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UNDERSTANDING INTERACTIVE EXPERIENCES: PERCEIVED INTERACTIVITY AND PRESENCE WITH AND WITHOUT OTHER AVATARS IN THE ONLINE VIRTUAL WORLD SECOND LIFE

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ABSTRACT OF DISSERTATION

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A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Communications and Information Studies
at the University of Kentucky

By
Jennifer Lynn Robinette

Lexington, Kentucky

Director: Dr. Donald O. Case, Professor of Library & Information Science

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Interactivity research lacks consensus regarding the qualities and consequences of interactive experiences. Empirical proof is needed to substantiate the numerous interactivity theories and provide direction for new media technology developers. Specifically, there is a shortage of research on differences between user experiences of interactivity when technology enables communication versus when it does not. In addition, interactivity research is often confounded by the construct of presence.

This study's objectives included: 1) identifying qualities associated with interactive experiences; 2) disambiguating the constructs of interactivity and presence; and 3) developing a measure of perceived interactivity for VW research. The experimental design measured perceived interactivity and presence following completion of a simple task in the online Virtual World (VW) known as Second Life. It was hypothesized that both perceived interactivity and presence would be greater for subjects encountering avatars believed to be controlled by other people than for subjects encountering no other avatars in the VW. A total of 180 subjects from the University of Kentucky participated in a 2 by 4 factorial experiment. Perceived interactivity was measured by modifying McMillan and Hwang's Measure of Perceived Interactivity for the VW context.

Two essential qualities of interactive experiences were identified: Responsiveness and engagement. These qualities are characteristic of unmediated, FTF conversation, which was perceived as the most interactive communication context above technologies routinely described as interactive. Decreased responsiveness of technology at a second study venue caused significant decline in perceived interactivity, demonstrating the importance of a technology's reaction speed and control provided to the user. Significant main effects for perceived interactivity due to encountering other avatars were confounded by interaction effects due to differences in technology responsiveness. Interactivity and presence appear to be separate psychological constructs

which covary in the context of a new media experience. Implications and directions for future research are discussed.

KEYWORDS: Interactivity, Presence, Virtual World, New Media, Communication Technology

Jennifer L. Robinette

Student's Signature

April 13, 2011

Date

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DEDICATION

In memory of my brilliant, courageous friend Kisha Pruitt as well as my remarkable grandmother Verla and astute grandfather Eugene Vankovich who encouraged me to cast aside all apprehensions and pursue this long-held ambition.

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CHAPTER 1

INTRODUCTION

Our lives and relationships are increasingly maintained through mediated channels of communication, many of which are identified as interactive. Certain characteristics seem to be recognized as interactive in a variety of contexts, but what exactly are those characteristics? What are the essential qualities of an interactive experience? Scholarly answers to these questions have conflicted. Interactivity remains a concept without clear definition. It has been compared to the Supreme Court's classification of pornography: We know it when we see it (Smith, 1999). A more complete understanding of interactivity is necessary for ascertaining the capacity of communication technologies to enhance or inhibit the human experience.

1.1. Interactivity in Mediated and Unmediated Contexts

We not only recognize interactivity when we experience it, we also recognize the deficit of it. Tanjev Schultz (1999) noted: "Lack of interactivity was a concern for media critics long before the term 'interactive' became an inflated buzzword in the age of the Internet (para. 1)." Interactivity is viewed as minimized or entirely missing in traditional mass media channels. Absence of interactive qualities tends to be associated with a sense of dissatisfaction. Scholars have traced this dissatisfaction to mass media's one-way communication structure and expectations of mass media based on comparisons to face-to-face (FTF) unmediated communication.

Habermas described mass media as imposing a "don't talk back" format on audiences through its hierarchical structure (Schultz, 1999, para. 1). Early studies based on Weiner's cybernetic theory (1948) analyzed letters to newspaper editors as well as radio and television station fan mail to identify trends in audience feedback to creators of mass media content. In 1956, Horton and Wohl proposed the concept of para-social relationships mimicking FTF relationships in mediated contexts (McMillan, 2002).

According to Michael Schudson (1978), social scientists seemed to view mass media channels as interrupting "the old way of face-to-face, interpersonal conversation" rather than offering novel ways to communicate (p. 320). Schudson (1978) identified qualities of FTF conversation missing from mass communication channels, which had been linked to audience dissatisfaction due to lack of interactivity. Therefore, Schudson's conversational ideals (1978) provide a logical starting point for examining the potentially essential characteristics of interactive experiences.

FTF communication has often been regarded as "the world of rich and complicated interaction" (Schudson, 1978, p. 321). Communication channels are viewed as richer based on the breadth and depth of sensory information they are capable of transmitting. Unmediated FTF communication is considered the richest channel possible because it maximizes the number of senses involved in message reception. In addition, the real-time, two-way aspect of FTF conversation enables immediate, simultaneous, and continual feedback, as well as spontaneity, variety, and control unparalleled by any traditional medium.

1.2. The Internet and Interactivity

Introduction of a new medium usually results in enhanced understanding of both the new and the old. Within the field of communication, the Internet has been viewed as a fourth mass medium (Morris & Ogan, 1996; Rash Jr., 1996; Webster & Lin, 2002). However, mass media outlets seemed forced into unfamiliar territory when faced with the prospect of utilizing the Internet's unique capabilities. Features of this new medium with potential to remedy the long-standing dissatisfaction with mass communication channels involved divergence from mass media's one-way, hierarchical structure. Mass communication theories could not explain the Internet's most significant media effects (Beniger, 1987; Morris & Ogan, 1996).

Concepts applicable to the Internet were distinguished as new media constructs, because they addressed deficiencies of traditional mass media. Scholars began to characterize the Internet's hybrid nature as personalization of a mass medium (Beniger, 1987). However, the Internet was not originally a mass medium. It was created for the purpose of connecting individual people to one another and transferring information from one computer to another. In the beginning, the Internet was a small network in which "everyone knew everyone" (Molyneux, 2003, p. 30).

The Internet initially linked only computers at universities in the United States. The U.S. government and military then began to utilize the Internet as a communication tool (Molyneux, 2003). Tim Berners-Lee's invention of the World Wide Web provided "on-line graphics, sound, and moving pictures, rather than just text, making the Internet more versatile and more interesting to look at" (Cairncross, 1997a, p. 6). Finally, Marc Andreessen is credited with developing the last piece of the puzzle—Mosaic and then

Netscape—the first Web browser technology. Web browsers provided a user-friendly graphical interface for surfing the World Wide Web. Andreessen's Web browser made navigation from one screen of information on the World Wide Web to another as easy as pointing a cursor and clicking a mouse button "even if that second page was held on a different computer in another part of the world" (Cairncross, 1997a, p. 6).

Still, the limited availability of computers and Internet access prevented the Internet and World Wide Web from being utilized as a mass medium. "Only in 1994 did the number of commercial computers connected to the Internet overtake the number of academic computers" (Cairncross, 1997a, p. 6). The World Wide Web enabling the Internet to function as a mass communication channel then became synonymous with it. Web pages of information could be viewed by many people located across the globe at the same time. In summary, the Internet initially connected individuals for the purpose of two-way text-based mediated communication and required additional developments to facilitate more complex media and communication with mass audiences.

Thus, the Internet could also be characterized as mass media-zation of an interpersonal communication technology. It is a medium with the capacity for both mass and interpersonal communication at once. In 1997, Cairncross described pending developments for the Internet on both fronts:

> Most people on earth will eventually have access to networks that are all switched, interactive, and broadband: "switched," like the telephone, and used to contact many other subscribers; "interactive" in that, unlike broadcast TV, all ends of the network can communicate; and "broadband," with the capacity to receive TV-quality motion pictures (Cairncross, 1997b, p. 7).

A 2006 survey of IEEE Fellows showed that 80% of the 700 members constituting the world's leading technology engineers believed that computer graphics

will become so life-like within the next 20 years that it will be almost impossible to separate the real from the computer-generated (Lim & Reeves, 2009). Advancements are expected to enable technology users "to see, hear and even feel inputs and outputs more closely resembling those occurring in the real world" (Lim & Reeves, 2009, p. 52). As a result, experiences mediated through the Internet can provide greater breadth and depth of real-time sensory information than any medium in history. Fueled by advancements in the graphical realism and speed of computer technologies, Internet applications seem to be continually evolving toward mediated experiences analogous to unmediated FTF communication.

1.3. Rationale for the Current Study

Although scholars have speculated that technology enabling communication may provide more interactive experiences than technology involving only media, studies empirically establishing differences among these experiences are lacking. The current study is aimed at filling this gap in the research. Interactivity seems to be an experience which varies to the extent that its associated properties are present and based on the degree of force with which they are present in different communication contexts (Walther, 1996). The Internet has been fertile ground for interactivity, and the dynamic between the two has garnered substantial attention from communication researchers.

Interactivity has been depicted as an undertheorized construct and a poorly operationalized variable in communication studies (Walther et al., 2005). For example, researchers have sought to identify types of web site features that facilitate interactive experiences for users without the benefit of an empirically validated definition and model of interactivity. Interactivity researchers Erik Bucy and Sally McMillan have commented

on the persistent fractured understanding of interactivity due to lack of systematic investigations (Bucy & Tao, 2007; McMillan, 2002). The pace of technological change can swiftly render irrelevant interactivity theories based on hardware capabilities and corresponding Internet features. Bucy (2004) advocated that the focus of interactivity studies "should be user centered so that new knowledge can be built around patterns of impacts on users rather than around ever-changing hardware developments" (p. 380).

To determine differences in user experiences of an interactive technology based on the potential for communication, this study compared subjects' perceptions of their experiences with or without other avatars believed to be maneuvered by real people present in an online Virtual Environment (VE). Virtual technology has existed since the 1990s and was studied heavily at one time. Scholarly interest waned because the technology was not simple or powerful enough to be widely adopted (Muller et al., 2005). Computer graphics capabilities and speed of Internet connections in the nineties fell short of enabling realistic virtual experiences. Over the past five years, technological advancements have given rise to a resurgence of interest in Virtual Worlds (VWs). The Gartner Group estimated that 80 percent of Internet users will have experienced at least one VW by 2012 (Mandryk & Inkpen, 2004).

As a new media enabled by the Internet, today's online VWs are regarded as providing considerable interactivity. The presence of other peoples' avatars in a VE in which the user also feels present may be associated with increases in perceived interactivity. If so, medium features providing potential to communicate with others may be reasonably attributed with providing higher levels of interactivity as suggested by

numerous interactivity scholars (Ahren et al., 2000; Carey, 1989; Chung, 2007; Heeter, 2000; Kiousis, 2002; Newhagen et al., 1995; Stromer-Galley, 2004).

The objective of this study is to contribute empirical data pertaining to the factors and effects of existing interactivity theories. The increasingly prominent role of mediated communication in our lives warrants attention from researchers. Though this study is focused on the context of VWs enabled by the Internet, implications of the findings will be important to technology and website developers concerned with maximizing the potential benefits of all interactive technologies.

CHAPTER 2

THEORETICAL PERSPECTIVES AND LITERATURE REVIEW

This chapter begins with a discussion of theoretical perspectives and proceeds to describe this study's perspective on experiences with new media frequently classified as interactive. Interactivity will be distinguished from interaction before reviewing the literature on interactivity and presence. The nature and relationship of the two constructs in addition to the definitions and models employed in this study are discussed.

2.1. Theoretical Perspectives

One of the keys to productive scientific inquiry is defining the researcher's theoretical perspective along with the research goals. Fisher (1978) pointed out that when choosing a metatheoretical perspective, "You cannot make the choice on the basis that one perspective is inherently superior but rather on whether it asks the questions you wish to ask" (p. 324).

2.1.1. Systems Theory

Questions addressed by the systems perspective are useful for understanding abstract phenomena like human experiences. Systems theory accounts for the dynamics of complexity and change and more accurately reflects the interdependent nature of communication. Both Dubin (1978) and Polkinghorne (1983) advocate employing the systems perspective for communication theory and research. Systems approaches are frequently employed in studies focused on communication and information technology. All systems exist within the environment of a larger system. Changes on each level of a

system affect change on other levels of the larger system in order to maintain a state of functional equilibrium.

2.1.2. New Media Experiences

A new media experience may be viewed as a system comprised of various degrees of interactive, presence, and flow experiences. Each of these experiences is a system with its own structure, components, and function. Relationships among interactivity, presence, and flow systems may be examined to determine their effects on new media experience outcomes.

First, the goal of systems research must be clearly defined in terms of the functional role under investigation. This study's focus is on the role of interactivity in a new media experience. Then, the researcher must choose whether that role will be observed and described in relation to theoretically higher, lower, or parallel systematic processes. In this study, interactivity is measured along with presence, and parallel rather than causal relationships are explored between the two.

Boundaries determine the level of inquiry in systems studies. Where does the region of interest begin and where does it end (beginning and ending only in the sense that the system under investigation connects with other systems outside of the study's scope)? Boundary issues in the interactivity literature center on whether components producing interactive experiences should include media technology, the user, or both.

2.1.3. Interactive Media Experiences

Interactivity theorists have debated whether interactivity is a quality of the medium or the user. Typically, researchers adopt one of these theoretical perspectives. Is interactivity embodied in the qualities of medium interface features or in the user's

distinct individual perception and experience of the medium and its interface? Can certain medium qualities or interface features be counted on to consistently cultivate interactive experiences for every person each time they encounter them? Sundar (2004) discusses the locus of interactivity as an attribute of the medium rather than the user. He points out that intuitive knowledge tells us a human user cannot be characterized as interactive. While that is true, a user can be characterized as experiencing interactivity.

Media interfaces and features are commonly identified as interactive in structural studies. The assumption of this theoretical approach is that media interface features have the same effect on all users. Studies empirically establishing equality among user experiences are lacking (Tremayne, 2005). On the other hand, theories focused exclusively on user qualities and perceptions assume that the user determines interactive experiences regardless of variations in the media technology's features. Results of interactivity studies have demonstrated relative consistency among user experiences of media features (Kalyanaraman & Sundar, 2006; Kalyanaraman & Sundar, 2008; Sundar, 2000).

Users may perceive a high degree of interactivity when media structures and features considered necessary for an interactive experience are not present, as in the case of unmediated FTF communication. At the same time, users may perceive a low level of interactivity even when features considered necessary for an interactive experience are present but not utilized or utilized in an unintended way (Tremayne, 2005). Vorderer et al. (2004a) observed that interaction between the media technology and user determines whether an experience will be perceived as more or less entertaining. The same could be said of more or less interactive experiences.

Baljko and Tenhaaf (2008) describe interactive artwork as one type of new media art. Similar to the relationship which has evolved between the Internet and interactivity, they say the history of new media art began with development of computer technology in the 1970s and 1980s and has become synonymous with the history of interactivity in the arts. New media technology has likewise become synonymous with interactive technology.

Baljko and Tenhaaf's (2008) theory focuses on interactive artwork as a human-computer interaction producing "emergent, co-constructed experience" (p. 11:15). Each person's behaviors and responses are unique, yet the experience can be analyzed based on commonalities. Just as a web site or VW designer cannot guarantee interactive experiences for every person based on specific media interface features, Baljko and Tenhaaf (2008) assert that an interactive artwork designer cannot design an interactive experience for all participants because the experience of the artwork depends on the input of human interactants. "At best, a designer can design interactive media that affords certain types of interactions" (Barnes, 2008, p. 11:15). That is, media features can be created for the purpose of eliciting specific types of interactions from a technology user which will trigger media feature responses associated with the experience of interactivity.

Gibson (1979) used the concept of affordance to describe individual differences among virtual technology users in terms of the possibilities or the opportunities that the environment offers or permits. His theory of affordance suggests that perception not only serves and controls what the user can do and not do (behaviors) but also that it depends on them (van der Straaten, 2000). The virtual system offers to the user an ensemble of stimuli and each individual interprets and reacts in his or her own way as a function of his

or her own personal characteristics. A range of possible interpretations exists based on the system stimuli.

Kiousis (2002) stated: "Interactivity is both a media and psychological factor that varies across communication technologies, communication contexts, and people's perceptions" (p. 355). Neither the user's qualities and perceptions nor the technology's attributes are capable of creating interactive experiences under all circumstances or being interactive on their own. The interactivity system is incomplete if a study boundary is drawn around the technology features to the exclusion of the technology user or vice versa.

2.2. Interactivity Conceptualized

Next, the nature of interactivity is discussed in relation to the phenomena of interactions and unmediated FTF communication. Then, various conceptualizations of the construct found in the literature are detailed after reviewing the message-centered, structural, and perceptual perspectives on interactivity. Finally, this study's definition and model of interactivity is outlined based on three essential components: Sensory experiences, engagement, and responsiveness.

2.2.1. Interaction versus Interactivity

Interactivity is a complex experience beyond simple interaction. It is distinct from interaction in that interaction is directly observable, while interactivity takes place within the psychological black box as a result of individual sensory experiences. Interactions involve a chronological sequence of events which can be broken down and analyzed to determine how they are initiated, maintained, and concluded. Attempts to dissect interactivity in a similar way have produced an array of frequently conflicting

interpretations. Researchers can infer the types of interactions which result in greater or lesser degrees of interactivity based on their own experiences and learn about others' experiences through self-report and physiological measures.

2.2.2. Mediated versus Unmediated Communication Contexts

Now that the concept of interactivity has been distinguished from simple interaction, unmediated FTF communication's relationship to interactivity requires attention. One reason the term interactive came to be applied to new media technology may be because it was recognized for its responsive nature and potential to emulate unmediated communication. Schudson (1978) addressed the idea that unmediated conversation is considered the ideal fully interactive experience. Schudson's (1978) conversational ideal of interactivity includes the criteria of continuous feedback, multiple channels of information, unique and spontaneous content, and each communicator sending and receiving messages simultaneously.

> Similarly, Burgoon et al. (2001) stated that interactivity increases . . .
>
> . . . to the extent that a communication context or system affords contingent discourse, creates interdependencies and dynamically changing linkages between communicators, affords participation among all social actors, and permits immediate rather than delayed exchanges of messages (p. 505).

They describe interpersonal communication acts as ranging from highly interactive to non-interactive and the concept of interactivity as encompassing the full range of structural and experiential interactive features which systematically impact communication processes and outcomes (Burgoon et al., 2001).

Blattberg and Deighton (1991) defined interactivity based on the ability to facilitate direct communication for individuals and organizations regardless of distance or time. As a psychological construct of the user, interactive experiences range from

perceptions of least interactive to most interactive depending partly on the features of the stimulus. For example, operating a standard telephone was not a rewarding experience in and of itself until a human on the other end of the medium responded. Only in the age of new media technology has engagement with the technology itself become fulfilling on various levels, with or without a human on the other end.

Therefore, it is logical for those levels of fulfillment through engagement with technology to be evaluated in comparison to the seminal interactive experience of unmediated FTF communication. Interactive properties of media are frequently described in interpersonal communication terms. In one of the first definitions pertaining to interactive new media, Rogers refers to interactivity as "the capability of new communication systems (usually containing a computer as one component) to 'talk back' to the user, almost like an individual participating in a conversation" (Chang-Hoan & Cheon, 2005, p. 192).

2.2.3. Perspectives on Interactivity

Bucy and Tao (2007) have documented three different perspectives on interactivity in the literature: Message-centered approaches represented by Rafaeli (1988); structural approaches (based on interactive attributes or features) represented by Sundar, Kalyanaraman, and Brown (2003); and perceptual approaches based on self-reports of user perception represented by McMillan and Hwang (2002). The two approaches to interactivity with the greatest heuristic value to date are the perceptual and the structural approaches. The perceptual approach emphasizes studying interactivity as an experience of the technology user whereas the structural approach focuses on studying technology features.

The appeal of message-centered and structural approaches to the study of interactivity is that the unit of analysis is directly observable. However, is interactivity directly observable? Can we literally see interactivity in message content, medium features, or human experience? Message content, medium features, and human experiences are frequently described as interactive, but they are recognized as interactive based on their various qualities. Confusing the concept of interactivity even further, descriptions of qualities contributing to interactivity vary depending on the context in which it is studied as well as on characteristics of the population from which the sample is drawn.

The structural approach in the interactivity literature provides precedent for distinguishing among types of interactivity based on technology features. Identifying types of interactivity is unavoidable. Bucy (2004) states that "a full account of interactivity must begin with the recognition that it is a phenomenon that may occur at multiple levels" (p. 378). Heeter (2000) distinguished direct human interaction from human interaction via media and human-computer interaction. Chung (2007) recognized that medium (human-computer interaction) and human interactivity are different types of the same phenomenon: Medium interactivity enables users to exert control through the technology; and human interactivity enables users to communicate with others.

Media technology is a medium or channel enabled by some form of technology, whether print, radio, telephones, television, or the Internet for the purposes of communication, information exchange, or entertainment. Interactivity concepts detailing various dimensions based on existing medium features alone can neither be exhaustive nor elemental enough to remain robust long-term. Longitudinal studies employing the

feature-based structural perspective on interactivity will inevitably face the dilemma of having no comparison data for outmoded and newly developed interactive medium features.

The message-centered approach associated with Rafaeli has minimal heuristic value due to its parsimony in theory more than in practice and difficulty with generalization across various contexts. Can interactivity exist without a chain of messages including historical references? Today's media technology has been shown to facilitate interactive experiences without history or message-centered significance.

Both the structural and perceptual approaches have demonstrated significant heuristic value, and both are fundamental components of interactions resulting in interactive experiences. Can they be considered in the same model or research design without sacrificing the goal of parsimony? Must a researcher choose between being a structural interactivity theorist or a perceptual interactivity theorist in order to define and study interactivity in a parsimonious manner?

Bucy and Tao (2007) have developed a compelling mediated moderation model of interactivity including the process of user perception based upon interaction between the medium's technological functions and the user's qualities. However, designing a study to test Bucy and Tao's model of interactivity brings the limitations of mixed models' empirical application to realization.

If a researcher must choose between the structural and perceptual approaches to design and implement a parsimonious study of interactivity, the perceptual approach is a defensible priority. When compared to feature-based measures, perception-based measures of interactivity are reportedly better indicators of actual interactivity (Changal,

2005). Sohn and Lee (2005) assert that perceptions of interactivity are indispensable when studying interactive media effects. In a study comparing perception-based and feature-based models of interactivity, McMillan found that the perception-based model is a better predictor of media effects such as user attitudes toward websites (Wu, 2006).

2.2.4. Definition and Model of Interactivity

Hammer and Reichl (2005) noted that providing a concise definition of interactivity is surprisingly difficult. Further, they observed that approaches to the definition and study of interactivity in the literature do not lend themselves to creation of meaningful or parsimonious objective measures of the construct (Hammer & Reichl, 2005). The need for consistency and "generalizability of definitions across all situations and technologies" is a frequently acknowledged shortcoming of the interactivity literature (Johnson et al., 2006, p. 35). As a result, interactivity remains a concept with many different faces (Hammer & Reichl, 2005).

Maras (2000) described the concept of interactivity as a complex of terms, desires and ideals. Different types and degrees of interactivity have been identified. The interactivity construct has been studied as an objective, actual, feature-based concept and as a subjective, potential, perceptual concept. Interactivity has been described in terms of criteria, a prototype, a hierarchy and a continuum as well as potential or actual, unidimensional or multidimensional.

A majority of the interactivity research has used multiple dimensions to define interactive experiences. Multidimensional conceptualizations of interactivity typically adopt some dimensions previously investigated, amend or eliminate others, and add new ones. Occasionally, this practice has resulted in three-dimensional models of

interactivity. In *Computers as Theater*, Laurel (1991) defines interactivity based on three dimensions: frequency; range; and significance. McMillan and Hwang (2002) generated a perceptual model of interactivity including three dimensions: the direction of communication; user control; and time. Similarly, Liu (2003) tested a perceptual scale for assessing interactivity based on a three-dimensional model including: active control; two-way communication; and synchronicity. Wu (2006) presented a three-dimensional model including: perceived control; perceived responsiveness; and perceived personalization. Johnson et al. (2006) validated three of the four facets derived from their literature review: responsiveness; nonverbal information; and speed of response (Johnson et al., 2006).

The multidimensional approach to studying interactivity has also produced four-, five-, and six-dimensional models centered on different causal assumptions. Jensen's (1998) model based on communication patterns includes four dimensions: transmission; consultation; conversation; and registration. Ha and James's (1998) feature-based model of interactivity includes five dimensions: playfulness; connectedness; reciprocal communication; information collection; and choice. Heeter's (1989) participant-centered model includes six dimensions: complexity of choice or selectivity; user effort; system responsiveness; potential to monitor system use as a form of feedback; potential for mass or many-to-many communication; and ability to facilitate interpersonal communication between specific users or person-to-person communication. McMillan and Downes (2000) also identified six dimensions of perceived interactivity including: direction of communication; time flexibility; sense of place; level of control; responsiveness; and perceived purpose of the communication.

Responsiveness, choice, immediacy, and control are most frequently identified in the literature as dimensions of the interactivity construct. When present, these features of medium interfaces are presumed to create interactive experiences for all users. First, responsiveness is included in nearly every multidimensional model of interactivity. Responsiveness has been portrayed as the relevance of communication in response to an action (Johnson et al., 2006). Heeter (1989) employs responsiveness as her third dimension of interactivity based on Rafaeli's idea that a "degree of 'intelligence' is necessary in both the user and the medium of interaction" for responsiveness to be fostered (p. 223). Responsiveness both fosters and reflects that intelligent exchange. Furthermore, some researchers have measured responsiveness as a function of reaction speed. For a system to be considered maximally responsive, it must provide both relevant and speedy responses.

Second, the concept of choice has been identified by multiple researchers as essential for experiencing interactivity (Bordewijk & Van Kaam, 1986; Ha & James, 1998). Heeter's (1989) first dimension of interactivity is complexity of choice, because users are compelled to interact with a medium when presented with choices. Third, the element of immediacy is commonly included in the multidimensional approach. Massey and Levy (1999) define immediacy as the extent to which media users are provided "the most immediately available information" (p. 141). Immediacy involves timely provision of up-to-date relevant information. Fourth and finally, numerous multidimensional interactivity theories have maintained that the more control a person enjoys the more interactive the experience (Jaffe, 1997; Newhagen et al., 1995; Wu, 1999, 2006).

Sohn and Lee (2005) argue that the problem with multidimensional approaches to interactivity research is a tendency to neglect empirical examination of each dimension's distinctive characteristics. Rather than a problem of researchers failing to see differences underlying the dimensions, they characterize the problem with multidimensional approaches as a tendency to overlook the possibility that dimensions identified as part of the interactivity construct may be empirically distinct and heterogeneous separate constructs (Sohn & Lee, 2005). Levine (2005) maintains that there is no such thing as a multidimensional construct when each dimension is empirically discrete. In order to estimate and interpret the validity and reliability of a construct, "unidimensionality is a prerequisite" (Levine, 2005, p. 337). He advocates utilization of Confirmatory Factor Analysis for establishing internal validity of study procedures and ensuring the validity of discrete unidimensional measures.

Systems theory can reconcile opposing perspectives on the unidimensionality or multidimensionality of the interactivity construct and more precisely capture the concept's complex nature. For example, individual constructs identified as multiple dimensions of interactivity may each be distinct systems producing the components of responsiveness, choice, immediacy, and control. Relational dynamics among these components may produce varying degrees of interactive experiences. Analysis of Variance results for scale items indicate which of them reflect significant differences among experimental groups. Then, factor analyses of the significant scale items indicate which components they measure. In the final analysis, correlational tests show the strength and significance of relationships among the components of interactive experiences. An empirically valid model of interactivity can be constructed by adjusting

the system boundaries to include only the most significant, discrete, and highly correlated components.

