological systems design as a component of VE development opens up numerous new applications for such spaces. Psychologists could begin to help develop and use VE to conduct scenario-based assessments and interventions. For example, scenarios that accurately represent self-interest and social harmony (i.e., agreeableness), emotional stability and adjustment (i.e., neuroticism), and/or goal directed behavior (i.e., conscientiousness) could be used to better assess people for aggressive or violent tendencies based on the actualization of behavior; or perhaps employ a more psychologically representative avatar in order to engender connection between therapist and client during virtual therapy sessions.

For educators, it would be prudent to understand how their students’ connections to a VE impacts outcomes. It has been suggested that VE provide a more authentic learning environment (Squire, 2006; Steinkuehler, 2004). However, authenticity has thus far has been defined as only activities within the environment, rather than the inclusion of the student’s connection to the environment. Yet education within these spaces is often designed around collaborative or cooperative learning models (e.g., Whyville, River City). Therefore, it would make sense to understand whether the system possesses the necessary constraints and affordances to facilitate the psychological connections needed to view group mates as individuals (e.g., doctors, journalists, investigators) working to solve a common problem rather than simple caricatures within the system. If so, lessons
can then be devised to harness these constraints and affordances to heighten motivation, strengthen the relevancy between knowledge and practice, and potentially increase learning outcomes.

With the emergence of a virtual self, it is important to begin to accounting for relevant participant predispositions when conducting research with or within a VE. Similar to an algebra equation, exclusion of potential covariates may skew outcomes. For example, is the scenario in question responsible for the sole production of aggressive behaviors or do the participant’s possesses personality traits that predispose them to aggressive behavior? This could be extended to include cognitive, cultural, language, or other characteristics that could impact outcomes.

**Limitations**

It is important to note that sample size appears to have played a role in masking effects related to two specific domains (i.e., agreeableness \(p = .067\) in Question One and openness to experience \(p = .064\) in Question Three). This limited the direct connection between the physical space and the virtual along the domain of agreeableness, as well as the observation of problem solving and normative activities found within the domain of openness to experience. Further, the psychometric properties (e.g., concurrent validity) of the scorecard employed during the analysis of video data was not fully assessed, potentially reducing the accuracy of study findings. Additional research must be conducted to assure its place in the assessment of personality.

There are several general limitations that have been identified and are important considerations for future investigations. Although the affordances of VE technologies have grown substantially from the early days of text-based MUDs, participant actions are
still limited in three key areas. First, the complexity of interaction within these environments is limited by home computing architecture. Significant increases require the scaling of both hardware and software in order to pass the additional information across networks as well as continuously redraw environmental changes. Second, the system constraints imposed by its creator(s) will always limit the actualization of participant behavior. For example, static or interactive environmental objects (e.g., buildings or doors) or animated emotes (e.g., hand waves or dancing) are limited to predefined sets deemed important or necessary by the developers and often vary by VE. Third, a user’s knowledge and experience within the system limits his or her ability to interact. For example, if one does not understand how to wave, then the behavior will not occur.

In addition to the limitations placed upon participant action within the system, it is difficult to generalize findings such as these due to the complex and contextualized nature of the individual VE. Virtual environments such as WoW and Second Life have vastly different content, context, and purpose, which likely influences the behavior produced. Further, one must remember that all interaction with any VE is mediated. Whether one is participating in true virtual reality, a massively multiplayer role-playing game (MMO), or a MUD, the interaction takes place through using keyboard and mouse, goggles and gloves, or any combination of input devices. As such, participant interaction with the environment is only as fluid as the input devices will allow. Research suggests that presence or the level of immersion into a VE through these input devices plays a significant role in the level of behavior produced (Welch, 1999). However, the measures of presence that currently exist may not represent the construct in its entirety (i.e., short-
term and long-term), have been limited to self-report, and do not incorporate physiological and behavioral measures (Lee, 2004).

**Future Research**

Outcomes from this study raise numerous questions for future consideration. This research explored potential linkages between personality and actualized behavior within the virtual environment, *World of Warcraft*. Additionally, presence factors were introduced to assess their impact on these behaviors. Although statistically significant results were found, these and other potential findings, as well as the limitations raised, indicate there are many questions yet to be answered. As a result, the following suggestions can be made regarding future investigations.