Questions regarding the concept of interactivity fall primarily within the realm of the perceptual approach to interactivity research: Is interactivity possible without human sensory experience? Can you touch interactivity? Where is interactivity found? Interactivity is experienced by the human psyche due to a person's interpretation of sensory experiences. Can interactivity be experienced without a response from a real or artificial object or person? If there were no response, the experience would remain an observation or action rather than an interaction. Can interactivity be experienced without feeling engaged? Engagement or feeling interested and connected to someone or something could be considered a core of interactive experiences. Three elements are fundamental to this study's definition and model of interactivity: Sensory experiences, engagement, and responsiveness.

2.2.4.1. Sensory Experiences. Interactivity may be intrinsically rewarding because interactive experiences involve sensory stimulation resulting in cognitive and emotional arousal. Marshall McLuhan said "All media are extensions of some faculty, psychic or physical" (1964, p. 26). A communicator's "actions and reactions are mediated through the body" (Heeter, 2000, p. 84). Our five senses are the interface between our autonomic system and our unmediated environment. Heeter (2000) maintains that if communication technologies are involved, a communicator's "actions and reactions are mediated . . . through technology which limits or extends normal physical channels" (p. 84).

Sensory information activates our cognitive neural networks which produce emotion. Physiological indicators of emotion during interactive experiences may occur because our senses are the interface communicating information from the environment directly to our brains which interpret the data. Our interpretations activate emotions, the experience of which motivates action.

Existing evidence in cognitive science lends support to the idea that physiological changes accompanying the perception of interactivity when interacting in a mediated environment may occur because the same neurons in the human brain are activated as when experiencing FTF interaction in a non-mediated environment. The neurons involved are referred to as mirror neurons. Neuroscientists have proven that the brain has "a wide range of interpersonal mirroring mechanisms" employing mirror neurons to mentally simulate or mimic emotion and cognitive states when observing those experienced by others (Goldman, 2006, p. 132). From the telegraph to the telephone to the Internet, mediums for communication have historically been developed to extend our senses enabling us to communicate with one another regardless of distance or time.

2.2.4.2. Engagement. Engagement is the psychological state of being interested which has been associated with excitement, fun, entertainment, and enjoyment in the communication literature. To be engaged is to psychologically and emotionally connect with someone or something. The element of engagement transforms an interaction into interactivity. Liu and Shrum (2002) delineated the structural aspects of interactivity as "the hardwired opportunity of interactivity provided during an interaction" or the potential for interactivity as distinct from the experiential aspects of interactivity or perceived interactivity (p. 55).

According to Lee (2004), technology users "engage in three types of behaviors—perception, manipulation, and interaction" when experiencing mediated or simulated objects or environments (p. 33). During perception or simple observation, "users identify and interpret objects that they are experiencing." A perceptual "phenomenon involves continuous (real time) responses of the human sensory, cognitive, and affective processing systems to objects and entities in a person's environment" (Lombard & Ditton, 1997). Manipulation occurs when users are able to "make changes to objects they perceive." "When users and experienced objects mutually affect each other, the domain of user experience goes beyond the physical world and an even higher level of experience—interaction—occurs" (Lee, 2004, pp. 33-34). Likewise, Steuer (1992) defined interactivity as the degree to which users of a medium can engage in influencing the form and content of the mediated environment.

2.2.4.3. Responsiveness. As previously discussed, responsiveness is included in virtually all communication researchers' multidimensional models of interactivity. Interactivity is a two-way process in any context. In the most basic sense, interactive means mutually or reciprocally active in interdependent ways. The response is what transforms a single person's action into interaction with an object or person. Where there is interaction, there is potential for an interactive experience. Responsiveness as a quality fostering the experience of interactivity is more than a simple reaction. It is a function of characteristics of the response including relevance and speed.

For Steuer (1992), speed is the rate at which a technology user's input is assimilated into the mediated environment. He contended that response time is one of the most important characteristics of interactive media. At its peak, response time is real-

time or instantaneous alteration of the mediated environment due to user actions. Real-time technology control was also central to Zeltzer's (1992) conceptualization of interactivity. Steuer (1992) held that new media strived to reach the highest level of real-time responsiveness in order to enable mediated experiences to substitute for real-world experiences. He argued that an immediate response could make even low-resolution video games seem highly interactive. Likewise, Heeter (1992) observed that when forced to choose between responsiveness and resolution of images, VR developers choose responsiveness as the more important factor.

This study's definition of interactivity, then, is a sensory experience activating perceptions of engagement with responsive actual or virtual objects or people. In terms of media effects research, this definition focuses on the affective and cognitive effects of media. The current focus on subjective experience of the technology user should not be construed as indicating that there are no identifiable patterns or that the locus of interactivity is exclusively within the user instead of the technology. Both the user's perception and the features of the technology are critical components of an interactive experience. A technology may be designed with features intended to create interactive experiences. However, if a user is not engaged by those features, the opportunity for an interactive experience exists but interactivity cannot. Appendix A shows a diagram of this study's conceptualization of perceived interactivity. Next, the concept of presence will be explored.

2.3. Presence Conceptualized

To provide a comparison for measures of interactivity obtained in this study, subjects' perceived experience of presence will be measured. The term presence is a

shortened version of the term telepresence, the original meaning of which was a sense of being there (Minsky, 1980; Sheridan, 1992). Presence is taken for granted during unmediated perception (Steuer, 1992). The psychological experience of presence is critical to VWs. According to Slater and Wilbur (1997), the "key to understanding virtual reality in terms of human experience rather than technological hardware is the concept of presence" (p. 605).

A review of various perspectives on the construct of presence will culminate in definitions of the two types of presence included in this study's model. Four components are identified as essential to the experience of presence: Sensory experiences, realism, immersion, and involvement. First, it is important to carefully distinguish between two fundamental conceptualizations of presence—spatial presence and social presence. Explanations of the varieties of presence found in the literature have included overlapping ideas and terminology.

2.3.1. Spatial Presence

Spatial presence, also known as physical presence, is considered by some to be the nucleus of the presence concept (Hofmann et al., 2002; Lombard & Snyder-Dutch, 2001). When researchers use the term presence, they are generally referring to spatial presence, which has been explained as the perceptual illusion of non-mediation in a mediated environment (Biocca, 2001; Lee, 2004; Lombard & Ditton, 1997; Vorderer et al., 2004a). Dow et al. (2007) define presence as the psychological state, specifically the subjective feeling of being transparently connected to a media experience" (p. 1476). Presence has also been described as perceptual immersion (Lombard & Snyder-Dutch, 2001). Surround sound is an example of media technology designed to create the

experience of perceptual immersion within sound as if a viewer were located in the televised or movie scene thus providing a sense of spatial presence. The encompassing media technology (the movie screen/theater or television and speakers) fades out of the viewer's awareness (Lombard & Ditton, 1997).

We frequently create mental representations of spatial environments in which we act when we dream or imagine ourselves running through a meadow (moving through space), typing on a keyboard (manipulating an object), or talking to coworkers (interacting with others) (Biocca, 1997). During mediated interactions, spatial presence becomes a matter of technology providing realistic sensory experiences. For example, you could be running through a virtual meadow as an avatar, typing on the virtual keyboard on your iPhone or talking with your coworkers located thousands of miles away via a Skype video-call. Building upon Lombard and Ditton's definition of presence, Heeter (2000) stated: "Presence is the sensation of being spatially and temporally located within a mediated experience. The sensation may be fleeting or it may continue for a longer duration" (p. 81). Heeter's description captures the essence of spatial presence.

Spatial presence includes the original conceptualization of telepresence as the sensation of being there rather than here or the sense of being in a place other than the one in which you are currently physically located, which is sometimes referred to as the idea of presence as transportation. Sheridan specifies that presence is a sense of being in a computer-generated environment and telepresence is a sense of being in an actual remote location. However, both of Sheridan's definitions refer to the experience of transportation whether the remote location is virtual (computer-generated) or actual (real) (Schuemie et al., 2001; Sheridan, 1992, 1996).

Steuer's (1992) definition of presence is also focused on spatial presence. He defines presence as the extent to which a person feels present in the mediated environment instead of the immediate physical environment. Lombard and Snyder-Dutch (2001) define spatial presence as occurring when a person fails to accurately perceive the role of technology making it appear that his or her physical environment is different from his or her actual location. Through perceptual immersion, spatial presence provides an environment which can facilitate the experience of transportation.

For instance, an online VW user must contend with computer screens as well as objects in the immediate environment like desks and chairs, a keyboard, and a mouse. The prevalence of the immediate physical environment and diminished sensory stimulation from the mediated environment makes it more difficult to become perceptually immersed and experience spatial presence, which inhibits the online VW user's ability to feel transported into the VE. On the other hand, an immersive VW user encounters a very different environment in which their senses of sight, sound and often touch are enveloped by the media using a helmet, headphones and gloves. The prevalence of the immediate physical environment is diminished to facilitate perceptual immersion thus the experience of transportation and spatial presence in the VW.

2.3.2. Social Presence

Social presence in VWs is made possible by spatial presence. If spatial presence can be understood as a sense of being there, then social presence can be understood as a sense of being there together (Schroeder, 2006). Biocca (1997) explains that when a technology user feels as though he or she has been transported into a VW, the possibility for sensing togetherness with another occurs. Vorderer et al. (2004a) say presence is

what happens in the mind of new media users when they are transported to a fictional place and feel as if they interact with other individuals. This sense of being together may result in mental modeling during interactions in the same way people experience this phenomenon during unmediated FTF communication.

Social presence was first defined by Short, Williams, and Christie (1976) as the social richness of a medium or "the degree of salience of the other people in the interaction" (p. 65). In other words, how meaningful interactions between technology users can be within a mediated environment based on its qualities. They demonstrated that media attributed with providing a sense of social presence were associated with the human characteristics of warmth and intimacy. Media rated as "having a high degree of social presence are judged as being warm, personal, sensitive, and sociable" (Short et al., 1976, p. 66).

Lombard and Ditton (1997) asserted that "presence as social richness is related to two important concepts originally applied to nonmediated interpersonal communication: intimacy and immediacy" (para. 11). Intimacy reflects a sense of closeness and personal knowledge. Immediacy reflects a sense of accessibility fostered by the medium. Social presence, according to Heeter (2000), is based on the extent to which other living or artificial beings coexist in the environment and react to you. For example, if a VW user walks through a virtual hallway and passes no other avatars, he or she should experience no or very minimal social presence compared to if he or she passes other avatars. Furthermore, a VW user should experience a higher degree of social presence if other avatars encountered in the hallway react to him or her by nodding, waving, or moving aside.

Lee's (2004) definition of social presence is focused on VWs: Social presence is "a psychological state in which virtual (para-authentic or artificial) social actors are experienced as actual social actors in either sensory or nonsensory ways" (pp. 41-42). Para-authentic virtual social actors or avatars are those controlled by human beings whereas artificial virtual social actors or avatars are those controlled by robotic programs (2004).

The concept of social presence has been elaborated upon by theorists and researchers who have used additional terms describing the various degrees of social presence. Mutual presence was the first term applied to becoming "accessible, available, and subject to one another" within a mediated environment (Goffman, 1963, p. 22). Mutual presence has also been referred to as a sense of togetherness. It requires both participants to recognize and be impacted by one another's presence and actions in the mediated environment or VW (Durlach & Slater, 2000; Schroeder, 2006). Two commonly used terms for describing particular forms of social presence today are co-presence and connected presence.

Co-presence (a shortened version of teleco-presence) has been defined as the sensory experience of being in a place other than the one you are physically in with other people (Casanueva & Blake, 2000). Zhao's taxonomy of co-presence (2003) distinguishes between telepresence and teleco-presence based on whether the technology enables interaction between the user and the remote environment to which the user is transported by the medium. For example, webcam monitoring technology cannot provide co-presence because a user can only view the remote environment whereas a webcam

video-call involves viewing and audio conversation with another person in the remote environment.

Online VW technology goes a step beyond reality by enabling users to explore and interact with the remote VE itself by navigating avatar representations, picking things up and moving them, and so on. While still rare, remote robotic surgery is one field in which a technology user interacts with a remote actual environment. A sense of co-presence for the remote surgeon and his or her surgical team is essential for successful teamwork. The first remote robotic heart catheterization was performed by a British surgeon who was not in the operating room on April 28, 2010, at Leicester, England's Glenfield Hospital. Interactive technology providing co-presence will enable future medical professionals to perform complex, highly specialized surgeries from anywhere in the world (Saenz, 2010).

Fewer studies have been conducted on co-presence (Bailenson & Yee, 2007; Schroeder, 2002; Zhao, 2003). Thie and van Wijk (1998) found a significant relationship between the construct of presence in general and that of co-presence. Furthermore, Slater et al. (1994) found a significant positive correlation between the constructs of presence and co-presence. Requirements for establishing co-presence have varied by study but most specify that media users must be aware of others and have a sense of being in the mediated environment with them (Bailenson et al., 2005; Gerhard et al., 2004; Nowak & Biocca, 2003; Zhao, 2001, 2003).

Finally, connected presence was described by Schroeder (2006) as an intensified form of co-presence. Licoppe first introduced the term connected presence in 2004 (Schroeder, 2006). Schroeder (2006) proposed that connected presence occurs on a

continuum with shared immersive VEs as an end point. He noted that the number of new media technologies operating as VEs and connecting people daily has been steadily increasing and covered a wide range of modalities. Schroeder's goal was to develop a model applicable to a variety of new media technologies capable of providing users with a sense of spatial presence, co-presence, and eventually connected presence.

He defined shared immersive VEs as the extreme end of the continuum. These media environments require users to wear equipment which envelops almost all of their senses in the VE—their senses of sight, sound, and touch. According to Schroeder (2006), when two or more people engage in interaction from within such an environment, their relationship is purely mediated and this immersive mediation enables them to experience connected presence. His conceptualization of co-presence and connected presence captures the essence of social presence despite the limitations of current technology, thereby providing an adaptable model for future studies. He identified three subdimensions of connected presence: immersion, which he calls "the all-embracing nature of the mediation"; number of relationships mediated in this way; and time spent in mediated encounters" (Schroeder, 2006, p. 448).

Overall, it is important to differentiate between terminology referring to spatial presence and social presence as well as among the varying degrees of each type of presence. New media technologies are capable of fostering various levels of spatial and social presence depending on the technology's features and characteristics of the technology users. For instance, Ravaja et al. (2006) found that playing video games against another human being versus a computer and playing against a friend versus a stranger elicited greater spatial presence potentially due to the mediating influences of

emotions. The next section delves briefly into different perspectives in the literature on the definition, generation, and measurement of presence.

2.3.3. Perspectives on Presence

Presence researchers have predominantly studied the construct as a subjective experience which can only be quantified by the user experiencing it (Schubert et al., 2001). Schloerb distinguished subjective presence from objective presence, which he defined as the likelihood of completing a task successfully. Schloerb prioritizes ability to accomplish tasks above individual perception of presence in a VE, because objective tasks are conducive to empirical measurement (Schloerb, 1995; Schuemie et al., 2001). However, it is arguable that ability to accomplish a task reflects qualities other than a sense of presence in the technology user. Regarding the objective measure of presence as task performance, Witmer reported that "significant correlation between presence and performance were the exception rather than the rule" (Schuemie et al., 2001, p. 187).

Studies measuring presence subjectively have used questionnaires to solicit self-reports from study participants. Scales developed and tested for measuring the concept have been constructed for different types of presence in a variety of contexts. As previously established, the major types of presence identified in the literature can be divided into two categories: Spatial presence, variations of which have been referred to as personal, physical, environmental, or self- presence; and social presence, variations of which have been called mutual, connected, or co- presence. Researchers frequently coin new terms to delineate the often subtle differences in the way presence manifests in different contexts. Terms such as mediated presence and virtual presence have been used

by researchers to differentiate scales developed for measuring presence in VWs versus non-virtual mediated environments.

Lee (2004) points out that a number of previous typologies of presence are problematic because their classifications are not mutually exclusive. For example, Lombard and Ditton's (1997) widely cited six presence factors include: Subjective or objective social richness; perceptual or social realism; transportation of self, place, or other selves; perceptual or psychological immersion; social interaction with an entity within a medium; and social interaction with the medium itself. There is significant overlap among their concepts of social richness, social realism, and social interaction with and within the medium as well as between perceptual immersion and transportation. IJsselsteijn et al. (2000) argue that physical and social presence can encompass all six of Lombard and Ditton's (1997) conceptualizations.

Heeter's (1992) types of presence include personal, environmental, and social presence. She introduced the concept of environmental presence to describe the extent to which a VE acknowledges and reacts to a user (Schuemie et al., 2001). Reactions of the mediated environment—essentially media qualities, characteristics or features—can be viewed as contributing to personal or spatial presence.

Whether two, three, or six different types are identified, presence is usually considered a subjective experience and almost exclusively viewed as a multi-dimensional construct reflecting underlying, inter-related perceptual factors (Kalawsky, 2000; Schuemie et al., 2001). Of course, theories differ about exactly what these converging psychological factors are that result in a perceived sense of presence. Areas of agreement

in the literature provide the most solid ground for developing a testable model of presence, which will be outlined in the next section.

2.3.4. Model and Definition of Two Types of Presence

Perceived presence is defined in this study as the technology user's sense of being in the VW as reflected by perceived spatial and social presence. This study's model of perceived sense of presence during a new media experience incorporates the two basic types of presence: Spatial or physical presence; and social or co-presence. Spatial presence is defined as the psychological sense of being in the VW as a result of three experiences to varying degrees: A sense of being there through self-awareness and perceived realism; a sense of immersion or being surrounded by and acting from within the VE; and a sense of involvement as captivation of one-way attention over time. Social presence is defined in this study as the technology user's psychological sense of being in the VW with others due to other-awareness and perceived realism.

The first type, spatial presence, pertains to self-presence, which according to Lee's (2004) definition "refers to a user's mental model of himself/herself or simply the awareness of self-identity inside a virtual world" (p. 42). Schubert, Friedmann, and Regenbrecht (2001) based their definition of this type of presence on Glenberg's concept of embodied cognition, describing presence as experienced when a VW user's actions include the perceived possibility of navigating and moving their own body in the VE (Schuemie et al., 2001). For this study, VW users' sense of spatial presence is fostered by embodied cognition experienced through navigation of personal avatars, the implications of which will be discussed in Chapter 3.

The second type, social presence, is the degree to which VW users are aware of others in the VE with them. A more involved form of social presence not included in this study's model would require the others' specific acknowledgement of or reaction to VW users. This study's objective is not to study the effect of social interaction on perceived presence. Rather, this study's focus is on the effect that believing other human beings are present in the VW with you has on perceived sense of presence.

Heeter discusses interaction with other social entities (human or computer-generated) within a VW, and even the simple existence of them in the VW, as contributing to the feeling of social presence. Whether the appropriate term for simple awareness of other entities in the VW constitutes social or co-presence is debatable. Bailenson et al. (2005) point out that these terms have been employed interchangeably. The four factors contributing to perceived presence as defined and measured in this study will now be explained: Sensory experiences, realism, immersion, and involvement.

2.3.4.1. Sensory Experiences. Just as with interactivity, sensory experiences are an indispensable consideration when exploring perceived sense of presence. According to Knudsen (2002), basic factors producing feelings of presence in Virtual Reality (VR) and other mediated contexts are related to the sensory environment and individual predispositions. In general, the more senses are stimulated, the higher the degree of presence (Sadowski, 1999). Presence researchers like Sheridan (1992) have considered the extent of sensory information provided by media technology a major factor contributing to presence. Slater and Usoh (1993) included quality and consistency of sensory stimulation in their factors. Witmer and Singer (1998) take the number of senses stimulated as well as the quality and consistency of sensory stimulation into account

(Schuemie et al., 2001).

Lombard and Ditton (1997) attest to the importance of continuous, real-time sensory experiences as well as to the importance of the number of senses stimulated. They report a general belief among presence researchers that the greater the number of senses a medium stimulates, the greater its capacity for producing a sense of presence. Lombard and Ditton (1997) describe new media technologies as uniquely extending human sensory capabilities in a way that is designed to seem . . .

> . . . truly 'natural,' 'immediate,' 'direct,' and 'real,' a mediated experience that seems very much like it is not mediated; a mediated experience that creates for the user a strong sense of presence (Lombard & Ditton, 1997, para. 1).

Media providing high quality, continuous stimulation of a maximum number of senses are considered richer. Steuer (1992) used the term vividness to describe a rich sensory experience provided by media technology. Vividness was one of his three dimensions determining presence. Since Steuer, rich sensory experiences have been routinely considered and linked to higher degrees of presence by researchers. The richer a sense experience, the more real a mediated experience may be perceived.

2.3.4.2. Realism. Freeman and Avon's (2000) focus group studies revealed that non-experts relate a sense of presence to realism. How realistic a mediated experience can be depends not only on sensory stimulation but also on the nature of and our ability to interact with the remote environment. A technology may be mediating a user's presence in a virtual (computer-generated) or actual (real) remote environment. Of course, remote actual environments have the greatest potential for realism depending on the quality of mediated sensory experiences and how much a technology user can interact with the remote environment rather than just observe it (Zhao, 2003). The remote robotic

heart catheterization surgery mentioned earlier in this chapter is an example of a media technology providing a high degree of realism thus sense of presence (Saenz, 2010).

Early in the lifecycle of new media, Minsky (1980) speculated whether mediated presence would ever be able to substitute for real presence: "Will we be able to couple our artificial devices naturally and comfortably to work together with the sensory mechanisms of human organisms" (p. 45)? Obviously, technology has made great strides since then toward providing a realistic sense of presence. Telecommuting has long been predicted to enable technology users to be somewhere other than their physical location and still operate in a very real way through the use of voice, video, and data available in real time without distortion and without sacrificing the quality of one over the other (Atkins et al., 1996). A sense of presence fostered by the technology's capacity for realistic, real-time, continuous sensory stimulation enables humans to perform functions from remote locations.

Lombard and Ditton (1997) identified realism as one of their six factors contributing to presence and defined realism as the extent to which a medium seems realistic on both a perceptual and social level. Perceptual realism is essentially photorealism. Does it look real? Freeman et al. (1999) proposed that increasing the size and fidelity of television and computer displays are attempts to increase the media's realism. Welch et al.'s (1996) study found a significant effect of pictorial realism on presence. According to Lombard and Ditton (1997), "Social realism is the extent to which a media portrayal is plausible or 'true to life' in that it reflects events that do or could occur in the nonmediated world" (Lombard & Ditton, 1997, para. 13). Witmer and

Singer (1998) included both the pictorial and social realism of a VE in their factors contributing to a sense of presence (Schuemie et al., 2001).

When a VW user perceives a sense of presence, Schuemie et al. (2001) observed one of the most important consequences to be that "a virtual experience can evoke the same reactions and emotions as a real experience" (p. 187). A VW is more likely to provide realistic experiences when the technology is imbued with the ability to stimulate human senses in realistic ways. For example, Hendrix and Barfield (1996) found that adding stereoscopic function to a virtual system positively influenced both the degree of perceived spatial realism and the level of presence perceived during interactions. Freeman et al. (2000) found a significant correlation between stereoscopy and presence as well.

Schubert et al.(2001) identified realism as one of three presence factors and defined it as a subject's sense of reality attributed to the VE. Efforts to increase the realism of a media seem to be aimed at replicating the sense of presence perceived during FTF interactions. Instead of asking how close interactions are to FTF interactions, Schroeder (2006) says it is now more productive to ask: How far removed are interactions from FTF interactions?

There is evidence that, in many ways, virtual experiences are not far removed from real experiences. Several studies on subjects being treated for fear of heights using virtual technology show that subjects reported increased anxiety and fear when faced with heights in a VW (Schuemie et al., 2001). Furthermore, people who fear public speaking have shown signs of fear when facing a virtual audience (North et al., 1998). A study by Slater et al. (1999) documented that people who experienced higher levels of

presence in a VW reported more negative reactions when facing a negative virtual audience and more positive reactions when facing a positive virtual audience (Schuemie et al., 2001). In other words, people's reactions to realistic VEs are similar to their reactions to real environments which inevitably include a sense of presence.

2.3.4.3. Immersion. Maximum levels of presence have been proposed to occur when the user feels immersed in the media environment (Wiederhold et al., 1998). Dow et al. (2007) define immersion as "features or qualities of the media technology that create sensory impact for the user. Media that surrounds a user (for example, consuming more of a user's visual field) is said to be more immersive" (p. 1476). A factor analysis Schubert et al.(2001) conducted for development of the Igroup Presence Questionnaire (IPQ), which incorporates items from several previously established presence scales, showed that five of the eight factors concerned with presence were related to immersion. Lombard and Ditton (1997) identified immersion as one of their six factors contributing to presence and defined it as "the extent to which the senses are engaged by the mediated environment" (Schuemie et al., 2001, p. 184). They emphasize that immersion can occur both perceptually (an objective determinant) and psychologically (a subjective determinant).

Borrowing from Biocca and Delaney (1995), Lombard and Ditton (1997) define perceptual immersion as "the degree to which a virtual environment submerges the perceptual system of the user" (p. 57). They argue that perceptual immersion can be measured objectively by counting the number of senses provided with input and the degree to which input from the immediate physical environment is minimized (Lombard & Ditton, 1997). Slater and Wilbur (1997) defined immersion objectively as a

"description of aspects of the system" but consider technological features "such as field of view and display resolution" important rather than objectively determined occupation of the human senses by the mediated versus physical environment (Schuemie et al., 2001, p. 184). Schubert et al. (2001) also regard immersion as based on objective technology features. They determined that the quality of immersion depended on a technology's richness as well as the consistency of multi-sensory experiences (Schuemie et al., 2001).

Lombard and Ditton (1997) describe psychological immersion as occurring when a technology user feels absorbed or engrossed, which can only be measured subjectively. Witmer and Singer (1998) define immersion as a subjective "psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with a VE" (Schuemie et al., 2001, p. 185). They view immersion as one of their two major aspects of presence, along with involvement (Witmer & Singer, 1998).

2.3.4.4. Involvement. Witmer and Singer (1998) define involvement as a subjective "psychological state experienced as a consequence of focusing one's attention on a coherent set of stimuli or related activities and events" (Schuemie et al., 2001, p. 185). According to Lombard and Ditton (1997), media experiences evoking a strong sense of presence tend to be highly involving, and involvement depends on media content as well as on user interests and experiences. Involvement is frequently cited in the literature as critical for experiencing presence. Freeman and Avon's (2000) focus group studies also revealed that non-experts relate a sense of presence to involvement (Schuemie et al., 2001).

Involvement is often explained as simply interest or attention, but more specifically, involvement is captivation of attention which may intensify with time.

Interest in the VW or task has been identified by Wiederhold et al. (1998) as key to the experience of presence. Vorderer et al. (2004a) attribute presence with describing what happens in the mind of new media users when their attention is captured by interesting content. A person gets more involved by focusing attention which results in a higher sense of presence. Witmer and Singer (1998) liken involvement to selective attention (Schuemie et al., 2001). Schubert et al.(2001) identified involvement as one of three presence factors and defined it as a subject's awareness devoted to the VE.

In conclusion, this study's definition of spatial presence focuses on subjects' perceived involvement, sense of being there, and immersion. Instrument items from Schubert et al.'s (2001) Igroup Presence Questionnaire (IPQ) will be used to measure spatial presence in this study. Items from the IPQ will measure: Involvement as captivation of one-way attention; transportation as subjects' sense of being there through self-awareness and perceived realism of being within the environment; and immersion as a sense of being surrounded by an environment as well as acting from within it. This study's definition of social presence is the sense of being in an environment with other people, and questionnaire items from Bailenson et al.'s (2005) co-presence instrument will be used to measure other-awareness and perceived realism of the others. Appendix B shows a diagram of perceived presence as conceptualized in this study.

2.4. The Relationship of Interactivity and Presence

Presence has frequently been linked to interactivity in the literature. For example, Stanney et al. (1998) suggested that presence may be closely related to other attributes of a mediated experience such as interactivity. Communication theorists have debated similar issues regarding both concepts, and both are associated with the same types of

new media technology. The next section discusses similarities and differences in the ways interactivity and presence have been advanced regarding mediated versus unmediated FTF communication, the definition and types of each, and construct measurement. The nature of the relationship between interactivity and presence as connected in the literature is reviewed. The relationship of interactivity and presence to the concept of flow is briefly addressed. Finally, the importance of defining the scope of study is explained before defining the scope of this specific study.

2.4.1. Mediated versus Unmediated Communication Contexts

Just as there are some researchers who advocate that the study of interactivity be confined to the world of mediation, there are researchers who advocate that the study of presence should be separated from non-mediated perception of an environment. The experience of presence seems to be rooted in unmediated communication in the same way as interactivity. The reason we recognize experiencing interactivity and presence may be that we experience both during unmediated FTF communication. However, we tend to take them for granted in the unmediated context whereas the experiences are less common, therefore more noticeable, in mediated contexts.

Interaction with an object has been theoretically explicated as occurring along a continuum from unmediated direct interaction with an object in the real world environment to indirect interaction with an object or no interaction with it due to involvement of a mediated environment. Direct interactions are generally considered to be capable of providing the most presence whereas indirect interactions face challenges to providing presence due to mediation of the experience. In the most extreme cases of mediation, we cannot interact with an object at all, which leaves us to only observe the

mediated environment. This is when presence is presumed to be the lowest (Gibson, 1966, 1979; Schneider, 2007). Schneider (2006) asserts that increased interactivity of a medium can make an object look and feel more like it does or would in the real world, which contributes to feelings of immediate interaction with the object. He reasons that users interacting with a virtual object through a highly interactive medium should experience higher degrees of presence (Schneider, 2006).

2.4.2. Definition and Types of Presence

Interactivity researchers have defined the same construct in numerous ways, while presence researchers have reached some degree of consensus regarding one type of presence—physical or spatial. On the other hand, presence researchers have defined a number of different types of social presence. Interactivity researchers are still in search of consensus over the essential nature and definition of interactivity and have not delineated different types of interactivity. Instead, interactivity is approached as occurring differently in various contexts. There is debate over whether contextual differences in the way interactivity is experienced render the construct fundamentally different thus not comparable across contexts or whether interactivity simply occurs to lesser or greater degrees of intensity in different contexts.

2.4.3. Measurement of Presence

Measures for presence and interactivity have often been based on expected results or measurement of underlying factors. Subjective measures of these two constructs are predominantly achieved through administration of questionnaires requiring self-reports from subjects. Instruments measuring interactivity are lacking compared to instruments for measuring presence. Likewise, instruments developed for measuring interactivity

across various contexts are deficient in comparison to instruments developed for measuring different types of presence.

While the majority of researchers define interactivity and presence as subjective experiences, some define interactivity and presence as objective characteristics of the technology. Presence researchers have made significant progress identifying technology features which foster a sense of presence such as higher image resolution, larger display size, color, 3D images and film, multi-channel surround sound, and audio levels ranging from normal to loud (Lombard et al., 2000). Since there is little consensus on the qualities constituting interactivity, pinpointing valid objective measures of technology characteristics cultivating it is difficult.

For instance, Klein et al. (2000) say a sense of presence in a VW can be created by visually compelling images that are refreshed quickly. They define interactivity objectively as frame rate or the speed at which computer images are refreshed. Ideally, the frame rate would be rapid and constant, which would emulate real-world visual perception. They measured interactive frame rates during the experimental task as frame refresh times and reported that frame rates between 10 and 30 frames per second have yielded interactive experiences for VW users. Image quality has been linked to presence, but how does this contribute to interactivity? Klein et al. (2000) studied non-photorealistic VEs, which eliminates realism as a factor. They described the subjects' task of walking an avatar through a virtual building as an interactive walkthrough. Tasks like this have been linked to interactivity. Their study's recorded frame rates ranged from 11 to 32 frames per second, which they concluded was adequate for creating a convincing illusion of presence in the VW (Klein et al., 2000).

2.4.4. Relationship between Interactivity and Presence

Schroeder (2006) states: "Interactivity and presence are clearly interrelated, but this relationship has not been subject to systematic research" (p. 447). According to Schuemie and van der Mast (1999), most presence authors have either assumed or argued that interactivity is a major or primary factor in presence. Ability to interact with a mediated environment or active participation, as opposed to passive observation, has been considered a reflection of interactivity. This over-simplified view of interactivity is prevalent in the presence literature. Nevertheless, Schuemie et al. (2001) say that many presence researchers view interaction as a key element and argue the merits of ". . . paying special attention to interactivity factors" (p. 194).

Presence has predominantly been viewed as the umbrella concept with interactivity as one part of the system contributing to it. It would follow that perceived interactivity must exist before perceived presence can, yet no causal relationship has been established between interactivity and presence. Schuemie et al. (2001) report finding empirical evidence in the literature that interactivity is an important factor for creating presence during their comprehensive survey of presence studies. They say ecological theories of presence focused on presence as transportation into a mediated environment place greater emphasis on the role of interaction in presence (Schuemie et al., 2001). Highly interactive conditions in these studies typically involve user actions and subsequent reactions of the mediated environment. Low interactivity conditions involve only passive user observation of the mediated environment.

One of the earliest and most influential of presence researchers who used the term interactivity to mean interaction and viewed it as contributing to the experience of

presence was Steuer (1992). He defined presence based on three dimensions—interactivity, vividness of sensory experiences, and user characteristics. He defined interactivity as the degree to which users can modify the form and content of the mediated environment (Steuer, 1992). Steuer's definition is focused on a technology user's ability to participate or interact with the medium rather than interactivity as a complex psychological experience in which active participation is only one element.

Slater and Usoh (1993) include interaction with the environment in their factors contributing to presence. Welch et al. (1996) included interactivity as a variable determining conditions capable of producing a sense of presence. In their high-presence condition, subjects drove a car while subjects were only passive observers in their low-presence condition. Their findings showed a significant positive effect for the interaction of driving a car, which was more influential than pictorial realism on the experience of presence (Welch et al., 1996).

Schubert et al. (2001) conducted an experiment based on technology users' beliefs that they were interacting with a VE. Subjects were either told that animations in a VE were independent of them or that the VE responded to their actions. They found a small but significant effect for the illusion of interaction on spatial presence but no significant effect for overall presence which incorporated social presence. Schuemie et al. (2001) frame social presence as involving a special form of interaction during which media technology users can interact with one another in the mediated environment.

Schuemie and van der Mast (1999) assert that interactivity in VWs leads to perceptions very similar to those in the real world. They attribute perceptions similar to the real world with causing a sense of presence. They also argue that not all variables of

interactivity have the same impact on presence and that the intensity of interactivity variables may only contribute to presence up to a certain threshold.

Lombard and Ditton (1997) describe high-presence media experiences as due to the media's interactive (i.e., active rather than passive) nature but acknowledge that there must be something more at work during a new media experience. "Individuals who have 'passively' viewed an IMAX film can confirm that this effect of presence is not limited to interactive media" (Lombard & Ditton, 1997, para. 113). Results of a study by Lombard et al. (2000) demonstrated that a sense of presence can exist independently of interaction. Several studies have found that the two constructs have little or no impact on each other. Schuemie and van der Mast (1999) report that studies have shown that increases in interactivity variables cause no increase in presence.

Although less common, interactivity researchers have included presence concepts in their definition of interactivity. For instance, McMillan and Downes (2000) utilized qualitative research methods to identify dimensions of interactivity and concluded that a sense of place is one of six dimensions. Their concept of a sense of place is the concept of presence, although they do not recognize it as such (Leiner & Quiring, 2008).

New media technology users may report perceived presence and interactivity but the degree to which they perceive each experience may covary. No evidence is found in the literature that increases in perceived interactivity cause decreases in perceived presence, but there is evidence that interactivity and presence may be positively related or covariants especially within new media experiences aimed at replicating FTF unmediated communication like VWs.

2.4.5. Relationship to Flow

Interactivity and presence have both been associated with Csikszentmihalyi's (1990, 1997) concept of flow. The cognitive psychological theory of flow has been applied when accounting for "the pleasure found by immersion in everyday activities" (Sherry, 2004, p. 331). Csikszentmihalyi (1990) articulated flow as providing "sense of discovery, a creative feeling of transporting the person into a new reality" (p. 74). Lessiter et al. (2001) explained flow based "a state of augmented concentration, in which the user is unaware of external distractors, the placement of self in the real world, and even real time" (p.285). Csikszentmihalyi (1997) asserts that flow is a stable and universal experience frequently occurring on some level for almost everyone regardless of culture. McMillan mentions the concept of flow in computer-mediated and VWs:

> The state of flow is generally assumed to be characterized by a state of high user activity in which the computer becomes virtually transparent as individuals 'lose themselves' in the computer environment (McMillan, 2002, p. 32).

Novak, Hoffman and Yung (1998) conceptualized flow on the Web as a cognitive state experienced during navigation that is enhanced by presence and interactivity. Hoffman and Novak (1996) say that requirements for the experience of flow include challenges, skills, and focused attention as well as interactivity and presence. The psychological states of interactivity, presence, and flow may be more accurately viewed as three systems within the same environment of the larger system constituting new media technology experiences. If a researcher is studying user experiences with new media as a whole, the study's boundary would need to encompass all three psychological constructs, because all three constructs may contribute to the phenomenon of a new media experience.

2.4.6. Scope of Study

Schroeder (2002) stated: ". . . for knowledge to make progress, we need a focused and systematic assault on specific phenomena that are delimited by clear concepts. Without these, we cannot communicate about –or build on each other's—findings" (para. 5). A systematic study begins with clearly defining the scope of study and challenges to maintaining focus on that scope. Two issues have prevented distinguishing between the constructs of interactivity and presence. First, researchers have defined and measured presence as including interactivity but no causal relationship has been empirically established. Second, when defining presence as an umbrella concept, researchers have measured qualities of the entire mediated experience and attributed all factors measured to the experience of presence. Therefore, some researchers have counted measures of elements related to interactivity as factors of presence.

Within the context of new media experiences, it has become commonplace for researchers to confound the construct of interactivity with presence. Interactivity may be a unique system with significant effects and implications. To make this determination, a study must carefully differentiate interactivity from other systems contributing to a new media experience, especially presence. Factor analyses of questionnaire items should be compared to the conceptual and operational definitions employed in the study.

For this study, social presence questionnaire items should be limited to factors indicating a sense of being there with others due to other-awareness and perceived realism. Spatial presence questionnaire items should be limited to involvement factors (as captivation of one-way attention), transportation factors (a sense of being there due to

self-awareness and perceived realism), and immersion factors (sense of being surrounded by and of acting from within the environment). Interactivity questionnaire items should be limited to engagement factors (including interest and two-way activity or interaction) and responsiveness factors (including reaction speed and sense of control). Operationalizing and measuring the concepts of involvement and engagement, in particular, need to be scrutinized to ensure no overlap occurs among items intended to measure interactivity and presence as discrete constructs.

Both interactivity and presence are critical to understanding new media experiences, especially those enabling communication. They are both qualities we experience when communicating in unmediated contexts. They are qualities which have been repeatedly noticed as missing from mass media and which we may be coming to expect from the options we have today for mediated communication with others.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter discusses the study procedures and research methods employed. First, the following sections explain the choice of Second Life for the experiment and the nature of the VE. Next, the chapter outlines the between-groups experimental design and operational definition of variables before explaining development of the post-test instrument used to measure subjects' perceived experience of interactivity and presence. Finally, the sampling and experimental procedures of the study are detailed before concluding with a brief description of the data analysis procedures used to analyze results.

3.1. Overview of the Study

This study examines new media technology users' experiences of interactivity and presence. Human experience involves sensory experience of actual or artificial objects or people. Schuemie et al. (2001) defined experience as "a person's observation of and/or interaction with objects, entities, and/or events in her or his environment" (p. 185). A virtual experience occurs when a person experiences—perceives, manipulates, or interacts with—virtual (computer-generated) objects (Lee, 2004).

3.1.1. Second Life

Second Life is an online VW where people represent themselves as avatars in order to communicate with each other through an assortment of tools which allow them to gesture, have text-based conversations, or use voice chat (Gao et al., 2008). The

quality of Second Life's 3D VE is often noted for its realism (Bardzell et al., 2008). Users' perceived possibility of navigating their body through a VW can foster virtual self-presence physically or psychologically (Slater et al., 1994).

> In the case of physical manifestation, users can see either the whole . . . or the partial . . . physical representation of themselves. In the case of a psychologically assumed virtual self, users cannot see physical representation of themselves. Instead, a virtual environment reacts to users as if they were in there [first-person viewpoint] (Lee, 2004, p. 40).

In Second Life, the virtual self is physically manifested in the form of whole embodiment as an avatar. The user's viewpoint is from behind his or her avatar while navigating through a VW, which means the physical appearance of the avatar could affect a user's psychological experience. Figure 1 in Appendix C shows an image of the subject's viewpoint in Second Life.

3.1.2. Subject Avatars

Users' identification with the whole or partial representation of themselves in a VW plays a key role in perceiving the existence of a virtual self. Weibel et al. (2008) emphasized the importance of matching study participants' gender with their avatars' to provide stronger identification, which more closely mirrors an individual's experience of VW technology beyond the lab setting. For this study, subjects were provided with an avatar matching their gender. To minimize any potential influence of ethnicity on the self-presence experienced by study participants, all avatars were designed to be as ethnically ambiguous as possible.

3.1.3. Experimental Virtual Environment

Four identical houses were constructed in a skybox above University of Kentucky (UK) Island in Second Life. The houses were designed as a maze leading directly to the

room for accessing the survey. Two houses were equipped for the Bots condition in which subjects encountered at least one of two robotic avatars (bots)—one male and one female. In the Not condition, subjects encountered no other avatars as they walked through the house. The experimental virtual space was designed to provide a visually interesting environment free of items which could hinder subject navigation of their avatars. The Bots were programmed to walk past subject avatars swiftly enough that there would be no opportunity to stop and communicate in order to foster the illusion that they were guided by a real person.

Previous studies have investigated perceptions of avatars in VEs. Guadagno et al. (2007) measured perceived behavioral realism and social presence to determine if these factors influenced an avatar's ability to persuade subjects in an immersive VE. When participants thought the avatar was being controlled by another human being and the avatar displayed high behavioral realism, more attitude change was observed. Gerhard, Moore, and Hobbs (2004) found that animated cartoon-style or humanoid avatars evoked a greater sense of presence than basic shape avatars in a collaborative VE (CVE). Lim and Reeves (2009) conducted a study in which participants played World of Warcraft. One group was told they were playing against a computer-controlled character and the other group was told they were playing against an avatar controlled by another person. In both conditions, the avatar was being controlled by a researcher who followed the same script with each participant. In post-tests, participants reported significantly greater senses of presence when they believed the avatar was controlled by a person. For the current study, it was thought that encountering avatars believed to be controlled by other people would activate perceptions of potential for communication in the VW.

3.2. Experimental Design

A 2 by 4 factorial experiment was designed in which a group of participants assigned to the control group were given a simple task to complete in the VW and the experimental group completed the same task but encountered other avatars in the VE. Self-report perceptual measures for the dependent variables of interactivity and presence immediately followed completion of the experimental task.

The objective of the task involved finding the room with an image of the first page of the online survey depicted on a virtual wall-mounted big screen. Figure 2 in Appendix C shows a photograph of the VW endpoint from the subject's point of view. When subjects found the room, they were instructed to use the mouse to click anywhere on the big screen. The image of the survey in Second Life was linked to the online version of the questionnaire assigned to one of the four virtual houses.

3.3. Operational Definition of Variables

According to McMillan and Hwang (2002), "interactivity has been positioned conceptually as a process, a function, and a perception, but most operational definitions have focused on the process or function" (p. 29). This study focuses on perception. Schuemie et al. (2001) defined perception as "a meaningful interpretation of experience" (p. 185). Schuemie and van der Mast (1999) report that ethnographic studies of interactions in multi-user VWs have shown perception and action are closely linked.

Research on perceived interactivity has typically viewed the construct as either an entirely subjective manifestation inaccessible through objective measurements or as an objective characteristic inherent in the medium interface and features. Interactive stimuli influence effects experienced through the mechanism of perceived interactivity.

Perceived interactivity arises from engagement in an interactive experience. The concept of engagement is often associated with experiencing interactivity, but has also been included in conceptualizations of presence, which mires the concepts of interactivity and presence in confusion between engagement and involvement.

Involvement is a psychological state experienced as a consequence of focusing one's attention on a coherent set of stimuli or related activities and events (Witmer & Singer, 1998). Involvement describes a state in which all perceptions, thoughts, and emotions are directed toward a particular mediated or non-mediated environment (Klimmt & Vorderer, 2003). The concept of involvement is most frequently and fittingly associated with experiencing presence, because involvement can exist without interaction. It is possible to be deeply involved when only observing media such as a 3D IMAX movie (Lombard & Ditton, 1997). Involvement has been related to how personally relevant a person finds some stimulus, particularly in advertising research (Zaichkowsky, 1986). "The involvement construct is motivating in nature. When we are involved, we pay attention, perceive importance and behave in a different manner than when we are not involved" (Zaichkowsky, 1986, p. 12).

Perceived presence is defined in this study as the technology user's perceptions of being in the VW, and the instrument items measuring this construct assess perceptions of involvement, transportation, realism and immersion. Instrument items from the Igroup Presence Questionnaire (IPQ) (Schubert et al., 2001) measure subjects' perceptions of: 1) involvement as captivation of one-way attention; 2) transportation as subjects' sense of being there through self-awareness and perceived realism of the environment; and 3) immersion as a sense of being surrounded by an environment as well as acting from

within it. Social presence is the perception of being in an environment with other people, and questionnaire items employed from Bailenson et al.'s instrument (2005) measure other-awareness and perceived realism of the other avatars. Appendix B presents this study's diagram of perceived presence.

Perceived interactivity is defined in this study as perceptions of engagement with responsive actual or virtual objects or people. The instrument items for measuring this construct assess perceptions of engagement, responsiveness, and conversational qualities. Modified questionnaire items from the Measure of Perceived Interactivity (MPI) (McMillan & Hwang, 2002) measure subjects' perceptions of: 1) engagement as interest and two-way activity; and 2) responsiveness as reaction speed and sense of control. Appendix A shows this study's diagram of perceived interactivity.

The independent variable (X) was operationalized as: Condition X_1 in which other avatars are encountered; and Condition X_2 in which no other avatars are encountered. The dependent variables (Y) were operationalized as self-reported measures of perceived interactivity (Y_i) and perceived presence (Y_p). Figure 1 below illustrates hypothesized relationships among the study variables. Two research questions and three hypotheses were addressed:

RQ1. What qualities are associated with a technology perceived as interactive?

RQ2. What communication context is perceived as most interactive?

H1. Subjects will report greater perceived interactivity when avatars believed to be controlled by other people are encountered.

H2. Subjects will report greater perceived presence when avatars believed to be controlled by other people are encountered.

H3. Perceived presence will covary with perceived interactivity.

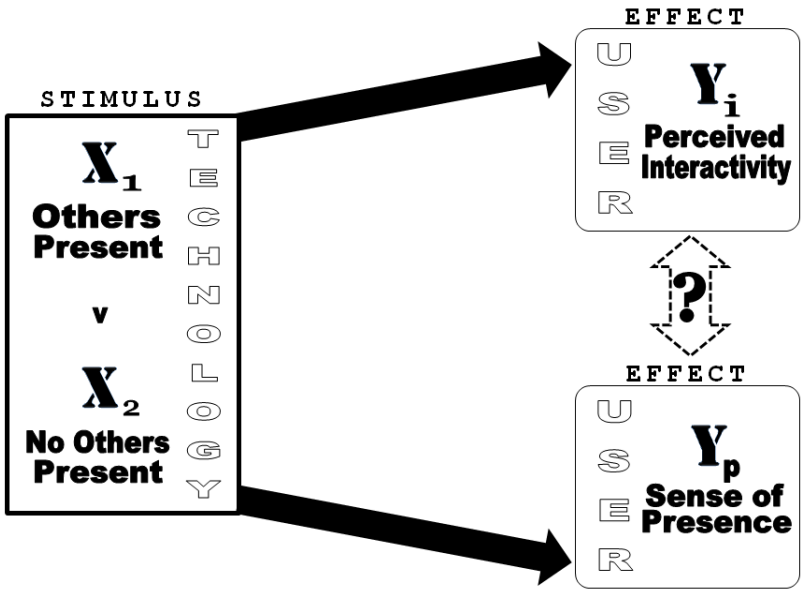


Figure 3.1. *Study Variables Diagram*

3.4. The Questionnaire

The questionnaire developed for this study incorporated items measuring perceived interactivity and perceived spatial and social presence as well as basic demographics such as gender, ethnicity and age. To determine if the concepts of interactivity and presence are distinct, a researcher must focus on the unique qualities of each construct and successful measurement of each independently. This focus enables the relationship between the two constructs to be systematically examined.

Based on their comprehensive survey of presence studies and factor analyses of study results, Schuemie et al., (2001) recommend use of valid and reliable questionnaires and the IPQ specifically. The post-experimental questionnaire was created using previously validated scales for measuring: Perceived spatial presence using Schubert, Friedmann, and Regenbrecht's (2001) Igroup Presence Questionnaire (IPQ); a sense of social presence using Bailenson et al.'s (2005) Co-Presence Questionnaire (BCPQ); and

perceived interactivity using the Measure of Perceived Interactivity (MPI) by McMillan and Hwang (2002) which was modified for the VW context (MPIVW). The IPQ and BCPQ were created for VWs.

All scales were measured using a seven-point Likert scale ranging from fully disagree (-3) to fully agree (+3) with a midpoint of zero. Four versions of the survey were created and one version was assigned to each virtual house. To reduce response bias, the polarity of answer choices as well as the primacy of the interactivity or presence scales was varied on each of the four questionnaires. Appendix E contains the Serendipity House version of the complete questionnaire with the MPIVW interactivity scale first and the positive to negative answer choice order.

3.4.1. Measuring Presence

The literature offers a multitude of objective and subjective methods used to measure presence. There are two types of objective measures used in presence research—those which measure technology characteristics and those that measure characteristics of subjects. Objective measures of technology characteristics have focused on qualities like display size, single- or multi-channel surround sound, loudness, image resolution, image content (e.g., photorealistic or non-photorealistic), and image quality reflected by speed of display response (Ijsselsteijn et al., 1998; Lombard et al., 2000). Table 1 lists the various types of subject-focused objective presence measures found in the literature including neural correlates, psychophysiological, behavioral, and task performance measures.

Table 3.1. *Subject-focused Objective Measures of Presence*

Type	Objective Measure
Neural Correlates	Electroencephalogram (Schlögl et al., 2002) Functional Magnetic Resonance Imaging (Hoffman et al., 2003)
Psychophysiological	Cardiovascular measures: Heart rate and blood pressure (Dillon et al., 2000) Skin conductance and temperature (Meehan et al., 2001) Ocular measures: Eye tracking and pupil response (Laarni et al., 2003) Facial Electromyography (Ravaja, 2002)
Behavioral	Researcher observation of: Pointing (Slater et al., 1995) Facial expression (Huang & Alessi, 1999) Postural responses (Freeman et al., 2000) Reflex responses (Nichols et al., 2000) Social responses (Bailenson et al., 2003)
Task Performance	Number of actions (Slater et al., 1996) Completion time and error rate (Basdogan et al., 2000) Secondary task performance (Nichols et al., 2000) Transfer to real-world situations (Youngblut & Perrin, 2002)

Subjective measures of presence found in the literature include: One continuous assessment measure; qualitative, psychophysical, and corroborative measures; and the commonly employed questionnaire. One continuous online subjective assessment for presence was developed using a slider button (Ijsselsteijn et al., 1998). Table 2 below lists the various types of subjective measures found in the presence literature, and Table 3 below lists questionnaires developed for measuring presence.

Table 3.2. *Various Types of Subjective Presence Measures*

Type	Subjective Measure
Qualitative	Ethnographic observation (McGreevy, 1992)
	Content analysis (Rourke et al., 1999)
	Interviews (Murray et al., 2000)
	Focus groups (Freeman & Avons, 2000)
	Think aloud procedures (Turner et al., 2003a)
	Repertory grid analysis (Steed & McDonnell, 2003)
	Interaction analysis (Spagnolli et al., 2003)
	The Experience Sampling Method (Gaggioli et al., 2003)
	Free-form self-reports (Turner et al., 2003b)
Psychophysical	Virtual Reality (VR) Turing Tests requiring subjects to discriminate between real environments and VEs (Schloerb, 1995)
	Paired comparisons which involve comparing the impact of pairs of stimuli (Welch et al., 1996)
	Cross-Modality Matching involving equal responses in different modalities (Welch, 1997)
Corroborative Measures	Subjective tilt angles (Hatada et al., 1980)
	Gravity-Referenced Eye Level tests assessing subjective estimates of spatial orientation (Nemire et al., 1994)
	Breaks in Presence (Slater & Steed, 2000)
	Duration estimation (IJsselsteijn et al., 2001a)
	Selective attention/awareness, spatial memory, and spatial memory awareness states (Darken et al., 1999; Mania et al., 2003)

A total of 31 questionnaires have been developed for measuring the subjective sense of presence. The vast majority of them, whether measuring spatial or social presence, were created for use in some kind of VE. Kim and Biocca's (1997) questionnaire is unique because it was developed to measure sense of spatial presence for television broadcasts. Lessiter et al.'s (2001) Immersive Tendencies Sense of Presence Inventory was the first instrument to measure spatial presence across a variety of different media. Usoh et al. (2000) argue that presence questionnaires should be able to

pass a reality test, meaning that perceived presence should be higher for real world experiences than for VE experiences if the questionnaire is a valid measure of the concept of presence.

Four questionnaires were developed to measure both physical or spatial and social presence. Eighteen different questionnaires have been created to measure only spatial presence, and seven were developed for measuring only social presence. Table 3 below lists questionnaires found in the literature for measuring spatial and social presence.