1. Replication of the study employing a larger sample size. This would provide the necessary statistical power needed to assess for linkages between the physical and virtual world along the domain agreeableness and explore the full impact of openness to experience on this VE.

2. Explore potential linkages between personality and actualized behavior within other environments, including real-world environments (i.e. classrooms), other MMOGs (e.g., *Everquest II*) and multi-user virtual environments (e.g., *Second Life*). Similarities and differences in virtual self structures could be accounted for as well as how content, purpose, constraints, and affordances impact its formation across types of VE.

3. Research should be conducted into how system proficiency levels, differences in input devices and software rendering impact the development of a virtual self.
4. Examine whether a relationship between presence and the psychological connection to one’s avatar exists and how these factors impact behavior over time. Specifically, is presence directly supplanted by this psychological connection or does this connection need inclusion into the overall construct of presence.

Results from this study indicate that participant behavior within the World of Warcraft is not just a product of the virtual environment. Rather, participants were aware of the interpersonal tendencies attributed to their avatar and how these tendencies manifested in the form of pro-social or anti-social agreeableness behaviors (e.g., interpersonal tendencies related to self-interest, concern for others, and social harmony). It appears that only physiological issues (e.g., eye strain, tiredness, or dizziness) impacted the actualization of these behaviors and the current understating of presence as an environmentally based construct may need to be updated to include variables related to identity effects. This also suggests that the relationship among relevant psychological characteristics (e.g., personality traits) and the content, purpose, constraints, and affordances of the environment in which the avatar exists should be considered when designing, developing or exploring outcomes related to this VE. Although many questions remain, it is clear the avatar is no longer a caricature but an emerging virtual self.
APPENDIX A

INDIVIDUAL DEMOGRAPHIC SURVEY

Thank you for taking the Individual Demographic Survey. Please answer the questions in the survey as completely and honestly as you can — there are no right or wrong answers. Simply answer the questions as best you can, and please ask the survey administrator if you have any questions.

For each question please circle the ONE answer that best fits.

Your sex: Male Female

Your age (Please write in your age): __________

Race: White Black or African-American Native American or Alaska Native Asian Hispanic or Latino Native Hawaiian or Other Pacific Islander Two or More Races Other

How often do you use the Internet (the internet includes the web, email, & instant messenger)?
Never About once a month Once a week Several times a week Every day

How often do you use information exchange sites like forums, wikis or blogs?
Never About once a month Once a week Several times a week Every day

How often do you use a social networking site like MySpace or Facebook?
Never About once a month Once a week Several times a week Every day

How often do you play massively multiplayer online role-playing games like World of Warcraft?
Never About once a month Once a week Several times a week Every day

How many hours a week do you spend playing video games?
0 hrs 1 – 5 hrs 6 – 10 hrs 11 - 20 hrs 20+ hours

How would you rate your OVERALL technological abilities?
Beginner Competent Proficient Expert
Would you describe Yourself as more:
(Calm, Even-tempered and Relaxed) or (Apprehensive, Easily Annoyed, and Impulsive)
Why?

Would you describe Yourself as more:
(Outgoing, Assertive and Talkative) or (Reserved, Independent, and a Loner)
Why?

Would you describe Yourself as more:
(Willing to Explore and Curious) or (Task Oriented and Stick to Methods That Work)
Why?

Would you describe Yourself as more:
Cooperative and Helpful) or (Competitive, and Superior to Others In Your Class)
Why?

Would you describe Yourself as more:
(Organized, Directed, and Thinks Before Acting) or (Spontaneous, Casual and Lazy)
Why?

Any Additional Comments?
APPENDIX B

AVATAR DEMOGRAPHIC SURVEY

Thank you for taking the Avatar Demographic Survey. Please answer the questions in the survey as completely and honestly as you can — there are no right or wrong answers. Simply answer the questions as best you can, and please ask the survey administrator if you have any questions.

For each question please circle the ONE answer that best fits.