Table 3.3. *Presence Questionnaires*

Type	Instrument
Both Spatial & Social Presence	Thie & van Wijk's (1998); Lombard et al.'s (2000); Schroeder et al.'s (2001); and Nowak & Biocca's (2003).
Social Presence	Short et al.'s (1976) Gunawerda & Zittle's (1997) GlobalEd Questionnaire Basdogan et al.'s (2000) Biocca, Harms, & Gregg's (2001) Networked Minds Questionnaire De Greef & Ijsselsteijn's (2001) IPO Social Presence Questionnaire Tu's (2002) Computer-Mediated-Communication Social Presence & Privacy Questionnaire Bailenson et al.'s (2005) Co-Presence Questionnaire
Spatial Presence	Johnson et al.'s (1988) Memory Characteristics Questionnaire Kennedy et al.'s (1993) Simulator Sickness Questionnaire Slater, Usoh, & Steed's (1994) Presence Questionnaire Barfield et al.'s (1995) Parent's (1998) Presence & Realism Questionnaire Witmer & Singer's (1998) Presence Questionnaire Dinh et al.'s (1999) Banos et al.'s (2000) Presence & Reality Judgment Questionnaire Krauss et al.'s (2001) Larsson et al.'s (2001) Swedish Viewer-User Presence Questionnaire Schubert, Friedmann, & Regenbrecht's (2001) Igroup Presence Questionnaire

Table 3.3. *Presence Questionnaires (continued)*

Type	Instrument
Spatial Presence	Stevens et al.'s (2002) Object Presence Questionnaire
	Vorderer et al.'s (2004b) MEC Spatial Presence Questionnaire
	Murray et al.'s (2000) Presence Questionnaire measuring presence for Immersive VEs following hearing loss
	Nichols et al.'s (2000) Presence Questionnaire focused on gaming
	Gerhard et al.'s (2001) Continuous Presence Questionnaire for Collaborative VEs

Two presence questionnaires were designed to measure para-social presence: Burgoon and Hale's (1987); and Kumar and Benbasat's (2002). Parasocial presence questionnaires measure memories of real, virtual, and imagined presence experiences, or presence in distance learning contexts. Parasocial presence reflects "strong identification with narrative and with onscreen characters" (Schroeder, 2006, p. 450). Schroeder (2006) points out that measures of parasocial presence assess imaginary identification with fictional characters rather than engagement of the senses by the mediated environment. This is consistent with Lee's view of real, virtual, or imagined objects or people. A person can perceive, manipulate, or interact with virtual or real objects or people, but the same is not possible for those which are parasocial or imagined (Lee, 2004).

One of the reasons there is confusion between interactivity and presence lies in the way the constructs have been measured. Presence questionnaires routinely contain items measuring interactivity and vice versa. Although no causal relationship has been empirically established, some instruments created for measuring presence include subscales measuring interactivity as a factor contributing to the experience of presence.

The ITC Sense of Presence Inventory (ITC-SOPI) is unique because it was the first cross-media presence questionnaire. The ITC-SOPI contains 44 items, and 13 of them measure engagement (Lessiter et al., 2001). Witmer and Singer's (1998) Presence Questionnaire (PQ) includes items that directly measure control and responsiveness—two qualities repeatedly linked to the construct of interactivity. The first two questions ask: "How much were you able to control events?"; and "How responsive was the environment to actions that you initiated (or performed)?" Presence questionnaires which include items measuring engagement or other factors of interactivity unwittingly confound the constructs of presence and interactivity, and were eliminated from consideration for measuring presence in this study. By the same token, many presence questionnaires have been developed for measuring specific types of presence in specialized contexts rendering them unsuitable for this study's purposes.

Questionnaires measuring social presence include items asking about direct interaction with a partner and perception of the partner's feelings (Basdogan et al., 2000; Gerhard et al., 2001; Nowak & Biocca, 2003; Schroeder et al., 2001), which does not fit the goals of this study. The Igroup Presence Questionnaire (IPQ) includes fourteen items focused exclusively on measuring the construct of presence in VWs. The conceptualizations on which the IPQ is based are particularly well matched with those of this study.

> We understand the *sense of presence* as the *subjective* sense of being in a virtual environment. Importantly, the sense of presence can be separated from the ability of a technology to *immerse* a user. While this immersion is a variable of the technology and can be described objectively, presence is a variable of a user's experience. Therefore, we obtain measures of the sense of presence from subjective rating scales (Schubert et al., 2001, para. 8).

Schubert et al. (2001) also looked at embodied cognition's contribution to spatial presence in VWs. The IPQ was developed from a large pool of potential questionnaire items administered during two waves of surveys amounting to almost 500 participants. The items were factor analyzed. Three subscales were identified: 5 items for spatial presence; 5 items for involvement; and 3 items for realism. In addition, one item was added which loaded on all three factors, although it loaded particularly strongly on spatial presence. This item assesses a sense of being there in general (Schubert et al., 2001).

In addition to the 14 IPQ items, subjects in this study answered a question adapted from the IPQ asking if there were other real persons in the VW besides them. If they selected "yes, and I did see them," they were presented with Bailenson et al.'s (2005) co-presence scale. The 5-item questionnaire measures social or co-presence in a way that fits this study's goals, because the items ask study participants only about their perceptions of others in the VW rather than about interaction with other avatars (Bailenson et al., 2005). Appendix E presents the complete study Questionnaire.

3.4.2. Measuring Interactivity

Interactivity researchers have developed substantially fewer instruments for measuring perceived interactivity in part because there is still no consensus on how the construct should be conceptually or operationally defined. Those who have developed a working definition of interactivity approach research of the construct from different theoretical perspectives. Message-based researchers measure the interactivity of messages through highly subjective and context-specific content analysis. Feature-based content analytic measurements are also driven by highly subjective and context-specific coding schemes. Most scales measure the number of interactive technical features

available and whether users notice or utilize them (Leiner & Quiring, 2008). Psychological approaches to interactivity research have focused on practical uses or affordances to the exclusion of physical or technical characteristics impacting perception (Leiner & Quiring, 2008). Few perceptual measures exist, and those which have been developed were created for websites to the exclusion of other new media technologies.

Interactivity is an experience taking place within the user, which is one reason why perceived interactivity is an indispensable measure. In addition, Leiner and Quiring (2008) note: "The selection and use of media depend largely on how users perceive such media. A central aspect of the 'new media' is their interactivity, but how users perceive this phenomenon has rarely been researched" (p. 127). Bucy (2004) pointed out that like attitudes, perceived interactivity can be reliably measured even though it is not physically observable. Self-report methods of investigating interactive experiences have invited skepticism due to inherent subjectivity. Perceptual measures may benefit from corroboration of objective physiological measures of emotional intensity and valence, but interactivity researchers have rarely employed them because the validity and reliability of psychophysiological methods is still being established. When measuring subjective experience is a study's goal, subjective self-report methods are appropriate and effective.

Several studies have developed scales for measuring perceived interactivity with varying focus and efficacy. All but one of these scale development studies have focused on websites. The most pertinent difference among these studies is the process through which the self-report items are developed and validated. Wu (1999) developed a scale for measuring the effects of perceived interactivity on users' attitudes toward websites by comparing subject responses to two well-established greeting card websites—Hallmark

and American Greetings. Cho and Leckenby (1999) created a perceived interactivity scale for websites which included items measuring the behavioral intentions of users (intent to bookmark and willingness to provide personal information) rather than perceptions of interactivity alone. Liu & Shrum (2002) intended to eliminate inclusion of attitudinal and behavioral intention items which could confound measurement of perceived interactivity and created a scale based on subject ratings of two fictitious websites for which researchers manipulated the degree of interactivity (Liu, 2003).

McMillan and Hwang (2002) created a perceived interactivity scale for websites using a mixed methods, multi-stage approach including qualitative preliminary studies. Subjects' quantitative ratings of two commercial websites were used to identify sites perceived as possessing different degrees of interactivity. The resulting 18-item Measure of Perceived Interactivity (MPI) is a tool for comparing subjects' attitudes toward a web site, which McMillan and Hwang found is closely related to perception of interactivity.

Leiner and Quiring (2008) attempted to develop a scale for measuring users' perceived interactivity regardless of the new media technology context. Their study focused on Internet-based website services such as weather forecasts, online news, multiplayer online games, music file sharing, online banking and shopping as well as e-mail. They introduced a new use-identified meaning research design to generate functional alternatives to these services. The resulting alternatives differed in many aspects other than level of interactivity. For example, their methods resulted in subjects comparing the act of reading a book to multi-player online games. Researchers explained this using information from ten preliminary "guided face-to-face interviews" that both activities are considered pastimes (Leiner & Quiring, 2008, p. 136).

Given that the most suitable perceived interactivity scale for this study's goals was McMillan and Hwang's (2002) which was developed for websites, measuring the perceived interactivity of a virtual experience necessitated development of a new self-report instrument. McMillan and Hwang's MPI provided a useful starting point. The MPI was developed and validated based on Churchill's (1979) paradigm for scale development. In order to create the MPI, the existing literature, in-depth interviews with 10 experts on interactivity, and focus groups were used to systematically determine words and phrases unique to interactivity. Predictive validity of the MPI was established through regression results indicating that the MPI scales are strong predictors of perceived interactivity (McMillan & Hwang, 2002). Wording of the 18 questionnaire items needed to be modified to pertain to the VW context.

Leiner and Quiring's (2008) use-identified meaning method facilitated development of language for their main study measuring aspects of perceived interactivity without directly using the term interactivity or employing terminology found only in academic literature. This helped ensure that self-report items measured perceptual constructs using terms relatable to study participants. An exploratory survey was conducted between March 31 and April 2, 2008 to gain insight for wording questionnaire items to assess subjects' interactive experiences. Appendix D presents pertinent exploratory survey results, and Appendix E contains the complete Questionnaire used in this study. Trends among respondents' impressions of interactivity supported information from the literature review. An interactive qualities rating scale was developed based on this information in an effort to verify terms the sample population associates with interactivity. In addition, subjects were asked to rate the level

of interactivity for 16 different types of potentially interactive experiences, which were initially tested in the exploratory survey.

3.5. Sampling Procedures

Recruitment of volunteers was conducted in accordance with requirements of the Institutional Review Board (IRB) and the University's Office of Research Integrity. E-mails were sent to the department listserv and thirteen classes offered incentives for participating in the study. Students in the participating courses amounted to a recruiting pool of approximately three hundred potential subjects. A website was established for the study linking to the College of Communications and Information Studies scheduling database. Students were provided information about the website and encouraged to sign up for an appointment time.

The site was connected to a database which collected pertinent information about subjects (name, gender, e-mail address, and appointment date and time) prior to their arrival at the Journalism Media Lab. This information was necessary to prepare for subjects by logging in an avatar matching their gender. Reminder e-mails were sent to participants the day before their appointment with links to the study website which also included directions to the location of the experiment. Approximately 40% ($n \approx 60$) of potential participants who signed up for an appointment did not attend their experimental session.

A total of one-hundred eighty subjects completed experiments over twelve days from February 9 to March 5, 2009: Fifty-one percent ($n = 92$) were assigned to the robotic avatars present (Bots) condition; and 49% ($n = 88$) were assigned to the no robotic avatars present (Not) condition. Approximately ninety percent of subjects were

randomly assigned to experimental groups and ten percent were assigned based on quota sampling to ensure relatively even distribution of subjects among the two experimental conditions and four virtual houses corresponding to each of the survey versions.

3.6. Experimental Procedures

When subjects reported to one of the two study venues (the Media Lab or the King Library) for their appointment, they were greeted by the researcher and directed to sign in as well as read and sign the study Consent Form. Appendix G contains the Consent Form used in this study. The researcher then logged a gender-matched avatar into the Second Life house to which a subject had been assigned. Assignment of subjects alternated between the Not and Bots condition virtual houses.

Signs posted in the bays helped ensure compliance with study procedures like wearing headphones and successful completion of the experimental task. They were purposefully created without images of avatars or people to avoid influencing subjects' responses to social presence questionnaire items. Figure 1 in Appendix F shows photographs of the signs posted in the Media Lab experimental environment. To enhance their focus on the VW, prevent distractions from phone calls, text messages, or e-mails, and inhibit perceptions of connection to the actual world as much as possible, subjects were required to leave all cell phones outside the room where they completed the experiment. Subjects were advised of this requirement on the Consent Form.

After completing the sign-in procedures, subjects were escorted to their assigned room where the avatar in their assigned house was already logged on and pointing in the desired direction. Figure 1 in Appendix C shows photographs of the VW starting point for subjects. After storing their cell phones to be stowed for safe-keeping outside their

experimental room, subjects were asked to have a seat in front of the desktop computer. The signs were used as visual aids while presenting instructions to subjects before they began the experimental task.

All subjects received the same instructions:

> Hold these headphones in your hands to be sure you do not forget to wear them. There is also a sign (pointing to the visual aid posted on the wall) to remind you. What you are going to do is use the arrow keys on the keyboard (pointing to the sign posted on the desktop computer's CPU then the computer's arrow keys themselves) to walk through this house (pointing to the VW on the computer monitor screen). This is you (pointing to the avatar on the computer screen at its starting point). This sign is your cheat sheet if you forget what to do—you can always look here (pointing to the sign). Your goal is to find this room (pointing to the image of the endpoint room on the sign). Once you find the room, you will use the mouse (pointing to the mouse) to click anywhere on the big screen (pointing to the wall-mounted virtual screen pictured in images of the endpoint room on the sign). When you do that, this message will drop down from the upper right corner (pointing to the example of the message on the sign then the location on the computer screen where the message would appear). When it does, you will see a button that says "go to page" (pointing to the example on the sign). Click on "go to page" and you will be taken to the survey. When you see "End of interview," you are done.

While presenting instructions, the researcher did not mention to subjects whether they might see other avatars in the VW for two reasons: In order to emulate a more realistic Second Life experience; and to facilitate the illusion that the avatars were being operated by other real people by not sparking any speculation prior to participation in the experimental task.

Experiments for this study required two to four rooms for subject sessions equipped with desktop computers and a broadband Internet connection. In addition, the experiment required a nearby room hidden from subject view and equipped with at least four computers and a broadband Internet connection for operating and monitoring the avatars in both of the Bots houses. Figure 2 in Appendix F shows the robotic avatars

caught in the transparent retaining wall system used for timing their release to ensure that they would walk past subject avatars. Additional transparent walls located on the first floor of the Bots houses were scripted to trigger each bot's release when subjects navigated their avatars through them. This mechanism was conceived and created by Beth Kraemer, a master builder in Second Life for UK.

The bots were programmed to drop through invisible holes in the ceiling and walk their assigned path through the downstairs and out the front door of the house, which was the only way out of the virtual house. During the first day of experiments, a few subjects turned around and followed the bots out of the house necessitating Kraemer's design of another transparent wall system programmed to let only the bots pass through them and out the front door. This system was in place by the second day of experiments.

Second Life software is particularly demanding on the graphics card, memory, and processing power of computers. The UK Journalism Department Media Lab had four video production editing bays which were ideal for this study. The desktop CPUs were equipped with powerful processors and graphics cards. Subjects viewed the VW on 22-inch computer monitors. The bays provided isolation from other people and windows which was necessary to ensure that the only stimulus subjects were responding to on the survey was their Second Life experience. Subjects also wore headphones to block all sounds but those from the VW. Figure 1 in Appendix F shows a photograph of the Media Lab experimental environment.

Due to a scheduling conflict, the final five days of experiments had to be conducted at an alternate site on campus. A location on the fifth floor of the King Library was selected because it was equipped with desktop computers and separate rooms

where subjects could be isolated from others as well as from windows with views just as they were in the Journalism Media Lab editing bays. The major difference between the two venues was capacity of the computer CPUs and size of the monitors.

Subjects participating at the King Library location (36%, $n = 65$) viewed the VW on 15-inch computer monitors. Although we upgraded them for this study, the computers in the King Library did not have graphics or processing power comparable to the Media Lab computers. At the first study venue, 56% ($n = 64$) of subjects were assigned to and completed the Bots condition of the experiment, while 44% ($n = 51$) of subjects completed the Not condition. At the second venue, 42% ($n = 27$) of subjects completed the Bots condition and 58% ($n = 38$) of subjects completed the Not condition of the experiment.

3.7. Data Analysis Procedures

Data was collected using the UK SSTARS Center's online SPSS Dimensions database and analyzed using SPSS software to run appropriate descriptive and inferential statistics. An Exploratory Factor Analysis (EFA) was used to determine which items of the MPIVW produced the most effective model of subjects' perceived interactivity in the VW context. Then, a correlational analysis was used to assess redundancy among the three scales measuring perceived interactivity (the 8-item MPIVW) and two types of presence (the IPQ for spatial presence and the BCPQ for social presence).

RQ1 was analyzed using both descriptive statistics and a one-way ANOVA to identify significant qualities of interactivity to subjects who perceived their VW experience as interactive. RQ2 was analyzed with basic descriptive statistics ranking the experiences rated most interactive by subjects. H1 and H2 were tested using one-way

ANOVA procedures to determine effects of the independent variable (IV)—the Bots or Not condition—on the dependent variables (DVs) of perceived interactivity and presence separately. Additionally, a factorial ANOVA was conducted with venue as a second IV along with experimental condition to determine main and interaction effects. For H3, a multivariate analysis of covariance (MANCOVA) was used to test for patterns of variation in the DVs of perceived interactivity and presence (as measured by both the IPQ and BCPQ) based on the study's experimental condition and two venues. All parametric tests used an alpha of 0.05 to determine statistical significance. Chapter 4 discusses the results for non-parametric and parametric tests conducted for this study.

CHAPTER 4

RESULTS

This study's experiment tested the effect of encountering other avatars in a VE on subjects' perceived experience of interactivity and presence in the VW. This chapter presents the results of that experiment, which are summarized in Table 4 below.

Table 4.1. *Experimental Results Summary*

		Result
RQ1	What qualities are associated with a technology perceived as interactive?	Responsiveness Engagement
RQ2	What communication context is perceived as most interactive?	Face-to-face
H1	Subjects will report greater perceived interactivity when avatars believed to be controlled by other people are encountered.	Not Supported
H2	Subjects will report greater perceived presence when avatars believed to be controlled by other people are encountered.	Not Supported
H3	Perceived presence will covary with perceived interactivity.	Supported

The sample and manipulation check are discussed prior to presenting results for the research questions. The next section explains the EFA conducted to identify MPIVW scale items producing the strongest model of subjects' perceived interactivity in the VW context. This section is followed by a discussion of the correlational analysis used to determine redundancy among the three scales measuring perceived interactivity and

presence in this study. Last, results of a series of statistical analyses testing the three study hypotheses are detailed.

4.1. The Sample

Subjects in the original sample (N = 180) were predominantly between the ages of 18 and 25 (n = 172, 96%). Forty-three percent of subjects were male (n = 77) and 57% were female (n = 103). Almost three-quarters (n = 129, 72%) of subjects participating in the study were Caucasian, 6% reported their race as African-American and 3% reported their race as Hispanic-American with 20% choosing other or no answer.

A small number of subjects reported having previous experience with Second Life (12%, n = 21). Of those with experience in Second Life, 57% (n = 12) were assigned to and completed the Bots condition and 43% (n = 9) were in the Not condition. Next, the manipulation check employed in the study will be described along with an analysis of the final study sample after eliminating cases based on the manipulation check, irregularities in survey completion times, and missing data.

4.2. The Manipulation Check

The experimental task was intended to be simple and quick. Subject completion times and comments indicate that this goal was accomplished. Average length of time spent completing the survey was ten minutes, twenty-four seconds (N = 147). Overall, most subjects spent a total of less than fifteen minutes participating in the experiment. Therefore, subject maturation should not be a competing explanation for the study results. Twenty subjects (12%) commented in their open-ended answers that the task was simple or easy.

Table 4.2. *Subject Comments on Ease of Experimental Task & Survey*

Questionnaire Open-Ended Item Responses
It was a simple task to do.
Very simple and easy to do.
. . . a relatively easy task.
The experiment was quick and easy to understand.
Operation of the virtual character was fairly easy. The task of walking through the house was not challenging.
. . .the study was quick . . . I'm definitely impressed with the succinctness.
I thought the questions were straight forward.
. . . It was easy to get around in.
The process of this experience went by fast.
Simple and straight forward.
The virtual world was simple and easy to get around . . . .
. . . the task was concise and not overbearing.

The experimental manipulation employed in this study was similar to that used by Weibel et al. (2008) to study differences in user perception of gaming experiences when subjects believed they were playing against a computer versus when they believed they were playing against a remotely located human being. Two questions adapted from Schubert, Friedmann, and Regenbrecht's (2001) Igroup Presence Questionnaire (IPQ) were used at different points on this study's questionnaire as a manipulation check. Following the 14 IPQ items assessing perceived spatial presence, subjects were asked if there were other real persons in the VW besides themselves. If they selected "yes, and I did see them," they were presented with Bailenson et al.'s (2001) 5 items measuring co-presence. Then, the online survey proceeded to the MPIVW's 18 items to assess

perceived interactivity, after which a second manipulation check item asked subjects whether they saw artificial characters.

Two sources provide detailed information about subjects' experiences of the experimental manipulation. First, a substantial number of subjects (n = 145, 81%) offered details about their experience on the open-ended question before the conclusion of the survey. A content analysis of subject responses shows that subjects could not determine the purpose of the study until after answering the manipulation check items.

Table 4.3. *Subject Comments Demonstrating Success of the Manipulation Check*

Questionnaire Open-Ended Item Responses
It was interesting. I didn't really understand what was going on until I read the questions.
I'm an experienced gamer . . . When I got to the second large room, I encountered what I thought to be an NPC, so I just walked right past. It didn't cross my mind until I was ready to take the survey that it could have been another character. I regret not trying to interact with it/her.
. . . I hadn't realized I would be able to interact with the others in the environment.
I felt like a detective, first in the virtual world, and then second, during the questions, trying to figure out the thesis of the research.

One graduate research methods student's review of her experience as a study participant also indicates that the experimental manipulation was successful, even with a subject who may have personal interest in the topic and knowledge of experimental methodologies:

> I set out to 'find' the 'room' that had been shown to me. . . . The 'hallway' I navigated in the virtual environment had some twists and turns, but basically it only led you toward the room – there were no options to go anywhere else. There were paintings and windows on the walls, and I could hear sounds, such as birds

> chirping. Halfway down the hall, another avatar or 'person' (a virtual man) appeared on the screen . . . .
>
> He did not stop, so I let him run past me and I continued onward. As I continued moving toward the room, I wondered if I should have stopped and investigated his presence or attempted to engage him in some sort of communication . . . .
>
> It occurred to me as I was answering the questions from the post-test/survey administered at the end (when I had found the room) that the avatar was probably being controlled by the researcher in another room, and that that had probably been my 'stimulus,' or the thing I was supposed to react to in some way. I concluded this as I answered questions relating to whether or not my interaction (if any) in the virtual environment had seemed to be with a 'real' person or simply with a computer-generated character. . . . I simply reacted to the avatar's presence without thinking . . . (Beirne, 2009).

Regardless of whom subjects thought were controlling the other avatars, the manipulation was successful if they reported perceiving that a real person was guiding them on the first manipulation check item: "Were there other real persons within the virtual environment besides you?" In the Not condition, one subject reported seeing both real and artificial characters, and therefore, that case had to be eliminated from the sample. Five subjects (3%) reported seeing only artificial characters. It is possible that the artificial character these subjects reported seeing was their own avatar based on the wording of the question: "Were there artificial characters within the virtual environment?" Since they did not perceive real others, the intended condition was not violated.

All subjects in the Bots condition who reported seeing other real people experienced the intended condition even if they reported seeing both real and artificial characters. On the other hand, subjects in the Bots condition who reported not seeing either or seeing only artificial others had to be eliminated from the final sample, because they did not experience the intended condition. Although each of the two Second Life

Bots houses contained two robotic avatars—one male and one female—programmed to walk past participants at different points, it was possible for a subject to complete the experimental task without seeing another avatar besides their own due to technical issues with the robotic avatars and Second Life. Results show that eight subjects (9%) in the Bots condition reported not seeing either real or artificial characters and seven subjects (8%) reported seeing only artificial others in the VE. Therefore, these 15 cases had to be removed from the final sample.

A second criterion for eliminating cases was irregularities in survey completion times, indicating technical trouble with the online survey system. Survey completion times ranged from 3 minutes, 53 seconds to 21 minutes, 13 seconds with the exception of three irregular cases that had to be eliminated from the final sample. The longest case was 2 hours, 20 minutes, 57 seconds on February 19 then two cases were similar to one another with completion times of 1 hour, 8 minutes, 37 seconds, which was also on February 19, and 1 hour, 5 minutes, and 4 seconds on February 9.

The third and final criterion for eliminating cases was missing data. A "no answer" option was included for every question to ensure that subjects were not forced to answer questions they did not want to answer. In addition, technical difficulties with the online survey occasionally prevented successful completion. Cases with missing data included totals of: 41 cases for the MPIVW; 9 cases for the IPQ; and 5 cases for the BCPQ.

Nine cases were eliminated from the final sample because they were missing four (22%) or more variables of the MPIVW's 18-item scale. Thirty-two (20%) cases missing one to three variables on the MPIVW were retained in the final sample. Likewise, two

cases were eliminated because they were missing three (21%) and four variables (29%) of the IPQ's 14-item scale, while seven cases missing only one variable on the IPQ were retained. Finally, only subjects in the Bots group who answered the manipulation check item asking if there were other real persons in the VE correctly completed the five BCPQ items (N = 73). Five cases were eliminated from this subset of subjects only, because they were missing one (20%) to two (40%) variables on the BCPQ 5-item scale.

Sample sizes in similar studies tend to vary depending on the complexity of the task and whether the VE is immersive or non-immersive. It is not unusual for immersive VE studies with complex tasks to have fewer than 50 subjects. Experiments involving simpler tasks and less immersive VEs tend to have between 50 and 150 subjects on average. Studies on the interactivity of websites typically include more participants than VW studies, especially when participants do not have to be in a laboratory setting and can complete the experimental task and online survey from anywhere.

Guadagno et al. (2007) reported sample sizes of 65 and 174 for two similar studies on the social influence of avatars in an immersive VE. In a study including only 27 participants, Gerhard, Moore, and Hobbs (2004) examined the effect of animated cartoon-style and humanoid versus basic shape avatars on subjects' sense of presence in a collaborative VE (CVE). Lim and Reeves (2009) conducted a study on presence in which 32 participants played World of Warcraft. Bailenson and Yee's (2007) study of virtual touch and handshake behavior on social influence in a VE was conducted with 90 participants. Compared to these studies with similar experimental tasks, sample size for the current study is sufficient for valid analysis.

Comparison of the original sample (N = 180, Bots n = 91, 50%; and Nots n = 89, 50%) to the final sample (N = 150, Bots n = 73, 49%; and Nots n = 77, 51%) showed no substantial differences in distribution of subjects between the two experimental conditions due to elimination of the 30 cases. Appendix H displays frequency tables comparing the two samples. Distribution of subjects with previous experience in Second Life also remained similar in the Bots condition for the final sample (N = 150, Bots n = 9, 6%; and Nots n = 8, 5%) as in the original sample (N = 180, Bots n = 12, 7%; and Nots n = 9, 5%). Distribution of subjects by age, gender, and ethnicity in the final sample was similar to the original sample: 96% of subjects (n = 145) were ages 18-25; 45% were male (n = 67); 55% were female (n = 83); and 73% (n = 109) were Caucasian. Independent samples t-tests verified that there were no significant differences in the final sample for the primary scales of interest (the MPIVW and IPQ) based on age, gender, race, polarity of answer choices, primacy of the interactivity or presence scale, or previous experience with Second Life. In the next section, the EFA for the MPIVW scale is discussed.

4.3. MPIVW Scale Factor Analysis

Wording of the MPIVW questionnaire was developed using McMillan and Hwang's (2002) previously validated MPI. Modifications to MPI questionnaire items involved only replacement or addition of terms applicable to the VW context. Table 1 in Appendix I presents the results of a one-way ANOVA test including each of the original 18 items of the MPIVW, and Table 2 ranks the items by mean score (MPIVW M_{MPIVW} = 3.43, SD_{MPIVW} = 0.89). The one-way ANOVA identified six of the 18 items which seem to be driving the scale's significance (p = .01). Items significant at the .01 level include:

MPIVW01-loads fast (p = .00); MPIVW08-operates at high speed (p = .00); and MPIVW13-seems like it enables delayed communication (p = .00). Items significant at the .05 level include: MPIVW02-seems like it enables 2-way communication with other people (p = .03); and MPIVW09-keeps my attention (p = .03). The highest significant mean is for item MPIVW09-keeps my attention (M = 3.94, SD = 1.68).

EFAs are frequently used to investigate the underlying structure of psychological measures containing a collection of observed variables. Liu's (2003) study on website interactivity for the purpose of scale development included a series of three experiments with 42, 87, and 80 participants respectively. The third study with 80 subjects was factor analyzed to verify the underlying structure of scale items.

An EFA of the MPIVW was an important step in the analysis of results for this study, because although based on a previously validated scale, items were modified to pertain to the VW context. Thus, an EFA was necessary to determine the reliability of the modified MPI items. Furthermore, the EFA identified two components of the interactivity construct demonstrating strong internal consistency.

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequancy index was 0.85, and 0.60 is required for valid factor analysis. Takatalo et al. (2008) conducted experiments measuring 68 subjects' sense of presence, interactivity, and the psychological experience of flow in an immersive VE. They conducted a factor analysis of the results, citing recommendations of a 5:1 subject to variable ratio (Takatalo et al., 2008). The original MPIVW contained 18 items requiring at least 90 cases. The factor analysis was conducted using this study's final sample which included 150 cases.

A principal-components factor analysis of the MPIVW, using varimax rotation, was conducted with maximum iterations for convergence set to 25. Cases with missing values were excluded pairwise. The first rotation involving all 18 MPIVW items converged in seven iterations and produced five components explaining 71% of the variance. Cronbach's alpha (0.84) showed that internal reliability for the 18-item scale was fairly strong (N = 120, 30 cases excluded) and significant (p = .00). An itemized analysis of Cronbach's alpha scores for the scale if each item were deleted first indicated that reliability of the MPIVW could be improved to 0.87 by eliminating MPIVW11 (highest factor loading = -0.76) and MPIVW13 (highest factor loading = -0.69).

Thus, the second rotation involved 16 of the MPIVW items and converged in seven iterations yielding four components which explained 68% of the variance. Cronbach's alpha (0.90) showed that internal reliability for the 16-item scale was strong (N = 125, 25 cases excluded) and significant (p = .00). However, not all of the highest item factor loadings were above the 0.60 threshold. The highest factor loading for item MPIVW14 was 0.46, which is not acceptable. In addition, the highest factor loadings for item MPIVW05 (0.54) and MPIVW07 (0.59) were below the 0.60 threshold. An itemized analysis of Cronbach's alpha scores indicated deleting each of these three items would not significantly reduce the MPIVW's reliability (Cronbach's alpha = 0.89). MPIVW03 had substantial cross-loadings for the second (0.53) and third components (0.56) and a communality of 0.63. Therefore, it remained in the model.

The third rotation involving 13 of the MPIVW items converged in seven iterations producing three components which explained 66% of the variance. Cronbach's alpha (0.88) showed that internal reliability for the 13-item scale was still strong (N = 134, 16

cases excluded) and significant (p = .00). All factor loadings were above 0.60 except for MPIVW06, for which the highest factor loading was 0.52 and communality was 0.55. Thus, MPIVW06 was eliminated from the model.

The fourth rotation involved 12 MPIVW items which converged in five iterations producing three components explaining 70% of the variance. Cronbach's alpha (0.88) showed strong (N = 135, 15 cases excluded), significant internal reliability (p = .00). All factor loadings were above 0.60 except for MPIVW15, for which the highest factor loading was 0.49 and communality was 0.37. After eliminating MPIVW15, the fifth rotation involved 11 MPIVW items converging in five iterations and yielding three components which explained 74% of the variance. Reliability for this 11-item scale was also strong (Cronbach's alpha = 0.88, N = 136, 14 cases excluded) and significant (p = .00).

Finally, an analysis of the reliability of each component subscale led to eliminating the three items comprising the third component in favor of an 8-item MPIVW proving to be the strongest model. The third subscale showed lower reliability (Cronbach's alpha = 0.82, N = 138, 12 cases excluded) which was not significant (p = .07). It included the following items pertaining to conversational communication: MPIVW02-seems to enable 2-way communication with other people; MPIVW04-seems like it enables immediate communication; and MPIVW16-seems like it enables conversation. Removal of any one of these three items would reduce the reliability of the subscale to 0.79 or below. It was attributed with explaining 21% of the variance.

The first component included four items which explained 29% of the variance. This subscale showed significant (p = .00), strong reliability (Cronbach's alpha = 0.90, N

= 147, 3 cases excluded). Removal of three of the four items (MPIVW01, MPIVW08, and MPIVW10) would reduce the reliability of the subscale to 0.87 or below, and reliability would remain the same if MPIVW17 was removed. The second component also included four items which were attributed with explaining 24% of the variance. This subscale also showed significant (p = .00) reliability (Cronbach's alpha = 0.84, N = 150, 0 cases excluded). Removal of any one of the four items (MPIVW03, MPIVW09, MPIVW12, and MPIVW18) would reduce reliability of the subscale to 0.82 or below.

The final rotation involving eight MPIVW items converged in three iterations and produced two components with four items each, which together explain 73% of the variance. The resulting 8-item MPIVW scale has a significant (p = .00), strong Cronbach's alpha score (0.89) for internal reliability (N = 147, 3 cases excluded). Elimination of any one of the eight items would reduce the reliability of the scale to 0.88 or below.

All eight items had primary loadings ranging from 0.74 to 0.89. Two items had cross-loadings of 0.30 and 0.39, but they both had strong primary loadings of 0.73 and 0.83 respectively. The factor loading matrix and communalities for subscale items are presented in Table 3 of Appendix I, and Table 4 shows Cronbach's alphas for each subscale, which indicate significant internal reliability. Descriptive statistics for the 8-item MPIVW (M = 3.63, SD = 1.32) and its Responsiveness and Engagement subscales are available in Table 5 of Appendix I. Subscale names are derived from the content of the questionnaire items and based on the literature review.

The Responsiveness subscale (M = 3.61, SD = 1.64) was statistically significant at the .01 level (p = .00) and explains 39% of the sample variance. It includes two of the

MPIVW's five significant items: MPIVW01-loads fast (p = .00); MPIVW08-operates at high speed (p = .00); MPIVW10-loads slowly; and MPIVW17-responds immediately (p = .06). The Engagement subscale (M = 3.67, SD = 1.36) was also statistically significant at the .01 level (p = .00) and explains 34% of the sample variance. It includes only one of the MPIVW's five significant items: MPIVW03-has variety (p = .27); MPIVW09-keeps my attention (p = .00); MPIVW12-lacks variety (p = .93); and MPIVW18-doesn't keep my attention (p = .44). The MPIVW appears to assess differences in the perceived interactivity of VW experiences based primarily on factors contributing to responsiveness such as speed and control experienced and keeping subjects' attention and interest via variety, thus engagement, which is consistent with numerous theories reviewed in Chapter 2.

In summary, ten of the 18 items adapted for this study from McMillan and Hwang's (2002) MPI were eliminated in favor of the strongest model for measuring perceived interactivity in the VW context. Results of the EFA indicated that two distinct and internally consistent factors underlie perceived interactivity as measured by the 8-item MPIVW. An approximately normal distribution was evident for this study's composite score data. Therefore, parametric statistical analyses could be conducted.

4.4. Correlational Analysis of the MPIVW and Presence Scales

Since one of the study objectives was to disambiguate the constructs of interactivity and presence, a correlational analysis of the MPIVW and two presence scales was conducted to test for redundancy. Results are displayed in Appendix J. For the primary scales of interest, the MPIVW and the IPQ, low significant correlation coefficients confirm that the two instruments are measuring distinct constructs, $r(148)$ =

0.38, p = .00. Low correlations were also evident for the MPIVW and BCPQ as well as the IPQ and BCPQ. However, these correlations were not statistically significant, most likely due to the small sample size of the BCPQ subset of subjects (N = 68). An analysis of results for the study's two research questions follows.

4.5. Research Questions Results

In addition to the literature reviewed in Chapter 2, results from a previously administered exploratory survey (shown in Appendix D) informed creation of two sets of items on the study questionnaire. One set of items included two groups of five questions each directly assessing subject perceptions of the VW's interactive qualities. Subjects were then asked to rate 16 different experiences for level of interactivity using the University's grade scale of "A" through "E." Results from these groups of questions on interactive qualities and experiences were used to assess the study's research questions.

4.5.1. RQ1: Qualities Associated with an Interactive Experience

The first research question asks: What qualities are associated with a technology perceived as interactive? Subjects in this study responded to ten seven-point Likert scale items about their level of agreement with various qualities characterizing their Second Life experience. One set of items was phrased "This virtual world is . . . : interesting; engaging; responsive; easy to operate; interactive; entertaining." The second set of items was phrased "While in the virtual world, I felt . . . : engaged; in control; able to choose; responded to immediately." A majority of subjects (n = 102, 68%) in the final sample (N = 150, M = 3.63, SD = 1.32) had a mean score on the 8-item MPIVW of at least 3.00 on a six-point scale, indicating that they did perceive their VW experience as having at least an average level of interactivity.

Table 1 in Appendix K shows the results of a one-way ANOVA test assessing differences for the interactive qualities items between subjects who experienced interactivity during the experiment and those who did not. Results for all interactive qualities items were statistically significant: Nine items were significant at the .01 level ($p < .00$); and one item measuring how in control subjects felt while in the VE was significant at the .001 level ($p = .001$).

Table 2 in Appendix K ranks the items by mean score. The three highest mean scores for interactive qualities were related to control: "The VW is easy to operate" ($M = 5.03$, $SD = 1.22$); ". . . I felt in control" ($M = 4.71$, $SD = 1.35$); and ". . . I felt able to choose" ($M = 4.56$, $SD = 1.36$). The fourth highest mean score was for the item "this VW is interesting" ($M = 4.52$, $SD = 1.37$) followed by the fifth highest mean score for ". . . I felt responded to immediately" ($M = 4.34$, $SD = 1.31$). Three of the top five mean scores were for the interactive qualities items phrased "While in the VW, I felt . . .," demonstrating that subjects tend to associate interactivity with a feeling. The second research question of interest asks: What communication context is perceived as most interactive?

4.5.2. RQ2: Perceived Interactivity of Communication Contexts

Two questionnaire items directly assessed subject perceptions of unmediated FTF communication. One item asked subjects to rank their experiences interacting with the researcher versus the VW. A majority of subjects ranked FTF communication with the researcher as most interactive (78%, $n = 117$) while 22% ($n = 33$) ranked their VW experience as most interactive. The experimental condition experienced did not seem to influence this result. Respondents were distributed similarly among the Not and Bots

groups. For subjects in the Not condition, 75% (n = 58) rated communication with the researcher most interactive and 25% (n = 19) rated the VW experience most interactive. Likewise, for subjects in the Bots condition, 81% (n = 59) rated communication with the researcher most interactive and 19% (n = 14) rated the VW experience most interactive.

Second, subjects were asked to assign a grade ranging from "A" for "highly interactive" to "E" for "not interactive at all" (the grade scale used at UK) to each of 16 different activities. The set of items assessing interactive experiences was created as part of the previous exploratory survey (shown in Appendix D). Results for these items in this study once again showed that FTF conversations are rated the most highly interactive experience with a substantially higher mean score than many technologies commonly labeled interactive.

Consistent with the exploratory survey results, the majority of subjects in this study rated FTF conversations "highly interactive" by assigning the experience a grade of "A" (87%, n = 130) while 9% of subjects (n = 14) assigned it a grade of "B" for "above average interactivity." Three subjects (2%) assigned FTF conversation a grade of "C" for "average" or "D" for "below average" interactivity (N = 148). Appendix L contains a table ranking all 16 interactive experience items by mean score for level of interactivity. The mean score for FTF conversations is 3.83 on a four-point scale (SD = 0.54). The activity rated second highest for interactivity is video instant-messaging (M = 2.93, SD = 1.27): 38% (n = 56) of subjects rated it "highly interactive"; 30% (n = 45) rated it an experience of "above average interactivity"; and 9% (n = 14) rated it of "average interactivity." The last section of this chapter examines results for the study's hypotheses.

4.6. Hypotheses Test Results

Each of the three hypotheses was assessed using parametric tests set at an alpha of 0.05 to determine the significance of main and interaction effects for the DVs and IVs.

4.6.1. H1: Differences in Subjects' Perceived Interactivity

An analysis of MPIVW mean scores indicated that encountering other avatars in the VE influenced perceived interactivity in the predicted direction. Scores for subjects' perceived interactivity in the Bots group (M_{Bots} = 3.91, SD_{Bots} = 1.27) were 0.54 points higher than scores for those in the Not group (M_{Not} = 3.37, SD_{Not} = 1.32). To assess whether differences between the MPIVW scores of the Bots and Not groups were significant, a one-way ANOVA test was performed. Results (shown in Table 1 of Appendix M) indicated significant differences in perceived interactivity between the two groups (F (1,148) = 6.67, p = .01, partial η^2 = 0.04). The effect of the two experimental conditions on perceived interactivity, as assessed by partial η^2, was small but statistically significant, accounting for 4% of the variance in the DV.

The MPIVW means for the two different venues indicated that a difference between the two locations influenced perceived interactivity significantly. Subject scores for perceived interactivity were considerably (1.21 points) higher for Venue 1 (M_{V1} = 4.06, SD_{V1} = 1.19) than for Venue 2 (M_{V2} = 2.85, SD_{V2} = 1.20). To assess whether this difference between the MPIVW means for the two venues was significant, a one-way ANOVA test was conducted. Results of the ANOVA (available in Table 2 of Appendix M) indicated significant differences in perceived interactivity between the two study venues (F (1,148) = 35.63, p = .00, partial η^2 = 0.19). The effect of the different venue on subjects' perceived interactivity accounted for 19% of the variance in the DV.

Since differences between both the two venues and the Bots and Not groups were significant for perceived interactivity, a factorial ANOVA test was performed to determine main and interaction effects for the experimental condition along with venue as a second IV. Mean scores were 0.61 points higher for the Bots condition at Venue 1 (n_{V1} = 54, M_{V1} = 4.33, SD_{V1} = 0.98; n_{V2} = 19, M_{V2} = 2.72, SD_{V2} = 1.29) while scores were 0.20 points lower for the Bots condition at Venue 2 (n_{V1} = 43, M_{V1} = 3.72, SD_{V1} = 1.34; n_{V2} = 34, M_{V2} = 2.92, SD_{V2} = 1.15). These differences are significant at the .05 level (p = .05). Results of a factorial ANOVA (Table 3 of Appendix M) show that there was a significant interaction effect between the two (F (1,149) = 3.81, p = .05, partial η^2 = 0.03), which accounted for 3% of the variance in perceived interactivity. Main effects were confirmed for venue (F (1,149) = 34.27, p = .00, partial η^2 = 0.19), once again accounting for 19% of the variance in the DV. However, main effects for the experimental condition were small and no longer significant (F (1,149) = 1.40, p = .31, partial η^2 = 0.01). A one-way ANOVA test controlling for the effect of venue reveals that main effects for experimental condition alone are negligent and no longer significant (F (1,146) = 0.27, p = .70, partial η^2 = 0.21).

Since the two IVs of experimental condition and venue were not correlated (r(148) = -0.19, p = .02), independent one-way ANOVAs for each venue could be conducted. Results for Venue 1 (F (1,96) = 6.71, p = .01, partial η^2 = 0.07) show that differences based on experimental condition ($n_{V1\ Bots}$ = 54, $M_{V1\ Bots}$ = 4.33, $SD_{V1\ Bots}$ = 0.98; $n_{V1\ Not}$ = 43, $M_{V1\ Not}$ = 3.72, $SD_{V1\ Not}$ = 1.34) were significant at the .01 level, accounting for 7% of the variance in perceived interactivity. Results for Venue 2 (F (1,52) = 0.32, p = .58, partial η^2 = 0.01) show that differences based on experimental

condition ($n_{V2\ Bots}$ = 19, $M_{V2\ Bots}$ = 2.72, $SD_{V2\ Bots}$ = 1.29; $n_{V2\ Not}$ = 34, $M_{V2\ Not}$ = 2.92, $SD_{V2\ Not}$ = 1.15), which were not in the predicted direction, were negligent and not significant. Table 7 below shows a comparison of MPIVW means by experimental condition and venue.

Table 4.4. *H1-MPIVW Mean Differences by Study Condition & Venue*

Condition	**Venue**	*N*	*M*	*SE*	*SD*	*V*	*Range*
Not	**Venue 1****	43	**3.72**	0.21	1.34	1.80	5.88
	Venue 2	34	2.92	0.20	1.15	1.33	4.88
	MPIVW**	77	**3.37**	0.15	1.32	1.73	5.88
Bots	**Venue 1****	54	**4.33**	0.13	0.98	0.96	4.00
	Venue 2	19	2.72	0.30	1.29	1.66	4.88
	MPIVW**	73	**3.91**	0.15	1.27	1.62	5.12
Total	**Venue 1****	97	**4.06**	0.12	1.19	1.41	5.88
	Venue 2	53	2.85	0.16	1.20	1.43	5.38
	MPIVW**	**150**	**3.63**	**0.11**	**1.32**	**1.74**	**5.88**

*NOTES: 6 = highest possible score; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

H1 predicted that subjects in the Bots condition would perceive greater interactivity than those in the Not condition. Results show that mean scores were in the predicted direction at Venue 1, and one-way ANOVA tests for both the final sample (N = 150) and Venue 1 sample (N_{V1} = 97) indicated that the results were significant at the .01 level (p = .01). However, the confounding factor of the two different study venues accounted for most of the effects on the DV in a factorial ANOVA. When results were analyzed controlling for the effect of venue on the DV of perceived interactivity, main

effects for the experimental condition were very small and no longer significant. Interaction effects between venue and the experimental condition confounded the main effects of perceived interactivity. Therefore, H1 was not supported. Significant one-way ANOVA test results for H1 are summarized in Table 8, and significant factorial ANOVA results are summarized in Table 9 below.

Table 4.5. *H1-Significant One-way ANOVA Results Summary*

Source	*M Difference*	*SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
MPIVW Not v. Bots	0.54	11.20	1,149	11.20	6.67	.01**	0.04	0.73
MPIVW V1 v. V2	-1.21	50.40	1,149	50.40	35.63	.00**	0.19	1.00
MPIVW Venue 1 Not v. Bots	0.61	8.92	1,96	8.92	6.71	.01**	0.07	0.73

Table 4.6. *H1-Significant Factorial ANOVA Results Summary*

Source	*M Difference*	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
MPIVW by V1 v. V2	-1.21	46.95	1,149	46.95	34.27	.00**	0.19	1.00
MPIVW V1 Not v. Bots	0.61	5.22	1,149	5.22	3.81	.05*	0.03	0.49
MPIVW V2 Not v. Bots	-0.20							

*NOTES: [a] Computed using alpha = 0.05; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

4.6.2. H2: Differences in Subjects' Perceived Spatial Presence

Two measures of perceived presence were employed in this study: The IPQ was used to assess perceived spatial presence in the VE; and the BCPQ was used to measure perceived social presence. For H2, the IPQ was tested for differences in perceived spatial presence based on the two experimental conditions and study venues. Since the BCPQ measured social presence and was only completed by subjects in the Bots condition, results for this subset of the final sample (N_{BCPQ} = 68) were tested for H3.

A comparison of IPQ mean scores indicated that encountering other avatars in the VE did not influence perceived spatial presence in the predicted direction. Contrary to the hypothesis, IPQ scores were 0.09 points lower for the Bots group (M_{Bots} = 2.46, SD_{Bots} = 0.89) than the Not group (M_{Not} = 2.55, SD_{Not} = 0.98). Results of a one-way ANOVA indicated that differences between the two groups were not statistically significant (F (1,148) = 0.36, p = .55, partial η^2 = 0.00). Thus, there was no main effect of experimental conditions on perceived spatial presence.

The IPQ means for the two different venues were then compared, and scores indicated that differences between the two locations did not influence perceived spatial presence significantly. With IPQ scores only 0.04 points higher at Venue 1 (M_{V1} = 2.52, SD_{V1} = 0.95) than Venue 2 (M_{V2} = 2.48, SD_{V2} = 0.92), there was little difference. One-way ANOVA test results showed that the difference was not significant (F (1,148) = 0.04, p = .84, partial η^2 = 0.00). Moreover, results of a factorial ANOVA (shown in Table 1 of Appendix N) confirm no significant interaction effects between study venue and condition for perceived spatial presence.

H2 predicted that subjects in the Bots condition would perceive greater presence than those in the Not condition. Results show that mean scores for spatial presence as measured by the IPQ were not in the predicted direction. Subjects in the Bots group reported experiencing less spatial presence than those in the Not group. However, this difference is not significant. Based on these results, H2 was not supported.

4.6.3. H3: Relationship of Perceived Interactivity and Presence

To fully analyze H3, tests must be conducted on the two study samples. Using the final sample (N = 150), results for the study's measure of spatial presence (IPQ scores) were tested for covariance with the measure of perceived interactivity (MPIVW scores). For the Bots group sample subset (N_{BCPQ} = 68), measures of both perceived spatial (IPQ scores) and social presence (BCPQ scores) were tested for covariance with perceived interactivity (MPIVW scores).

4.6.3.1. Interactivity and Social Presence. A comparison of BCPQ means for the two different venues indicated that a difference between the two locations did not have a significant effect on perceived social presence in the BCPQ sample subset. There was a small difference in perceived social presence scores for the two groups: BCPQ scores were 0.16 points lower at Venue 1 (n_{V1} = 51, M_{V1} = 2.25, SD_{V1} = 1.00) than Venue 2 (n_{V2} = 17, M_{V2} = 2.41, SD_{V2} = 1.14). Results of a one-way ANOVA indicated that the difference in perceived social presence between the two study venues was not significant (F (1,67) = 0.31, p = .58, partial η^2 = 0.01).

A one-way ANCOVA was conducted to test the covariance of perceived interactivity with social and spatial presence individually based on venue. Results showed significant covariance of perceived interactivity and spatial presence only (F

(1,67) = 4.52, *MSE* = 4.74, p = .04, partial η^2 = 0.07). Then, a one-way MANCOVA was performed to test for covariance of both social and spatial presence with perceived interactivity due to study venue. Results once again showed significant covariance of spatial presence only (*F* (1,67) = 5.59, *MSE* = 3.82, p = .02, partial η^2 = 0.08). For the final sample (*N* = 150), subjects' MPIVW scores were analyzed based on perceived spatial presence (subject IPQ scores), venue, and experimental condition.

4.6.3.2. Interactivity and Spatial Presence. Factorial ANCOVA test results show significant covariance of MPIVW scores with perceived spatial presence (*F* (1,149) = 34.66, *MSE* = 38.59, p = .00, η^2 = 0.19) based on study venue explaining 19% of the sample variance. There was a significant interaction effect between study venue and experimental condition (Bots or Not) for the final sample (*F* (1,149) = 6.50, *MSE* = 7.23, p = .01, η^2 = 0.04). A factorial MANCOVA showed significant main effects for perceived interactivity based on venue (*F* (1,149) = 40.89, *MSE* = 45.52, p = .00, η^2 = 0.22) and significant interaction effects for perceived interactivity between venue and study condition (*F* (1,149) = 3.81, *MSE* = 5.22, p = .05, η^2 = 0.03). Lack of correlation between the IVs enables comparison of perceived interactivity (MPIVW scores) based on experimental condition for each venue independently. Table 10 presents the significant factorial MANCOVA test results for H3.

Table 4.7. *H3-Significant MANCOVA Results Summary for Final Sample*

Source	*M Difference*	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
MPIVW & IPQ [b]	**-**	**38.59**	**1,149**	**38.59**	**34.66**	**.00****	**0.19**	**1.00**

Table 4.7. *H3-Significant MANCOVA Results Summary for Final Sample (continued)*

Source	*M Difference*	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
MPIVW Bots V1 v. V2	-1.61	7.23	1,149	7.23	6.50	.01**	0.04	0.72
MPIVW Not V1 v. V2	-0.80							
MPIVW & Venue	**-1.21**	**45.52**	**1,149**	**45.52**	**40.89**	**.00****	**0.22**	**1.00**
MPIVW V1 Not v. Bots	0.61	7.23	1,149	7.23	6.50	.01**	0.04	0.72
MPIVW V2 Not v. Bots	-0.20							

*NOTES: [a] Computed using alpha = 0.05; [b] Two interval level variables; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

4.6.3.3. Covariance of Interactivity and Presence. H3 predicted that perceived presence would covary with perceived interactivity. Significant covariance was found for perceived interactivity and spatial presence both in the Bots group sample subset (N_{BCPQ} = 68) and the final sample (N = 150). Differences in the Bots group were based only on study venue, but interaction effects were significant between study venue and condition in the final sample. Although the variance is not based on experimental condition alone, perceived interactivity (measured by the MPIVW) does covary significantly with spatial presence (measured by the IPQ) within the context of this new media experience. Based on these results, H3 is supported.

4.7. Summary

Overall, this study appears to have generated relatively low perceived presence for subjects compared to perceived interactivity. The final 8-item MPIVW mean score range for perceived interactivity was 5.88 (M_{MPIVW} = 3.63, SD_{MPIVW} = 1.32) on a 6-point

scale. Three of the eight items were significant: One at the .05 level; and two at the .01 level. The IPQ mean score range for perceived spatial presence was 4.34 (M_{IPQ} = 2.50, SD_{IPQ} = 0.94) on a 6-point scale. The table in Appendix P ranks IPQ scale items by means. One significant mean score was observed for item IPQ13-I felt like I was just perceiving pictures (*M* = 2.72, *SD* = 1.59), which was significant at the .05 level (*p* = .05). The item with the highest mean score was IP08-had a sense of being there (*M* = 2.93, *SD* = 1.56). Table 11 summarizes scale means for the final sample.

Table 4.8. *Final Sample Scale Means Comparisons*

	N	*M*	*SE*	*SD*	*V*	*Range*
MPIVW	150	3.63	0.11	1.32	1.74	5.88
IPQ	150	2.50	0.08	0.94	0.88	4.43

NOTE: 6 = highest possible score.

For the Bots group sample subset (N_{BCPQ} = 68), the mean score range for perceived social presence was 4.60 (M_{BCPQ} = 2.29, SD_{BCPQ} = 1.03) on a 6-point scale. The table in Appendix Q ranks BCPQ scale items by means. Two BCPQ items were significant at the .05 level among subjects who perceived their experience as interactive: BCPQ01-"I perceived that I was in the presence of another person in the room with me" (*M* = 2.87, *SD* = 2.02, *p* = .05); and BCPQ02-"I felt that the person was watching me and aware of my presence" (*M* = 2.04, *SD* = 1.50, *p* = .02). For this group of subjects, the IPQ means score range for perceived spatial presence was 3.93 (M_{IPQ} = 2.50, SD_{IPQ} = 0.85). The MPIVW means score range for perceived interactivity was 5.12 (M_{MPIVW} = 3.98, SD_{MPIVW} = 1.25). Table 12 summarizes scale means for this sample subset.

Table 4.9. *BCPQ Sample Scale Means Comparisons*

	N	*M*	*SE*	*SD*	*V*	*Range*
MPIVW	68	3.98	0.15	1.25	1.57	5.12
IPQ	68	2.50	0.10	0.85	0.72	3.93
BCPQ	68	2.29	0.13	1.03	1.07	4.60

NOTE: 6 = highest possible score.

In conclusion, non-parametric and parametric test results for this study determined two significant qualities associated with an interactive technology: Responsiveness and engagement. Unmediated FTF communication was considered the most interactive experience by subjects. Perceived interactivity appeared to be greater when avatars believed to be controlled by other people were encountered in the VE, but this effect was confounded by differences in the two study venues. Perceived spatial presence was not greater when other avatars were encountered, but it did covary significantly with perceived interactivity. In the last chapter, implications of these results as well as potential directions for future research are discussed.