Your Main Character’s Sex: Male Female

Your Main Character’s Class (Please write your character’s class):
____________________________

Your Main Character’s Race (Please write your character’s race):
____________________________

Approximately how long have you played the game (IN DAYS)? _________

Approximately how long have you played Main Character (IN DAYS)? _________

Approximately how much time per week do you spend logged into the game (IN HOURS)? _________

Please rate your expertise with respect to your Main Character:
Beginner Competent Proficient Expert

Please rate your expertise with MMOGs in General:
Beginner Competent Proficient Expert

What type of game server does your Main Character reside on?
PVE PVP RP RPPVP

Why?
Overall, are you more similar or different to your Main Character?  Similar  Different

Why?

Would you describe your Main Character as more:
(Calm, Even-tempered and Relaxed)  or  (Apprehensive, Easily Annoyed, and Impulsive)

Why?

Would you describe your Main Character as more:
(Outgoing, Assertive and Talkative)  or  (Reserved, Independent, and a Loner)

Why?

Would you describe your Main Character as more:
(Willing to Explore and Curious)  or  (Task Oriented and Stick to Methods That Work)

Why?

Would you describe your Main Character as more:
(Cooperative and Helpful)  or  (Competitive, and Superior to Others in Your Class)

Why?

Would you describe your Main Character as more:
(Organized, Directed, and Thinks Before Acting)  or  (Spontaneous, Casual and Lazy)

Why?
APPENDIX C

BEHAVIORAL ASSESSMENT CATEGORIES

Note: To be included behavior must be seen by other members of the virtual community not just the participant.

[R] = Reverse

Neuroticism

1. Adjusted Behaviors (e.g., Complimenting, Positive Statement)
2. Positive Emotions (e.g., Stated or Emoted: cheering, clapping)
3. [R] Maladjusted Behaviors (e.g., Complaining, Sarcasm, Self Defacement)
4. [R] Repetitive Behaviors (e.g., jumping, camping)
5. [R] Negative Emotion (stated or emoted; e.g., swearing at someone, /rude)
6. [R] Solicitation of Recognition (e.g., ding)

Extroversion

1. Grouping
2. Leading (e.g., Assuming Role, assigning roles, assigning tasks)
3. Social Conversation (e.g., group, raid, guild or otherwise, join a special chat channel)
4. [R] Following (e.g., Accepting assigned role or task)
5. [R] Soloing
6. [R] Absence of Conversation in Social Settings

Openness

1. Exploration
2. Problem Solving (e.g., applying others ideas, asking questions, strategy or technology discussions, damage assessment)
3. Normative Activities (e.g., reporting a gold seller)
4. [R] Non exploration
5. [R] Non normative activity (e.g., condoning illegal or immoral activity)
6. [R] Close-mindedness (e.g., racist, stereotyped comments)
7. [R] Mimicry

Agreeableness

1. Altruism (e.g., coming to aid of others, asking if OK, guarding others)
2. Cooperative (e.g., sharing, need before greed)
3. [R] Antagonistic (e.g., picking fights, slapping, spitting)
4. [R] Disagreeable (e.g., making fun of, impolite, forcing opinions)
5. [R] Competitive (e.g., posting damage meters)
Conscientiousness

1. Situational Evaluation (e.g., situational assessment for best proximity pulls)
2. Preparation Activities (e.g., inventory, repairing etc…)
3. Strategy Application (includes item usage)
4. Caretaking (e.g., making sure group is ready and or together)
5. [R] Impulsivity (e.g., engaging w/o checking or thinking of consequences)
### APPENDIX D

#### EXAMPLE SCORING MATRIX

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<td>[R] Repetitive Behaviors</td>
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<td>[R] Absence of Conversation in Social Settings</td>
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multiplayer online games: Forum discourse as an indicator of literacy practices
and intellectual exchange. Paper presented at the European Association for
Research on Learning and Instruction, Amsterdam, Netherlands.


Dissertation Title: Personality, Presence, and the Virtual Self: A Five-Factor Model Approach to Behavioral Analysis within a Virtual Environment

Dissertation Committee:
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Co-Committee Chairperson, P.G. Schrader, Ph.D
Committee Member, S. Kathleen Krach, Ph. D
Graduate Faculty Representative, Andrew Hardin, Ph.D.