CHAPTER 5

DISCUSSION

We are living in a global village, and more of our communication than ever before is mediated through channels extending our psychological and physical faculties (McLuhan, 1964). The Internet's unprecedented capacity for connecting people continues to enable more interactive communication regardless of physical distance. Better understanding of new media experiences is vital if developers are to reliably provide and build upon interactive elements and effects in the future. Empirical proof is needed to substantiate interactivity theories and provide direction. This study's objective was to fill a gap in the research by investigating differences between user experiences of interactivity when technology enables communication versus when it does not. This chapter discusses the implications of study findings as well as limitations and future directions for interactivity and presence research.

Earlier investigators have held that communication contexts, technological properties, and technology user perceptions affect interactive experiences (Kiousis, 2002). Appendix A presents this study's model of perceived interactivity which takes both the user and the technology into consideration. Based on a review of the literature, interactivity was defined as a sensory experience activating perceptions of engagement with responsive actual or virtual objects or people.

This study also examined interactivity's relationship to presence, a quality often linked to interactive experiences in the literature. Interactivity and presence were

conceptualized as distinct constructs within the system of a new media experience. Presence was defined as the technology user's sense of being in the Virtual World (VW) as reflected by perceived spatial and social presence or co-presence. Appendix B displays a diagram of this study's model of perceived presence, and Appendix R contains a glossary of terms and abbreviations relevant to this discussion.

The focus of the current study is users' psychological experiences or perceptions of new media. A 2 by 4 factorial experiment compared subject perceptions following completion of a simple task in the online VW called Second Life. It was hypothesized that both perceived interactivity and presence would be greater for subjects encountering other avatars and that perceived interactivity and presence would covary. Subjects in the control group encountered no other avatars in the VE. When subjects in the experimental group believed the avatars were controlled by other people, perceptions of potential for communication were thought to be activated. Results of this study have implications for the qualities of interactive experiences as well as the disambiguation of interactivity and presence. In addition, a measure of perceived interactivity was developed for the VW context that may be useful for future research. Significant study findings are presented in the next section.

5.1. Findings

Qualities of interactive experiences have been a source of debate among interactivity researchers. Distance learning researchers tend to regard FTF communication as the highest level of interactivity. They often evaluate communication in new media contexts by measuring how closely it emulates FTF conversation (Walther & Burgoon, 1992). In exploratory survey research preceding this study, 87% of

respondents rated FTF conversation highly interactive. In the present study, 96% of subjects rated FTF conversation highly interactive and 78% reported that FTF communication with the researcher was more interactive than the VW.

Two qualities of interactivity found in the literature were confirmed by this study: Responsiveness and engagement. Both are characteristic of unmediated, FTF conversation, which was perceived as the most interactive communication context above technologies frequently described as interactive. The following section explores the implications of these qualities which seem to be fundamental to interactive experiences.

5.1.1. Qualities of Interactive Experiences

Significant variation in perceived interactivity was detected by the Measure of Perceived Interactivity for VWs (MPIVW) due to differences in subject experiences of responsiveness and engagement. The importance of each of these for interactivity will now be discussed.

5.1.1.1. Responsiveness. Whether the response is from a medium or another person, responsiveness has been associated with channels of communication since the cybernetics theories of the 1950s (Wiener, 1950). Elements of responsiveness embody the idea of rapid reciprocal actions, which have long been associated with interactivity (Rafaeli, 1988). The top rated interactive contexts in this study enable instant human feedback. Three forms of instant-messaging (text, audio, and video) were among the top five along with phone conversations and FTF conversations, which had the highest mean score of all communication contexts. FTF conversation was rated 31% higher for interactivity than the second place context of video instant-messaging.

In this study's model of perceived interactivity, responsiveness includes two components: Reaction speed and control. Current findings confirm the influence of speed and control on responsiveness as glimpsed in the literature. Relevant MPIVW subscale items that yielded statistically significant differences in responsiveness at the .01 level (p = .00) include: Loads fast; operates at high speed; loads slowly; and responds immediately. As detailed in this chapter's discussion of study limitations, effects of the venue change are evident in differences among subject scores for these items. The Responsiveness subscale of the MPIVW explained 39% of the variance in perceived interactivity.

Previous research has found that reaction speed contributes significantly to perceived responsiveness and interactivity. Researchers have also linked speed with a sense of control or appropriateness of the technology's response to a user's input. For example, Steuer (1992) regarded interactivity as having three factors, two of which are directly related to this study's responsiveness components: Speed, which is reaction time; and mapping, which is a technology's natural and predictable response to a user or the user's sense of control.

Other researchers have credited speed with contributing to interactivity factors other than responsiveness or presence. For example, Lombard and Snyder-Dutch discuss speed as contributing to engagement in their theory of presence. Novak et al. (1998) found, contrary to their hypothesis, that higher speed did not contribute to the experience of presence and was not associated with greater attention—a factor contributing to the interactive quality of engagement. This study's findings corroborate Steuer's (1992) theory of interactivity: Two of his factors contributing to interactive experiences were

directly related to responsiveness; and the third is directly related to engagement, which is the second component of perceived interactivity in this study.

5.1.1.2. Engagement. Previous research has confused engagement with involvement, but there are important differences between the two. Findings of this study indicate that engagement is associated with interactivity and involvement with spatial presence. Engagement is active by definition, though some researchers have said that engagement can also be passive (Heeter, 2000; Norman, 1998). If classified as passive, the observed quality is more likely involvement, which entails captivation of our awareness that intensifies with time. For instance, one might say "I was going to take out the garbage, but then I got involved in this movie." The longer you watched the movie, the more involved you got in it which progressively took more of your awareness away from the immediate physical environment.

Research studying breaks in presence demonstrates that awareness in a mediated context is interrupted by awareness of the immediate physical environment (Ijsselsteijn & Riva, 2003; Slater & Steed, 2000). Whereas the experience of presence in a mediated context psychologically takes us out of the physical environment, interactivity can include psychological engagement in both the mediated and physical environments at once. Interactivity encompasses mediated and physical environments when clicking a computer's mouse button causes action in the mediated environment of an Internet browser. Immersive VEs allow us to experience interactivity by engaging in activities entirely within a mediated environment. On the other hand, engagement within the physical environment resulting in interactive experiences is more common such as having a conversation with someone over coffee.

Some studies have attributed involvement effects to interactivity and engagement effects to presence. For example, Riva and Waterworth discuss different layers of presence that intensify with time, which seems to describe involvement yet their highest level of extended presence is called engagement (Ijsselsteijn & Riva, 2003). Lombard and Synder-Dutch (2001) also use the terms engagement and involvement interchangeably, but the phenomenon they call engagement seems to describe involvement's role in presence. They explain engagement as psychological immersion occurring when a person's perception is directed toward environments created by technology and away from the physical world (Lombard & Snyder-Dutch, 2001). Dow et al. (2007) found, contrary to their expectations, that immersive interfaces increased a sense of presence but not engagement. Thus, engagement and presence are most likely distinct constructs. As previously discussed, interactivity and presence research frequently confound the two constructs, and a significant portion of the confusion centers on differences overlooked between engagement and involvement.

Lessiter et al.'s (2001) ITC Sense of Presence Inventory took all components of presence in the literature into consideration, and their factor analysis yielded four components, among them engagement which included items measuring involvement and intensity of experience (Dillon et al., 2000). The IPQ was chosen for measuring spatial presence in this study because it does not include items that overlap with the concept of interactivity. Items of the IPQ's involvement subscale include: How aware were you of the real world surrounding you while navigating the VW; still paid attention to real environment; and was not aware of real environment. Cronbach's alpha scores for the

IPQ showed significant internal reliability for the scale as well as for its involvement subscale items.

Most important for differentiating engagement and involvement, correlation of the MPIVW Engagement subscale and the IPQ Involvement subscale was extremely low (r = 0.06). Relatively low levels of engagement were generated in this study, possibly due to lack of variety in the experimental task. Subjects were restricted to walking their avatars through the virtual house and clicking on a wall-mounted screen. This study's task was designed to be as simple as possible in a visually interesting environment free of obstacles that could impede subject efforts to navigate their avatars. The VE did provide visual variety which seems to have garnered subjects' attention and interest. Table 1 in Appendix S shows examples of subject comments on feeling engaged during the experiment, and Table 2 in Appendix S shows examples of the numerous subject comments on interest and attention. One key indicator is that a total of 29% of subjects mentioned in their open-ended responses that their experience was interesting and/or kept their attention. The next section addresses study findings that contribute to the disambiguation of interactivity and presence.

5.1.2. Disambiguating Interactivity and Presence

A first step toward understanding the system which produces new media experiences is to differentiate qualities contributing to interactivity and presence. Ijsselsteijn et al. (2001b) contend that technology users can experience presence with both interactive and non-interactive media. In this study, perceived interactivity and presence appear to be distinct factors which covary during new media experiences. Low correlation between the MPIVW and IPQ scales (r = 0.38) demonstrate that these

instruments measured discrete psychological constructs. VW users seem to experience interactivity whether or not their sense of presence is of a similar level. Mean scores were substantially lower for spatial presence than for perceived interactivity in the final sample of 150 subjects.

Significant differences were observed in perceived interactivity due to variation between the Bots and Not groups (F (1,148) = 6.67, p = .01, partial η^2 = 0.04) and variation in the study venue (F (1,148) = 35.63, p = .00, partial η^2 = 0.19). No significant differences in perceived spatial presence were found based on study condition or venue. However, spatial presence did covary significantly with perceived interactivity (F (1,149) = 34.27, p = .00, η^2 = 0.19).

Findings for this study support conceptualizations of the relationship between interactivity and presence proposed in the flow literature. Novak, Hoffman, and Yung (1998) describe interactivity and presence as separate antecedents and facilitators of flow in computer-mediated contexts. The experience of flow has been expressed as optimal and enjoyable, and it has been described as occurring when we engage in activities with complete interest, concentration, and involvement which causes time distortion (Chen et al., 1999). Within this description of flow are indicators of interactivity (engagement, activities, interest) and presence (concentration, involvement, time distortion). It is possible that perceptions of interactivity, presence and flow converge to produce optimal new media experiences. Each of these psychological experiences has unique contributing factors which set it apart from the others yet they have all been shown to occur in the same mediated contexts.

Distinctive qualities of flow include enjoyment and a sense of entertainment. We can experience interactivity and presence without experiencing enjoyment or entertainment. For example, you can experience the act of paying bills (engagement) quickly (responsiveness) and easily (control) using your bank's online service as interactive. However, you most likely do not feel a sense of enjoyment or a sense of presence in the bank's website.

At the same time, we can experience presence in a mediated environment without experiencing enjoyment or entertainment. There have been numerous applications of VR for treatment of fears and phobias (Huang et al., 2000; Wiederhold et al., 2003). The purpose of these applications is to evoke unpleasant experiences requiring a sense of presence in the VE but not necessarily flow or interactivity. For instance, if your avatar suddenly falls off of a skyscraper rooftop in Second Life and you are unable to prevent plummeting to the ground by pushing various keys (lack of control and responsiveness), you may be experiencing presence in the VW without experiencing interactivity or enjoyment. Developing an instrument to measure perceived interactivity of virtual experiences such as this was another goal of the current study. The resulting Measure of Perceived Interactivity for VWs (MPIVW) is discussed in the next section.

5.1.3. Measuring Perceived VW Interactivity

A scale for measuring the perceived interactivity of a VW experience was created for this study by modifying McMillan and Hwang's (2002) Measure of Perceived Interactivity (MPI) for websites. An Exploratory Factor Analysis (EFA) was conducted to find the strongest model for measuring perceived interactivity in the VW context. The MPIVW detected statistically significant differences in perceived interactivity due to

variation in subject experiences of responsiveness based on system reaction time and control as well as engagement due to variety and attention.

Table 4 in Appendix I shows the results of reliability testing for the MPIVW and each of the two Responsiveness and Engagement subscales. The 8-item MPIVW explains 73% of the total variance in perceived interactivity and shows significant reliability which does not change from the final sample of 150 subjects to the smaller BCPQ sample of 68. Reliability also remains strong for the 97 subjects who completed experiments at Venue 1 (the Journalism Media Lab) and the 53 subjects who completed experiments at Venue 2 (King Library).

The four items comprising the Responsiveness subscale of the MPIVW together explain 39% of the variance and show high internal reliability which changes little from the final sample to the BCPQ sample. Reliability for responsiveness also remains strong at Venue 1 and Venue 2. The four items of the MPIVW's Engagement subscale explain 34% of the variance and also show high internal reliability unchanged from the final sample to the BCPQ sample and remaining strong for Venue 1. Although reliability was still strong at Venue 2, this finding was not significant. Table 3 in Appendix I shows the EFA results for the MPIVW. Thus, the MPIVW appears to be an effective measure of perceived interactivity in VEs. Next, limitations of the current study are addressed.

5.2. Limitations of the Study

All studies face limitations. The following discussion considers issues involving this study's sample, missing data, lower levels of presence, and differences between the two venues.

5.2.1. Sample Limitations

Since this study's models of perceived interactivity and presence (shown in Appendices A and B) take characteristics of the technology and technology user into account as well as user perceptions, one of the primary concerns regarding the sample was controlling for characteristics of the technology user. Personal characteristics that have been attributed with affecting perceived interactivity in previous studies include interest in the technology, previous experience with the technology, and skill level. Interest in the technology was controlled for by randomly assigning subjects to the Bots and Not experimental groups. Skill level was controlled for by choosing a simple experimental task, which may have been too simple and brief to evoke substantial senses of engagement (affecting interactivity) or involvement (affecting presence).

Previous experience with the technology was controlled for by choosing Second Life as the experimental VE, because it was anticipated that few subjects would have previous experience with it. In addition, the first item on the questionnaire asked study participants if they had ever used Second Life, permitting assessment of differences based on this personal characteristic. As expected, the majority of subjects (89%) had no experience with Second Life. Independent samples t-tests showed that there were no significant differences in perceived interactivity or presence for subjects with Second Life experience.

The sample for this study was homogeneous on two demographic characteristics in particular. Seventy-three percent of subjects were Caucasian, and 96% of subjects were between the ages of 18 and 25. Considering that this study was focused on new media technology, consistency in the ages of study participants may be desirable.

Generational differences in attitudes toward and expectations of new media technology may have impacted study results if there had been wider variations in the ages of subjects. On the other hand, increased demographic diversity also may have provided a sample representative of more perceptions. Independent samples t-tests confirmed that there were no significant differences in perceived interactivity or presence for subjects based on age or race.

The next issue of concern for the sample in any study is sample size, especially when scale development and factor analysis methods are involved. As discussed in Chapter 4, sample sizes for similar studies tend to vary depending on the complexity of the experimental task and the immersiveness of the VE. Studies of immersive VEs involving complex tasks typically have fewer than 50 subjects. When simpler tasks and less immersive VEs are involved, studies tend to have between 50 and 150 subjects. The experimental task for this study was simple and the desktop online VE was not immersive. The final sample included 150 cases. A subset of this sample including 68 subjects in the Bots condition who completed the BCPQ was also analyzed. These sample sizes exceed some earlier studies involving non-immersive VEs (Gerhard et al., 2004; Lim & Reeves, 2009).

A 5:1 subject to variable ratio is required for valid factor analysis (Takatalo et al., 2008). The modified MPI contained 18 items requiring at least 90 cases. This study's factor analysis was conducted using the final sample of 150 cases. While it is always desirable to have more subjects in scientific research, the sample size for this study was average and sufficient for effective factor analysis compared to studies with similar goals

and experimental tasks. Nevertheless, a larger sample would have been beneficial for addressing the next study limitation—missing data.

5.2.2. Missing Data

Factors contributing to the problem of missing data in this study consist of the "no answer" option for every question and problems with the online survey. First, each question on the survey included a "no answer" option to ensure that subjects were not forced to answer questions. Second, as described in Chapter 4, irregular online survey completion times were evidence of trouble with the University's SSTARS servers. As one subject commented: "Takes a LONG [time] to load questions within survey." As a result, some completed surveys contained sizeable blocks of missing data which necessitated elimination of 14 cases. After 16 additional cases were eliminated based on the manipulation check, the final sample was reduced from 180 to 150 cases. Future studies of this nature could over sample to compensate for the inevitable missing data due to these kinds of regulatory requirements and technical errors with online surveys. The next challenge faced in this study that will be discussed is low levels of presence experienced by subjects.

5.2.3. Lower Levels of Presence

In this study, presence is considered the perception of being in a VW. Findings support conceptualizations of presence in the literature as comprised of three experiences to varying degrees: Immersion; involvement; and realism. The experimental design for the current research did not generate substantial levels of presence, and no statistically significant differences were observed for perceived presence. Several dynamics may have contributed to lower levels of presence in this study: 1) Sensory stimuli from the

surrounding environment due to the experimental VE being online with desktop computers rather than an immersive VE; 2) the brief length of time spent in the VW, which limited subject sense of involvement; and 3) reduced perceptions of realism due to technical problems affecting lag time and graphics rendering.

First, Second Life is an online VE rather than an immersive VE. Immersion is the sense of being surrounded by and acting from within the VE. In a fully immersive VE, subjects wear head gear and their entire visual field is occupied by the VW making sensory information more "psychologically prominent" (Bailenson et al., 2008, p. 356). Highly immersive technologies have been attributed with providing a strong sense of presence (Berneburg, 2007). All online VWs face the same challenges for immersing the senses of the user. Whereas immersive VE technology engulfs the senses, online VWs must contend with sensory stimuli from the user's surrounding physical environment. Lack of immersion was not an anticipated problem for this study, because previous research has demonstrated effects of interactivity in non-immersive contexts and other elements are involved in generating a sense of presence (Bailenson et al., 2008).

Second, length of time spent in the mediated environment has been identified as contributing to presence (Schroeder, 2006). As users spend more time navigating the VW, experiences of involvement may increase and prevalence of the surrounding physical environment may decline due to flow-like psychological experiences. Because they are non-immersive by nature, online VWs may have greater difficulty generating a sense of presence in users unless they spend enough time in the VE to foster involvement. The brevity of the task in this study could have prevented subjects from experiencing involvement, thus a sense of presence, to a significant degree. Jaa-Aro (2004) recognized

the importance of this balancing act. For his study on CVEs, he describes designing the experimental task and VE to be simple enough for subjects to learn quickly but complex enough for subjects to have to coordinate navigation and work together for a substantial length of time.

Ideally, the VW task for this study would have taken participants about five minutes to complete. However, subjects completed the task in three minutes or less. This was unanticipated because learning to maneuver an avatar in Second Life can be awkward for first-time users, which the majority of study subjects were expected to be. Most of the study participants had never experienced Second Life before but managed to maneuver their avatars well enough to walk through the virtual hallways successfully in a shorter period of time than anticipated. While the brief task helped to ensure consistency of subject experiences and limit subject fatigue, 19% of subjects expressed dissatisfaction with the brevity of the experimental task in their open-ended answers. Table 3 in Appendix S presents examples of subject comments on the brevity of their task and time in Second Life.

Third and finally, new media technology enables psychological transportation into the mediated environment due to self-awareness and perceived realism. Second Life is often noted for its realism (Bardzell et al., 2008). However, the same technical issues that inhibit a sense of responsiveness can impact perceived realism for a VW due to lag times and problems rendering graphics. The result is unrealistic visuals and movements of the avatars which reminds users that it is a computer-generated environment. The ideal interactive medium, according to Lombard and Snyder-Dutch (2001), responds in real time to user input, meaning that the response or lag time is not noticeable. Table 4 in

Appendix S shows examples of comments from subjects who mentioned graphics trouble and lag times resulting in lack of speed and control at Venue 2. These technical issues were introduced due to differences in the technology at two study venues, which are discussed in the following section.

5.2.4. Differences in Two Study Venues

In this experiment, subjects occupied two environments—the surrounding physical environment and the online VE. The change of venue interfered with intent to control for the effect of differences in the technology and surrounding environment on users' perceived interactivity and presence. The Journalism Media Lab was a more central location in a building on campus whereas the King Library location was more isolated.

Differences in the physical appearance of environments at the two venues cannot be discounted as impacting study results. The Media Lab environment included a number of rooms with newer MAC computers and larger 21 inch flat screen monitors as well as a room with visible video and sound editing equipment, making it appear more high tech. The King Library location included one large room with older Dell computers and standard 15 inch flat screen monitors. The perimeter of the room was lined with bookshelves containing older volumes of books, making it appear low tech.

Procedures inside the rooms in which subjects completed the experimental task included steps to minimize sensory stimuli from the surrounding physical environment. Subjects at both venues used desktop computers in rooms isolated from other people and window views. They all wore headphones, and their visual fields during the experiment

included the computer monitors and CPUs, the desk, mouse, mousepad, the walls of the room, and signs pertaining to study directions.

Differences in technology at each venue are more likely to have caused the significant differences found in subject perceptions. Jaa-Aro (2004) noted the negative effects of asymmetric equipment in his study on CVEs. There were significant differences for participants using the lower end equipment with non-immersive versus immersive interfaces and long lag times versus short. Two differences between the equipment at each venue could have influenced this study's results: 1) Size of computer monitor screens; and 2) reaction time and control provided to the user due to computer processing power and graphics capabilities.

First, there is evidence that screen size affects psychological experiences related to interactivity, most often perceived presence but also attention factors. For instance, Reeves and Nass (1996) suggested that larger images may create a greater sense of immersion because they occupy a greater portion of our visual field therefore are more likely to evoke a sense of presence. Prothero and Hoffman (1995) found that increasing a subject's field of view increases the subjective senses of presence and immersion. Even natural images have been rated more realistic in a larger field of view than the same images in smaller fields of view (Hatada et al., 1980). The intensity of experiences such as attention, liking, and arousal has also been shown to increase when the same phenomenon is viewed on larger screens (Reeves et al., 1999). Computer monitor screens were six inches smaller at Venue 2. Findings show no significant differences between the two venues for perceived presence. IPQ scores were only 0.04 points higher

at Venue 1 (M_{V1} = 2.52, SD_{V1} = 0.95) than Venue 2 (M_{V2} = 2.48, SD_{V2} = 0.92), and the difference was not significant.

Therefore, the data was further analyzed to determine the source of differences observed in perceived interactivity due to venue, which were significant at the .01 level (p = .00) and accounted for 19% of the sample variance. Subject scores for perceived interactivity were 1.21 points higher for Venue 1 (M_{V1} = 4.06, SD_{V1} = 1.19) than for Venue 2 (M_{V2} = 2.85, SD_{V2} = 1.20). We know there were differences in computer processing power and graphics capabilities at the two venues. Subject comments shown in Table 4 of Appendix S attest to problems with graphics rendering, reaction speed and control experienced at Venue 2.

An analysis of mean differences for the MPIVW subscales between the two venues (shown in Table 6 of Appendix I) reveals that the majority of the difference occurred on the Responsiveness subscale. Scores on the Engagement subscale items from Venue 1 to Venue 2 varied little (M difference = -0.55) compared to the Responsiveness subscale items (M difference = -1.89). Table 7 of Appendix I shows results of an analysis of mean differences for each Responsiveness and Engagement subscale item. Closer examination of these items provides insight into the crux of the differences affecting study results for the two venues.

The greatest difference observed between the two locations was for the item "operates at high speed." The mean score for this item was 2.01 points higher at Venue 1 than Venue 2, and the item was significant at the .01 level for Venue 1 (p = .00). Differences for the MPIVW item "loads slowly" were also substantial (M difference = -1.90 from Venue 1 to Venue 2). This is the only item which yields significant results for

both Venue 1 (p = .03) and Venue 2 (p = .02). The MPIVW item "responds immediately" was considerably different (M difference = -1.86 from Venue 1 to Venue 2), but this finding was not statistically significant. Last, the difference for the item "loads fast" was also fairly substantial (M difference = -1.75 from Venue 1 to Venue 2), and the item was significant at the .01 level for Venue 1 (p = .00). Thus, findings show that differences in technology responsiveness based primarily on speed at the two venues impacted perceived interactivity significantly, but differences between the two venues did not impact results for perceived presence. Potential directions for future research based on this study's findings will now be discussed.

5.3. Future Research

Obviously, the limitations described above suggest possible replications of this experiment that would avoid some of the unexpected problems, e.g., the sudden need to shift subjects to a new venue. Other avenues for research are more subtle. This study tested one aspect of a theory proposed by Thorson and Rodgers (2006) that perceived potential for communication would be enough to activate perceptions of interactivity. Findings of their study suggested that actually using website features offering the potential for communication was not required for a site to be perceived as interactive. Even subjects who did not choose to act on the communication features of the high interactivity website had higher scores for perceived interactivity.

Thorson and Rodgers (2006) advocated researching differences between actually engaging in a two-way interaction and perceived possibilities for two-way interaction on the Internet. The task in this study did not involve direct interaction with other avatars. The robotic avatars were programmed to simply walk past subject avatars in the VW.

Encountering other avatars was only intended to activate perceptions of the potential for communication with another person. In this case, any further interaction would have exposed the avatars as robotic and violated the intended condition of believing the avatars were controlled by real people.

However, this brief encounter in a mediated context unfamiliar to most subjects may not have provided enough indication of the potential for communication. VWs are still a novelty. If a person has never communicated in a VW using avatars, he or she may not associate them with this capability. One subject's comment expressing uncertainty of whether communication with the other avatars was possible reflects the sentiment of several others: "I thought it was good, I enjoyed it, but I hadn't realized I would be able to interact with the others in the environment."

Future research on perceived potential to communicate needs to provide more of an indication that communication is possible. For VW research, a robotic avatar could be programmed to say "hello" and nod or wave to activate subject perceptions. Perhaps a within-subjects experimental design would be better for detecting differences in the perceived interactivity of a technology when there is potential to communicate. Subjects would complete the VW task once without encountering other avatars and again when other avatars would be encountered. Subject fatigue would be a concern for this type of study as well as subject exposure. If only one post-test is given asking subjects to recall both experiences, study results would be compromised by inaccurate recall. If each of the two experimental tasks were followed by completion of the post-test, exposure would influence results of the second post-test.

Second, lower levels of presence were generated in this study overall. This was most likely due in part to the experiment taking place in an online VW using desktop computers, which did not activate the experience of immersion. Moreover, the task was too brief to foster another important factor in perceived presence—a sense of involvement. A sense of realism was also inhibited by technology performance issues at Venue 2. Interactivity and presence appear to be separate constructs in this study, but research comparing the two by employing contexts and experimental tasks more conducive to perceived presence is necessary.

Previous presence studies to determine the effects of realism have compared subject perceptions after completing VW tasks in which they were either told an avatar character they interacted with was being controlled by another person or by a computer (Guadagno et al., 2007; Lim & Reeves, 2009). A few studies have investigated the effect of immersion on presence by comparing subject experiences in immersive VEs to those using desktop VEs (Bangay & Preston, 1998; Slater et al., 1996). Researchers have not yet determined if greater involvement induced by increasing the duration of time spent in the VE can compensate for the reduced immersiveness of online VWs explored on desktop or laptop computers.

To further examine the role of involvement in presence, future studies need to ensure that the experimental task lasts for a sufficient duration of time. Lengthening the duration of a simple task like the one employed in this study would help determine if time spent in the VW can compensate for lack of an immersive VE. For instance, if walking through a house is the experimental task, one group of subjects would walk through a smaller house and the other through a larger house with longer hallways. Results of this

type of study may have implications significant to the concepts of presence, flow, and interactivity.

Third, this study's findings provide a basis for isolating and measuring components of interactive experiences. Interactivity seems to result from perceptions of engagement and responsiveness. More experiments are required to determine the respective power of responsiveness and engagement factors for explaining interactivity effects. To further examine the significance of responsiveness for interactivity, this study's findings indicate that it is necessary to vary the speed of a technology's reaction to users. To study the effects of control on responsiveness and interactivity, researchers need to vary the appropriateness of a VW's response to subjects. For instance, a VE could be constructed in which a subject tries to open a door but a nearby window opens.

Although the current study contributes to distinguishing between engagement and the presence component of involvement, more research is needed to establish differences between the two as well as to establish the effects of engagement on interactivity. Findings of this study indicate that researchers need to increase the complexity or variety of the experimental task to increase perceptions of engagement. A task like watching an avatar walk through a virtual house compared to navigating the avatar would provide an opportunity to examine variations in engagement and its impact on interactivity.

Finally, future VE research may benefit from employing the measure of perceived interactivity developed for this study. To date, there is no accepted instrument for measuring subjects' perceived interactivity of virtual experiences. A series of studies will be required to further test and validate the MPIVW. Findings of this study

demonstrate the instrument's utility for detecting significant differences in the perceived interactivity of VW experiences.

5.4. Conclusions

This study contributes to a growing body of literature on interactivity, which is still a difficult to define yet widely experienced phenomenon. Within the system of a new media experience, perceived interactivity and presence appear to be separate psychological constructs which covary. This system includes characteristics of the user as well as the technology. The decreased responsiveness of technology at a second venue caused significant decline in perceived interactivity.

Since the IVs of study venue and condition were not correlated ($r(148) = -0.19$, $p = .02$), results for each venue can be evaluated independently. Considering only subjects who completed the experiment at Venue 1 ($N_{V1} = 97$), H1, which predicted that perceived interactivity would be greater for subjects encountering avatars believed to be controlled by other people, is supported. Subjects in the Bots condition rated their experience more interactive than those in the Not condition ($n_{V1\ Bots} = 54$, $M_{V1\ Bots} = 4.33$, $SD_{V1\ Bots} = 0.98$; $n_{V1\ Not} = 43$, $M_{V1\ Not} = 3.72$, $SD_{V1\ Not} = 1.34$). This main effect was statistically significant at the .01 level ($F(1,96) = 6.71$, $p = .01$, partial $\eta^2 = 0.07$) and accounted for 7% of the variance in perceived interactivity.

This effect is reversed at Venue 2 ($N_{V2} = 53$) due to interaction effects introduced by less responsive technology. Technical difficulties with Second Life were greater for the Bots houses at Venue 2 because of increased demand on the less capable computer graphics cards. Subjects in the Bots condition rated their experience slightly less interactive than those in the Not condition ($n_{V2\ Bots} = 19$, $M_{V2\ Bots} = 2.72$, $SD_{V2\ Bots} = 1.29$;

$n_{V2\ Not}$ = 34, $M_{V2\ Not}$ = 2.92, $SD_{V2\ Not}$ = 1.15). However, this result was not statistically significant (F (1,52) = 0.32, p = .58, partial η^2 = 0.01). Thus, it appears that H1 would have been supported by this study's results if it were not for interaction effects due to the unexpected venue change. These results demonstrate the importance of controlling for differences in technology characteristics when studying perceived interactivity.

Both responsiveness and engagement were identified as essential qualities of interactive experiences. Responsiveness seems to depend primarily on a technology user's experience of control and speed, and engagement appears to involve the technology's ability to keep our attention by providing variety. These qualities are characteristic of unmediated, FTF conversation, which was perceived as the most interactive communication context.

While Schudson's (1978) intent may have been to discourage comparisons of mass and interpersonal communication, the Internet is a "new" medium in that it provides certain qualities of unmediated communication that traditional mass media have lacked. According to uses and gratification theory, people actively work to fulfill their psychological and social needs by selecting the mediated or interpersonal channel capable of providing the gratification they seek (Nabi et al., 2006). The theory also suggests that we will create a medium to fulfill our needs if none exists (Palmgreen et al., 1985).

Interactivity has been recognized as a catalyst for communication and relationship development (Ha & James, 1998). Developers continue to create websites with more advanced social networking features. As a result, the average person can now have a micro mass media-like effect. Facebook has more than 500 million active users and more

than 200 million active mobile users. Average Facebook users have over 130 friends to whom they can broadcast a message instantly and from anywhere ("Facebook Fact Sheet," 2011). Today's Internet could be characterized as the mass media-zation of interpersonal communication just as it has come to be known for its personalization of mass media (Beniger, 1987).

In the 1990s, interest in VWs declined due to lack of technological power for their resource intensive applications and graphics requirements (Muller et al., 2005). Will VWs lose out once again to more advanced, life-like technology emulating unmediated FTF conversation and enabling more fulfilling communication and relationships? Would video-calling through services like Skype be perceived as more interactive than using avatars with voice features in Second Life, or would the ability to shake someone's virtual hand as an avatar be perceived as more interactive than video-calling? Currently, we do not have definitive answers to these questions. If we are to understand how the proliferation of mediated communication is impacting our lives and relationships, we must continue to strive toward understanding the technology enabling it.

Figure A1. *Perceived Interactivity Diagram*

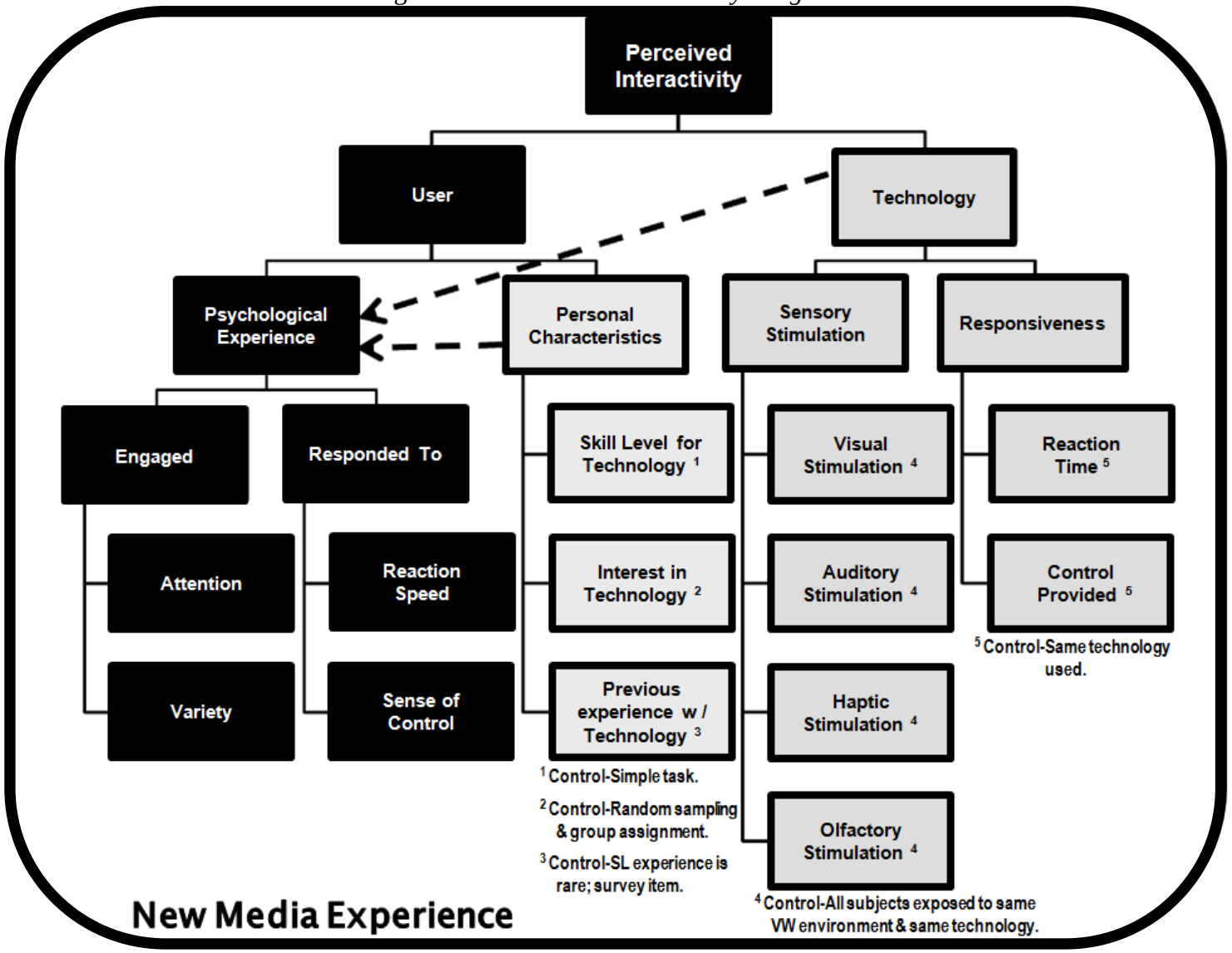
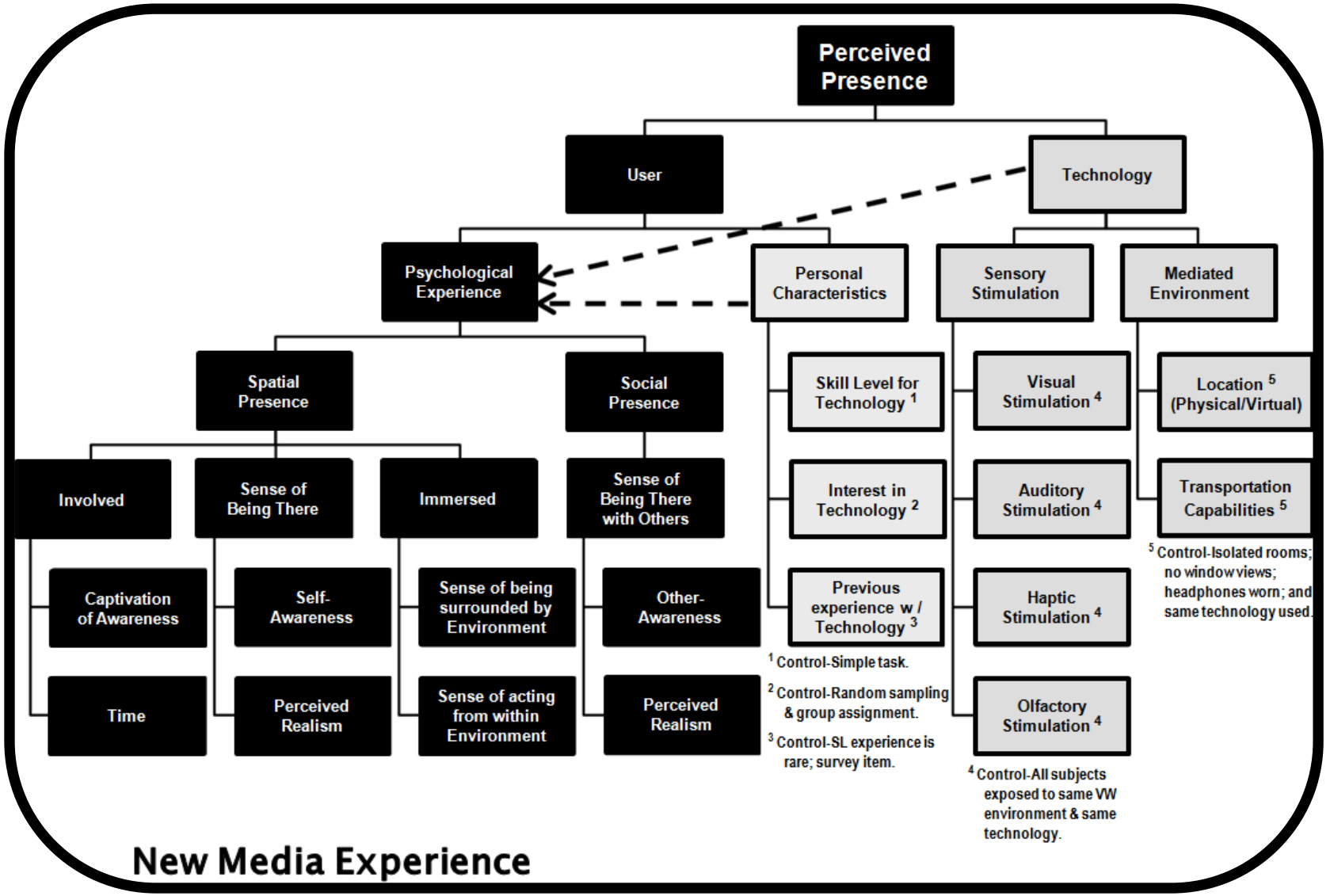


Figure B1. *Perceived Presence Diagram*



APPENDIX C

SUBJECT VIEWPOINTS IN SECOND LIFE

Figure C1. *Virtual World Subject Starting View*

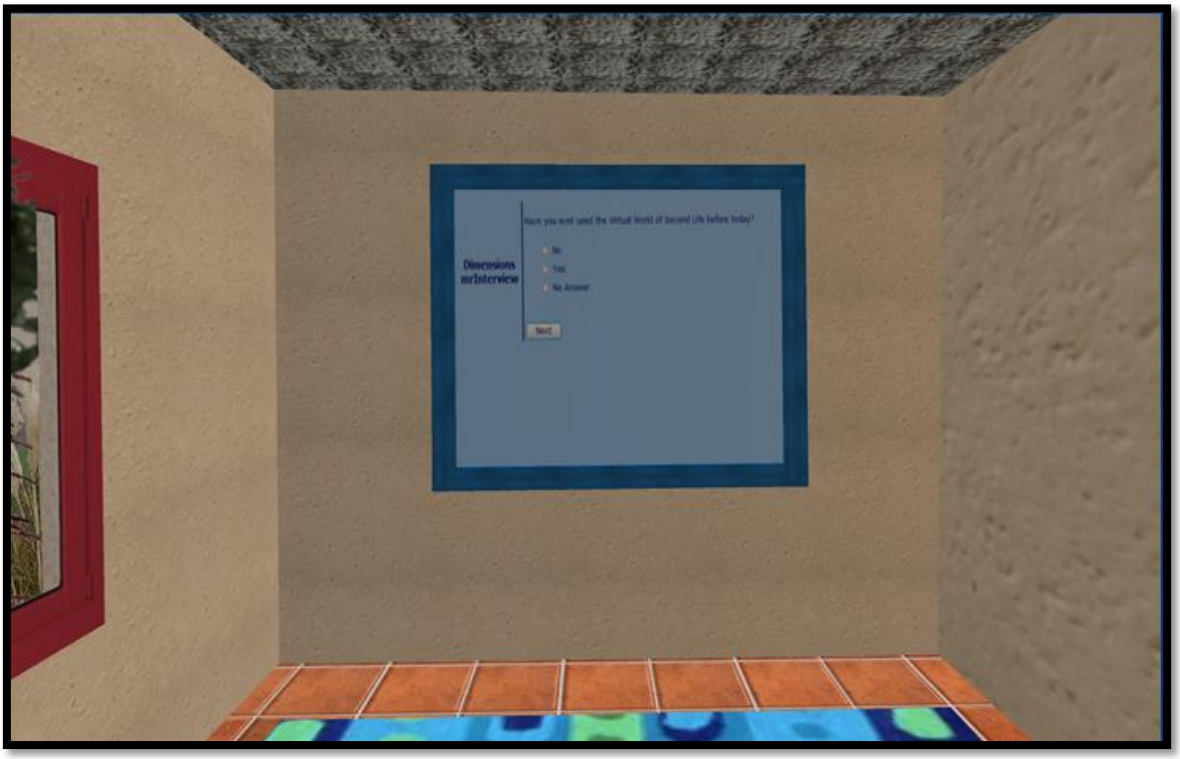
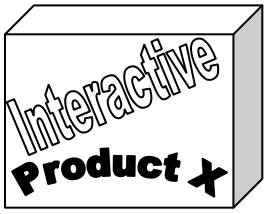


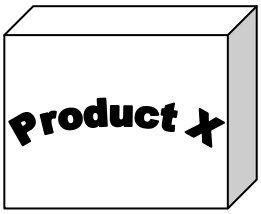
Figure C2. *Virtual World Subject Endpoint*

APPENDIX D

EXPLORATORY SURVEY RESULTS



90% (100)



9% (10)

Figure D1. *Exploratory Survey Interactive Product Preference Results* (*N* = 111)

Table D1. *Exploratory Survey Results for Interactive Product Qualities*

% (*n*)	Positive Quality	Neither % (*n*)	Negative Quality	% (*n*)
88% (98)	Interesting	8% (9)	Boring	4% (4)
76% (84)	Desirable	23% (26)	Undesirable	1% (1)
69% (77)	Expensive	26% (29)	Cheap	5% (5)
57% (63)	Good	41% (46)	Bad	2% (2)
55% (60)	Best	44% (49)	Worst	2% (2)
46% (51)	Easy to Operate	34% (38)	Difficult to Operate	27% (22)
39% (43)	Positive	59% (66)	Negative	2% (2)

(*N* = 111)

Table D2. *Exploratory Survey Open-Ended Responses*

Quality	% (*n*)	Most Frequently Used Words and Phrases
Responsive	52% (58)	Responds, Reacts, Active, Interacts, Can interact with, Talks to you, Works with you, Communicates with you, Gets results, Active with you, Participates with you, Give and take, You can react to it, Responds to stimulation
Engaging	23% (25)	Can touch, use & see it, Involved, Interesting, Personable, You have to respond, Keeps you active, Holds your attention, Involved physically and/or mentally
Controllable	12% (13)	Hands on, Needs you to function, Function depends on user, Your opinion is expressed, Can affect its action, outcomes or changes in it, I use it, Choice determines activity
Entertaining	9% (10)	Fun, Playful, You play with it, Rewarding, Fulfilling, 3D
Helpful	5% (6)	Helps, Walks you through, Specifically helps or informs, Can use in a better way
Versatile	5% (6)	Choices, Does whatever is asked, Does more than one thing, Options, Adjusts to the user
Facilitates Communication	5% (6)	Working with others to complete tasks, Used for communicating with others, Being active with others, Group participation, Get involved with group activities
Intelligent	5% (5)	Learns from you, Acts different than expected, Understanding, Senses users' needs, Works well, Discusses topic with you

(N = 111)

Table D3. *Exploratory Survey Results for Interactive Experiences*

Highly Interactive (A) % (*n*)	Experience [a]	Interactive (B+C) % (*n*)
87% (97)	Face-to-face Conversations	12% (13)
63% (70)	Playing Multi-Player Video Games	32% (35)
57% (63)	Playing Multi-Player Video Games via Internet	33% (37)
45% (50)	Video Instant-messaging via Internet	36% (40)
37% (41)	Playing Individual Video Games	44% (49)
32% (35)	Audio Instant-messaging via Internet	50% (55)
27% (30)	Surfing the Internet	58% (64)
26% (29)	Instant-messaging via Internet	67% (74)
21% (23)	Cell Phone Conversations	77% (85)
21% (23)	Telephone Conversations	77% (85)
17% (19)	Navigating a Specific Web Site	68% (75)
13% (14)	Responding to E-mail	75% (83)
13% (14)	Watching Video on Web Sites	65% (72)

NOTES: [a] Rated using the following scale: A = "Highly Interactive" (4); B = "Above Average Interactivity" (3); C = "Average Interactivity" (2); D = "Below Average Interactivity (1); and E = "Not Interactive at All" (0); N = 111.

Table D4. *Exploratory Survey Results for Interactive Items*

Highly Interactive (A) % (*n*)	Item [a]	Interactive (B+C) % (*n*)
78% (87)	The Internet	21% (23)
77% (85)	Computers	22% (24)
69% (76)	Home Video Games	27% (30)
65% (72)	Web Site: Facebook	30% (33)
59% (65)	Cell Phones	40% (44)
56% (62)	Web Site: My Space	32% (36)
52% (58)	Portable Video Games	35% (39)
51% (57)	Web Site: YouTube	45% (50)
40% (44)	E-mail	51% (57)
36% (40)	Software	52% (58)
34% (38)	Web Site: Google	62% (69)
31% (34)	Web Site: Yahoo!	59% (65)
30% (33)	mp3 Players	52% (58)
24% (27)	Web Site: ESPN	50% (55)

NOTES: [a] Rated using the following scale: A = "Highly Interactive" (4); B = "Above Average Interactivity" (3); C = "Average Interactivity" (2); D = "Below Average Interactivity (1); and E = "Not Interactive at All" (0); N = 111.

APPENDIX E

QUESTIONNAIRE

Second Life Experience

Have you ever used the Virtual World of Second Life before today? If you do not want to answer, mark "No Answer."

❍ No

❍ Yes

❍ No Answer

NEXT

MPIVW-Part 1

You'll see some statements about experiences. Please indicate how much you agree or disagree with each statement based on the experience you just had. There are no right or wrong answers. Only your opinion counts. If you do not want to answer a question, mark "No Answer."

MPIVW Item	This virtual world . . .	+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
01	loads fast	❍	❍	❍	❍	❍	❍	❍	❍
02	seems like it enables two-way communication with other people	❍	❍	❍	❍	❍	❍	❍	❍
03	has variety	❍	❍	❍	❍	❍	❍	❍	❍
04	seems like it enables immediate communication	❍	❍	❍	❍	❍	❍	❍	❍

MPIVW Item	This virtual world . . .	+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
05	is interactive	❍	❍	❍	❍	❍	❍	❍	❍
06	was easy to find my way through	❍	❍	❍	❍	❍	❍	❍	❍
07	is interpersonal	❍	❍	❍	❍	❍	❍	❍	❍
08	operates at high speed	❍	❍	❍	❍	❍	❍	❍	❍
09	keeps my attention	❍	❍	❍	❍	❍	❍	❍	❍

NEXT

MPIVW-Part 2

[CONTINUED] You'll see some statements about experiences. Please indicate how much you agree or disagree with each statement based on the experience you just had. There are no right or wrong answers. Only your opinion counts. If you do not want to answer a question, mark "No Answer."

MPIVW Item	This virtual world . . .	+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
10	loads slowly	❍	❍	❍	❍	❍	❍	❍	❍
11	seems like it primarily enables one-way communication	❍	❍	❍	❍	❍	❍	❍	❍
12	lacks variety	❍	❍	❍	❍	❍	❍	❍	❍
13	seems like it enables delayed communication	❍	❍	❍	❍	❍	❍	❍	❍
14	appeared passive	❍	❍	❍	❍	❍	❍	❍	❍
15	was unmanageable	❍	❍	❍	❍	❍	❍	❍	❍

MPIVW Item	This virtual world . . .	+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
16	seems like it enables conversation	❍	❍	❍	❍	❍	❍	❍	❍
17	responds immediately	❍	❍	❍	❍	❍	❍	❍	❍
18	doesn't keep my attention	❍	❍	❍	❍	❍	❍	❍	❍

NEXT

Once again, you'll see some statements about experiences. Please indicate how much you agree or disagree with each statement based on the experience you just had. There are no right or wrong answers. Only your opinion counts. If you do not want to answer a question, mark "No Answer."

IPQ01

How aware were you of the real world surrounding you while navigating in the virtual world (i.e., sounds, room temperature, other people, etc.)?

❍ -3-Extremely Aware

❍ -2

❍ -1

❍ 0

❍ +1

❍ +2

❍ +3-Not Aware At All

❍ No Answer

NEXT

IPQ02

How real did the virtual world seem to you?

❍ +3-Completely Real

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Not Real At All

❍ No Answer

NEXT

IPQ03

I had a sense of acting in the virtual space, rather than operating something from outside.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ04

How much did your experience in the virtual environment seem consistent with your real world experience?

❍ +3-Very Consistent

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Not Consistent At All

❍ No Answer

NEXT

IPQ05

How real did the virtual world seem to you?

❍ +3-Indistinguishable from the real world

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-About as real as an imagined world

❍ No Answer

NEXT

IPQ06

I did not feel present in the virtual environment.

❍ +3-Felt Present

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Did Not Feel Present

❍ No Answer

NEXT

IPQ07

I was not aware of my real environment.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ08

In the computer generated world, I had a sense of "being there."

❍ +3-Very Much

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Not At All

❍ No Answer

NEXT

IPQ09

Somehow, I felt that the virtual world surrounded me.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ10

I felt present in the virtual space.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ11

I still paid attention to the real environment.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ12

The virtual world seemed more realistic than the real world.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ13

I felt like I was just perceiving pictures.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

IPQ14

I was completely captivated by the virtual world.

❍ +3-Fully Agree

❍ +2

❍ +1

❍ 0

❍ -1

❍ -2

❍ -3-Fully Disagree

❍ No Answer

NEXT

Real Others (Routing Item)

Were there other real persons within the virtual environment besides you? (Mark the one that best applies to the experience you just had.)

❍ Yes, but I did not see them. (*Skip to Artificial Others Item*)

❍ No. (*Skip to Artificial Others Item*)

❍ Yes, and I did see them. (*Answer BCPQ Items Below*)

❍ No Answer (*Skip to Artificial Others Item*)

NEXT

BCPQ

Please indicate how much each of the following statements applies to the experience you just had. Remember, there are no right or wrong answers. Only your opinion counts. If you do not want to answer a question, mark "No Answer."

BCPQ Item		+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
01	I perceived that I was in the presence of another person in the room with me.	❍	❍	❍	❍	❍	❍	❍	❍
02	I felt that the person was watching me and aware of my presence.	❍	❍	❍	❍	❍	❍	❍	❍
03	The thought that the person was not a real person crossed my mind often.	❍	❍	❍	❍	❍	❍	❍	❍
04	The person appeared to be sentient (conscious and alive) to me.	❍	❍	❍	❍	❍	❍	❍	❍
05	I perceived the person as being only a computerized image, not as a real person.	❍	❍	❍	❍	❍	❍	❍	❍

NEXT

Artificial Others (*Manipulation Check*)

Were there artificial characters within the virtual environment? (Mark the one that best applies to the experience you just had.)

❍ Yes, but I did not see them.

❍ No.

❍ Yes, and I did see them.

❍ No Answer

NEXT

Interactive Qualities - Part 1

This virtual world is . . .	+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
Interesting	❍	❍	❍	❍	❍	❍	❍	❍
Engaging	❍	❍	❍	❍	❍	❍	❍	❍
Responsive	❍	❍	❍	❍	❍	❍	❍	❍
Easy to Operate	❍	❍	❍	❍	❍	❍	❍	❍
Interactive	❍	❍	❍	❍	❍	❍	❍	❍
Entertaining	❍	❍	❍	❍	❍	❍	❍	❍

NEXT

Interactive Qualities - Part 2

While in the virtual world, I felt . . .	+3 Fully Agree	+2	+1	0	-1	-2	-3 Fully Disagree	No Answer
Engaged	❍	❍	❍	❍	❍	❍	❍	❍
In Control	❍	❍	❍	❍	❍	❍	❍	❍
Able to Choose	❍	❍	❍	❍	❍	❍	❍	❍
Responded to Immediately	❍	❍	❍	❍	❍	❍	❍	❍

NEXT

Rank Experience with Researcher v. Virtual World

With level of INTERACTIVITY in mind, please rank the activities you just participated in by marking #1 for the MOST Interactive and #2 for the LEAST Interactive.

	#1 MOST Interactive	#2 LEAST Interactive	No Answer
Your Experience in the Virtual World	❍	❍	❍
Receiving Instructions from the Researcher	❍	❍	❍

NEXT

Now, think about each of the following activities anytime you have experienced them. You'll be asked to assign a grade to each type of activity. Remember, there are no right or wrong answers. Only your opinion counts. If you do not want to answer a question, mark "No Answer."

Interactive Experiences - Part 1

With level of INTERACTIVITY in mind, assign a grade to each of the following. If you have never used the item or engaged in the activity, please mark "Don't Know." If you do not want to answer a question, mark "No Answer."

	A Highly Interactive	B Above Avg Interactivity	C Average Interactivity	D Below Avg Interactivity	E Not At All Interactive	Don't Know	No Answer
Face-to-Face Conversations	❍	❍	❍	❍	❍	❍	❍
Phone Conversations	❍	❍	❍	❍	❍	❍	❍
Cell Phone Text Messaging	❍	❍	❍	❍	❍	❍	❍
Computers	❍	❍	❍	❍	❍	❍	❍
The Internet	❍	❍	❍	❍	❍	❍	❍
Writing E-mail	❍	❍	❍	❍	❍	❍	❍
Reading E-mail	❍	❍	❍	❍	❍	❍	❍
Writing Blogs	❍	❍	❍	❍	❍	❍	❍

NEXT

Interactive Experiences - Part 2

[CONTINUED] With level of INTERACTIVITY in mind, assign a grade to each of the following. If you have never used the item or engaged in the activity, please mark "Don't Know." If you do not want to answer a question, mark "No Answer."

	A Highly Interactive	B Above Avg Interactivity	C Average Interactivity	D Below Avg Interactivity	E Not At All Interactive	Don't Know	No Answer
Reading Blogs	❍	❍	❍	❍	❍	❍	❍
Posting Comments on Blogs	❍	❍	❍	❍	❍	❍	❍
Instant-Messaging via Internet	❍	❍	❍	❍	❍	❍	❍
Audio Instant-Messaging	❍	❍	❍	❍	❍	❍	❍
Video Instant-Messaging	❍	❍	❍	❍	❍	❍	❍
Single Player Video Games	❍	❍	❍	❍	❍	❍	❍
Multi-Player Video Games	❍	❍	❍	❍	❍	❍	❍
Virtual Worlds	❍	❍	❍	❍	❍	❍	❍

NEXT

Please answer the following demographic questions. Your answers are completely anonymous and confidential. If you do not want to answer a question, mark "No Answer."

Age Item

Please enter your age. If you do not want to answer, mark "No Answer" below then click Next.

(0-99)

|

❍ No Answer

NEXT

Gender Item

Gender

❍ Male

❍ Female

❍ No Answer

NEXT

Ethnicity Item

What race/cultural background do you identify with most? (Mark the one that best applies to you.)

❍ African-American (*Skip to Open-Ended Response Item*)

❍ Caucasian (*Skip to Open-Ended Response Item*)

❍ Hispanic-American (*Skip to Open-Ended Response Item*)

❍ Other (*Answer Ethnicity Other Item*)

❍ No Answer (*Skip to Open-Ended Response Item*)

NEXT

Ethnicity Other Item

Please describe the race/cultural background you identify with most. If you do not want to answer, mark "No Answer" below then click Next.

❍ No Answer

NEXT

Open-Ended Response Item

How would you describe your experience today? Take this opportunity to let us know your thoughts before you go.

If you do not want to answer, mark "No Answer" below then click Next.

❍ No Answer

NEXT

End of interview. Thank you for participating.

APPENDIX F

EXPERIMENTAL ENVIRONMENTS

Figure F1. *Media Lab Environment*

Figure F2. *Robotic Avatars Retained in the Transparent Wall System*

APPENDIX G

CONSENT FORM

Consent to Participate in a Research Study

COMMUNICATION TECHNOLOGY STUDY

You are being invited to take part in a research study about communication technology. If you volunteer to take part in this study, you will be one of about 100 people to do so.

WHO IS DOING THE STUDY?

The person in charge of this study is Jennifer Robinette, a doctoral candidate in the Department of Communication at the University of Kentucky. She is being guided in this research by Dr. Donald O. Case. There may be other people on the research team assisting at different times during the study.

WHAT IS THE PURPOSE OF THIS STUDY?

By doing this study, we hope to learn more about your experiences with communication technology.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted on the main campus of the University of Kentucky. You will need to come to the Media Lab located in the basement of the Grehan Journalism Building one time during the study. Your visit will take about 35 to 45 minutes. The total amount of time you will be asked to volunteer for this study is approximately 50 minutes over the next two weeks, including scheduling your appointment online and your Media Lab session.

WHAT WILL YOU BE ASKED TO DO?

When you arrive at the Media Lab, you will be assigned by chance to one of four rooms equipped with desktop computers. You have a 25% chance of being assigned to any one of the four rooms.

Because they could influence study results, your cell phone, Blackberry, and any other electronic communication devices you carry with you will be safely stored in close proximity but outside the room where you will be working on a computer for 20 to 30 minutes.

You will be asked to use a computer keyboard and mouse to perform a simple task on the computer. After you complete the brief task, you will be asked to answer some questions about your opinions of the experience.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

To the best of our knowledge, the things you will be doing have no more risk of harm than you would experience in everyday life.

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

There is no guarantee that you will get any benefit from taking part in this study. Your willingness to take part, however, may, in the future, help society as a whole better understand this research topic.

DO YOU HAVE TO TAKE PART IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?

If you decide not to take part in this study, see your communication instructor for an alternative assignment.

WHAT WILL IT COST YOU TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will receive class credit for participating in this study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep private all research records that identify you to the extent allowed by law.

Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be personally identified in these written materials. We may publish the results of this study; however, we will keep your name and other identifying information private.

We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. Your responses to

questions will go directly into a computer database and be labeled only with a participant number.

We will keep private all research records that identify you to the extent allowed by law. However, there are some circumstances in which we may have to show your information to other people. For example, we may be required to show information which identifies you to people who need to be sure we have done the research correctly; these would be people from such organizations as the University of Kentucky.

CAN YOUR TAKING PART IN THE STUDY END EARLY?

If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study.
The individuals conducting the study may need to withdraw you from the study. This may occur if you are not able to follow the directions they give you.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Jennifer Robinette, at Jennifer.Robinette@uky.edu. If you have any questions about your rights as a volunteer in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. We will give you a signed copy of this consent form to take with you.

WHAT ELSE DO YOU NEED TO KNOW?

You will need to sign up for an appointment this week by visiting the following web site:

http://comm.uky.edu/techstudy

The maximum amount of time your appointment will take is 45 minutes during one day in the next two weeks. Please keep this in mind when scheduling around your classes and other obligations. In addition, please plan to arrive about 5 minutes prior to your scheduled appointment.

_____ _____

Signature of person agreeing to take part in the study Date

_____

Printed name of person agreeing to take part in the study

Jennifer Robinette 01/21/2009

_____ _____

Name of authorized person obtaining informed consent Date

APPENDIX H

SAMPLE DISTRIBUTION TABLES

Table H1. *Original Sample Distribution by Condition*

Reported Seeing . . .		No One	Artificial Others Only	Real Others Only	Real & Artificial Others	*Row Total*
Not	%	46%	3%		1%	50%
Group	(*n*)	(83)	(5)		(1)	(89)
Bots	%	4%	4%	23%	19%	50%
Group	(*n*)	(8)	(7)	(41)	(35)	(91)
Column	%	50%	7%	23%	19%	100%
Total	(*n*)	(91)	(12)	(41)	(36)	(180)

NOTE: Prior to elimination of cases based on the Manipulation Check, irregular survey completion times and missing data.

Table H2. *Final Sample Distribution by Condition*

Reported Seeing . . .		No One	Artificial Others Only	Real Others Only	Real & Artificial Others	*Row Total*
Not	%	48%	3%			51%
Group	(*n*)	(72)	(5)			(77)
Bots	%			26%	23%	49%
Group	(*n*)			(39)	(34)	(73)
Column	%	48%	3%	26%	23%	100%
Total	(*n*)	(72)	(5)	(39)	(34)	(150)

NOTE: Following elimination of cases based on the Manipulation Check, irregular survey completion times and missing data.

APPENDIX I

MPIVW SCALE RESULTS ANALYSIS

Table I1. *One-way ANOVA for each MPIVW Item*

		SS	*df*	*MS*	*F*	*p*
MPIVW01 [b] ** **loads fast**	Between Groups	64.30	1	64.30	20.35	.00
	Within Groups	464.48	147	3.16		
	Total	528.78	148			
MPIVW02 * **seems to enable 2-way comm w/other people**	Between Groups	13.41	1	13.41	4.78	.03
	Within Groups	395.95	141	2.81		
	Total	409.36	142			
MPIVW03 [b] **has variety**	Between Groups	2.88	1	2.88	1.21	.27
	Within Groups	354.19	148	2.39		
	Total	357.07	149			
MPIVW04 **seems like it enables immediate comm**	Between Groups	4.71	1	4.71	1.83	.18
	Within Groups	374.19	145	2.58		
	Total	378.90	146			
MPIVW05 **is interactive**	Between Groups	0.08	1	0.08	0.02	.88
	Within Groups	451.19	147	3.07		
	Total	451.26	148			
MPIVW06 **easy to find my way through**	Between Groups	0.31	1	0.31	0.11	.74
	Within Groups	417.53	147	2.84		
	Total	417.84	148			
MPIVW07 **is interpersonal**	Between Groups	0.11	1	0.11	0.04	.84
	Within Groups	365.86	142	2.58		
	Total	365.97	143			

		SS	*df*	*MS*	*F*	*p*
MPIVW08 [b] ** **operates at high speed**	Between Groups	34.61	1	34.61	10.92	.00
	Within Groups	468.88	148	3.17		
	Total	503.49	149			
MPIVW09 [b] * **keeps my attention**	Between Groups	13.37	1	13.37	4.86	.03
	Within Groups	407.09	148	2.75		
	Total	420.46	149			
MPIVW10 [a b] **loads slowly**	Between Groups	5.88	1	5.88	1.61	.21
	Within Groups	529.91	145	3.66		
	Total	535.80	146			
MPIVW11 **seems like it enables 1-way comm**	Between Groups	7.81	1	7.81	3.27	.07
	Within Groups	332.02	139	2.39		
	Total	339.83	140			
MPIVW12 [a b] **lacks variety**	Between Groups	0.02	1	0.02	0.01	.93
	Within Groups	366.36	148	2.48		
	Total	366.37	149			
MPIVW13 ** **seems like it enables delayed comm**	Between Groups	37.81	1	37.81	16.89	.00
	Within Groups	320.19	143	2.24		
	Total	358.00	144			
MPIVW14 [a] **appeared passive**	Between Groups	5.89	1	5.89	2.53	.11
	Within Groups	331.00	142	2.33		
	Total	336.89	143			
MPIVW15 [a] **was unmanageable**	Between Groups	1.65	1	1.65	0.70	.40
	Within Groups	345.23	147	2.35		
	Total	346.87	148			

		SS	*df*	*MS*	*F*	*p*
MPIVW16 **seems like it enables conversation**	Between Groups	0.71	1	0.71	0.24	.62
	Within Groups	415.43	143	2.91		
	Total	416.14	144			
MPIVW17 [b] **responds immediately**	Between Groups	11.79	1	11.79	3.50	.06
	Within Groups	499.07	148	3.37		
	Total	510.86	149			
MPIVW18 [a b] **doesn't keep my attention**	Between Groups	2.04	1	2.04	0.60	.44
	Within Groups	501.30	148	3.39		
	Total	503.33	149			

*NOTES: Computed using alpha = 0.05; [a] Reverse coded variables; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed); Chronbach's alpha of complete scale = 0.84 (p = .00).*

Table I2. *MPIVW Scale Items Means Analysis*

Item		*N*	*M*	*SE*	*SD*	*V*
MPIVW06	was easy to find my way through	149	4.60	0.14	1.68	2.82
MPIVW15 [a]	was unmanageable	149	4.55	0.13	1.53	2.34
MPIVW09 [b] *	keeps my attention	150	3.94	0.14	1.68	2.82
MPIVW10 [a b]	loads slowly	147	3.88	0.16	1.92	3.67
MPIVW18 [a b]	doesn't keep my attention	150	3.87	0.15	1.84	3.38
MPIVW01 [b] **	is interactive	149	3.77	0.15	1.89	3.57
MPIVW05	loads fast	149	3.73	0.14	1.75	3.05
MPIVW08 [b] **	operates at high speed	150	3.51	0.15	1.84	3.38
MPIVW03 [b]	has variety	150	3.45	0.13	1.55	2.40
MPIVW12 [a b]	lacks variety	150	3.41	0.13	1.57	2.46
MPIVW17 [b]	seems like it primarily enables one-way communication	150	3.26	0.15	1.85	3.43
MPIVW11	responds immediately	141	3.19	0.13	1.56	2.43
MPIVW13**	seems like it enables delayed communication	145	3.00	0.13	1.58	2.49
MPIVW07	is interpersonal	144	2.99	0.13	1.60	2.56
MPIVW14 [a]	appeared passive	144	2.78	0.13	1.53	2.36
MPIVW04	seems like it enables immediate communication	147	2.61	0.13	1.61	2.60
MPIVW02 *	seems like it enables two-way communication with other people	143	2.55	0.14	1.70	2.88
MPIVW16	seems like it enables conversation	145	2.38	0.14	1.70	2.89
	MPIVW**	**150**	**3.43**	**0.07**	**0.89**	**0.78**

*NOTES: 6 = highest possible score; [a] Reverse coded variables; [b] Included in the final MPIVW scale; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed); Chronbach's alpha for the 18-item scale = 0.84 (p = .00); Listwise N = 120.*

Table I3. *MPIVW Factor Analysis Results*

73% **(Total Variance Explained)**	Component 1 **Responsiveness (39%)****	Component 2 **Engagement (34%)****	**Communalities**
MPIVW01** **loads fast**	**0.88**	.26	**.85**
MPIVW08** **operates at high speed**	**0.85**	.23	**.77**
MPIVW10 [a] **loads slowly**	**0.83**	.30	**.78**
MPIVW17 **responds immediately**	**0.79**	.17	**.66**
MPIVW12 [a] **lacks variety**	.16	**0.80**	**.73**
MPIVW18 [a] **doesn't keep my attention**	.14	**0.78**	**.64**
MPIVW09* **keeps my attention**	.39	**0.73**	**.71**
MPIVW03 **has variety**	.29	**0.68**	**.67**
Final MPIVW 8-Item Scale (*M* = 3.63, *SE* = 0.11, *SD* = 1.32, *V* = 1.74)**			

*NOTES: [a] Reverse coded variables; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level; Chronbach's alpha of the final scale 0.89 (p = .00).*

Table I4. *Cronbach's Alphas for Reliability of the MPIVW Subscales*

	MPIVW**	MPIVW **Responsiveness****	MPIVW **Engagement****
Final Sample	0.89**	0.90**	0.84**
Listwise *N*	*147*	*147*	*150*
BCPQ Sample	0.89**	0.89**	0.84**
Listwise *N*	*66*	*66*	*68*
Venue 1	0.87**	0.87**	0.83**
Listwise *N*	*95*	*95*	*97*
Venue 2	0.86**	0.82*	0.83
Listwise *N*	*52*	*52*	*53*

*NOTES: Computed using alpha = 0.05; * Correlation is significant at the .05 level (2-tailed); ** Correlation is significant at the .01 level (2-tailed).*

Table I5. *MPIVW Subscale Descriptive Statistics*

	N	*M*	*SE*	*SD*	*V*	*Range*
MPIVW	150	3.63	.11	1.32	1.74	5.88
Engagement	150	3.67	.11	1.36	1.86	6.00
Responsiveness	150	3.61	.13	1.64	2.70	6.00
Valid *N* (Listwise)	150					

NOTE: 6 = highest possible score.

Table I6. *MPIVW and Subscales Means Analysis by Venue*

Scale	Venue	*N*	*Range*	*M*	*SE*	*SD*	*V*	***M* Difference**
MPIVW Responsiveness**	Venue 1	97	5.75	4.27**	0.14	1.41	1.99	**-1.89**
	Venue 2	53	5.75	2.38	0.18	1.31	1.71	
MPIVW Engagement**	Venue 1	97	6.00	3.86	0.13	1.32	1.73	**-0.55**
	Venue 2	53	5.25	3.31	0.19	1.39	1.93	
MPIVW*	**Venue 1**	**97**	**5.88**	**4.06****	**0.12**	**1.19**	**1.41**	**-1.21**
	Venue 2	**53**	**5.38**	**2.85**	**0.16**	**1.20**	**1.43**	

*NOTES: 6 = highest possible score; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

Table I7. *MPIVW Subscale Items Means Analysis by Venue*

Scale	Item	Venue 1 (*N* = 97)			Venue 2 (*N* = 53)			***M* Difference**
		N	*M*	*SD*	*N*	*M*	*SD*	
MPIVW Responsiveness**	MPIVW10 [a]	95	4.55*	1.65	52	2.65*	1.77	**-1.90**
	MPIVW01	96	4.39**	1.66	53	2.64	1.77	**-1.75**
	MPIVW08	97	4.22**	1.60	53	2.21	1.52	**-2.01**
	MPIVW17	97	3.92	1.74	53	2.06	1.39	**-1.86**
MPIVW Engagement**	MPIVW09	97	4.21*	1.58	53	3.45	1.76	**-0.76**
	MPIVW18 [a]	97	4.09	1.74	53	3.45	1.96	**-0.64**
	MPIVW03	97	3.60	1.54	53	3.17	1.54	**-0.43**
	MPIVW12 [a]	97	3.55	1.58	53	3.17	1.54	**-0.38**
MPIVW*	**. . . . . .**	**97**	**4.06****	**1.19**	**53**	**2.85**	**1.20**	**-1.21**

*NOTES: 6 = highest possible score; [a] Reverse coded variables; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

APPENDIX J

CORRELATION OF SCALES

Table J1. *Correlation Coefficients for the MPIVW & Presence Scales*

	MPIVW & IPQ	**MPIVW & BCPQ**	**IPQ & BCPQ**
Final Sample *N* = 150	0.38**	0.09	0.28*
BCPQ Sample *N* = 68	0.22	0.10	0.21
Venue 1 *N* = 97	0.40**	0.07	0.24
Venue 2 *N* = 53	0.42**	0.36	0.40

*NOTES: Computed using alpha = 0.05; * Correlation is significant at the .05 level (2-tailed); ** Correlation is significant at the .01 level (2-tailed).*

APPENDIX K

RQ1-INTERACTIVE QUALITIES RESULTS

Table K1. *One-way ANOVA for RQ1-Qualities Associated with an Interactive Experience*

		SS	*df*	*MS*	*F*	*p*
This VW is . . .						
Interesting	Between Groups	39.71	1	39.71	17.33	.00
	Within Groups	339.13	148	2.29		
	Total	378.83	149			
Engaging	Between Groups	63.71	1	63.71	26.81	.00
	Within Groups	351.63	148	2.38		
	Total	415.33	149			
Responsive	Between Groups	86.18	1	86.18	45.40	.00
	Within Groups	279.07	147	1.90		
	Total	365.25	148			
Easy to operate	Between Groups	100.94	1	100.94	46.34	.00
	Within Groups	322.39	148	2.18		
	Total	423.33	149			
Interactive	Between Groups	47.15	1	47.15	20.37	.00
	Within Groups	340.34	147	2.32		
	Total	387.49	148			
Entertaining	Between Groups	94.30	1	94.30	39.31	.00
	Within Groups	355.06	148	2.40		
	Total	449.36	149			

		SS	*df*	*MS*	*F*	*p*
While in the virtual world, I felt . . .						
Engaged	Between Groups	62.04	1	62.04	32.47	.00
	Within Groups	282.79	148	1.91		
	Total	344.83	149			
In control	Between Groups	29.82	1	29.82	12.46	.001
	Within Groups	354.18	148	2.39		
	Total	384.00	149			
Able to choose	Between Groups	38.05	1	38.05	17.11	.00
	Within Groups	329.13	148	2.22		
	Total	367.17	149			
Responded to immediately	Between Groups	144.51	1	144.51	76.74	.00
	Within Groups	274.92	146	1.88		
	Total	419.43	147			

NOTES: One-way ANOVA for Subjects with an MPIVW M ≥ 3.00 on the 6-point scale versus those with M < 3.00, indicating they did not experience interactivity during the experiment.

Table K2. *Interactive Qualities Means Analysis for RQ1*

	N	*M*	*SE*	*SD*	*V*
This VW is easy to operate.	102	5.03	0.12	1.22	1.49
While in the VW, I felt in control.	102	4.71	0.13	1.35	1.83
While in the VW, I felt able to choose.	102	4.56	0.13	1.36	1.85
This VW is interesting.	102	4.52	0.14	1.37	1.88
While in the VW, I felt responded to immediately.	100	4.34	0.13	1.31	1.72
This VW is engaging.	102	4.31	0.14	1.40	1.96
This VW is entertaining.	102	4.30	0.15	1.52	2.31
This VW is interactive.	101	4.29	0.15	1.46	2.13
While in the VW, I felt engaged.	102	4.27	0.13	1.34	1.79
This VW is responsive.	102	4.02	0.13	1.35	1.82

NOTES: 6 = highest possible score; Means for Subjects with an MPIVW M ≥ 3.00 on the 6-point scale (MPIVW M = 4.36, SE = .08, SD = 0.80, V = .64), indicating they did experience interactivity during the experiment; Listwise N = 100.

APPENDIX L

RQ2-INTERACTIVE EXPERIENCES RESULTS

Table L1. *Interactive Experiences Means Analysis for RQ2*

	N	*M*	*SE*	*SD*	*V*
Face-to-face Conversations	148	3.83	0.04	0.54	0.29
Video IM-ing	134	2.93	0.11	1.27	1.62
Phone Conversations	150	2.89	0.07	0.86	0.73
Audio IM-ing	132	2.61	0.10	1.10	1.22
Instant-Messaging (IM-ing)	148	2.45	0.08	0.93	0.86
Multi-Player Video Games	145	2.43	0.09	1.09	1.19
The Internet	150	2.38	0.09	1.11	1.23
Computers	150	2.35	0.09	1.09	1.19
Cell Phone Texting	148	2.27	0.09	1.06	1.12
Writing Email	150	2.03	0.08	1.00	0.99
Virtual Worlds	136	1.92	0.10	1.19	1.42
Reading Email	150	1.87	0.09	1.06	1.13

	N	*M*	*SE*	*SD*	*V*
Posting Comments on Blogs	135	1.76	0.08	0.97	0.93
Single Player Video Games	147	1.50	0.10	1.23	1.51
Writing Blogs	133	1.50	0.09	1.09	1.19
Reading Blogs	137	1.43	0.09	1.07	1.14

NOTES: 4 = highest possible score; Grades were assigned by subjects based on the following scale: A = "Highly Interactive" (4); B = "Above Average Interactivity" (3); C = "Average Interactivity" (2); D = "Below Average Interactivity (1); and E = "Not Interactive at All" (0); Listwise N = 113.

APPENDIX M

H1 TEST RESULTS

Table M1. *H1-One-way ANOVA for the MPIVW by Experimental Condition*

		SS	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
MPIVW Bots v. Not	**Between Groups**	**11.20**	**1**	**11.20**	**6.67**	**.01****	**0.04**	**0.73**
	Within Groups	248.57	148	1.68				
	Total	259.77	149					

*NOTES: [a] Computed using alpha = .05; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

Table M2. *H1-One-way ANOVA for the MPIVW by Venue*

		SS	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
MPIVW Venue 1 v. Venue 2	**Between Groups**	**50.40**	**1**	**50.40**	**35.63**	**.00****	**0.19**	**1.00**
	Within Groups	209.37	148	1.42				
	Total	259.77	149					

*NOTES: [a] Computed using alpha = .05; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

Table M3. *H1-Factorial ANOVA for the MPIVW by Experimental Condition & Venue*

Source	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
Bots	1.40	1	1.40	1.02	.31	0.01	0.17
Venue	**46.95**	**1**	**46.95**	**34.27**	**.00****	**0.19**	**1.00**
Venue * Bots	**5.22**	**1**	**5.22**	**3.81**	**.05***	**0.03**	**0.49**
Error	205.22	147	1.40				
Corrected Total	259.77	149					

*NOTES: [a] Computed using alpha = .05; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

APPENDIX N

H2 TEST RESULTS

Table N1. *H2-Factorial ANOVA for the IPQ by Experimental Condition & Venue*

Source	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
Bots	0.11	1	0.11	0.12	.73	0.00	0.06
Venue	0.04	1	0.04	0.04	.84	0.00	0.06
Venue * Bots	0.56	1	0.56	0.64	.43	0.00	0.12
Error	129.47	146	0.89				
Corrected Total	130.442	149					

*NOTES: [a] Computed using alpha = .05; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

Table N2. *H2-Factorial ANOVA for BCPQ by Perceived Spatial Presence & Venue*

Source	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
Spatial Perceived	1.85	1	1.85	1.73	.19	0.03	0.25
Venue	0.67	1	0.67	0.62	.43	0.01	0.12
Venue * Spatial Not Perceived	2.04	1	2.04	1.91	.17	0.03	0.28
Error	68.47	64	0.89				
Corrected Total	71.48	67					

NOTE: [a] Computed using alpha = .05.

APPENDIX O

H3 TEST RESULTS

Table O1. *H3-One-way ANOVA for BCPQ by Perceived Interactivity*

		SS	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
BCPQ Perceived Interactive v. Not Perceived Interactive	**Between Groups**	**6.27**	**1**	**6.27**	**6.34**	**.01****	**0.09**	**0.70**
	Within Groups	65.21	66	0.99				
	Total	71.48	67					

*NOTES: [a] Computed using alpha = .05; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed).*

Table O2. *H3-Factorial ANOVA for BCPQ by Perceived Interactivity & Venue*

Source	*Type III SS*	*df*	*MS*	*F*	*p*	*Partial* η^2	*Power* [a]
Perceived Interactive	**8.06**	**1**	**8.06**	**8.30**	**.01****	**0.12**	**0.81**
Venue	0.51	1	0.51	0.52	.47	0.01	0.11
Venue * Perceived Interactive	0.80	1	0.80	0.83	.37	0.01	0.15
Error	62.15	64	0.89				
Corrected Total	71.48	67					

NOTE: [a] Computed using alpha = .05.

APPENDIX P

IPQ SCALE RESULTS ANALYSIS

Table P1. *IPQ Scale Items Ranked by Mean*

		N	*M*	*SE*	*SD*	*V*
IPQ08	In the computer generated world, I had a sense of "being there."	149	2.93	0.13	1.56	2.42
IPQ11 [a]	I still paid attention to the real environment.	150	2.82	0.14	1.71	2.91
IPQ02	How real did the virtual world seem to you?	150	2.82	0.12	1.46	2.14
IPQ06	I did not feel present in the virtual environment.	149	2.78	0.13	1.60	2.57
IPQ03	I had a sense of acting in the virtual space, rather than operating something from outside.	150	2.75	0.13	1.54	2.38
IPQ10	I felt present in the virtual space.	150	2.72	0.12	1.49	2.22
IPQ13 [a] *	I felt like I was just perceiving pictures.	149	2.72	0.13	1.59	2.52
IPQ07	I was not aware of my real environment.	148	2.59	0.13	1.62	2.61
IPQ05	How real did the virtual world seem to you?	149	2.52	0.12	1.48	2.20
IPQ01 [a]	How aware were you of the real world surrounding you while navigating in the virtual world (i.e., sounds, room temperature, other people, etc.)?	150	2.48	0.14	1.74	3.04

		N	*M*	*SE*	*SD*	*V*
IPQ09	Somehow, I felt that the virtual world surrounded me.	150	2.46	0.13	1.59	2.52
IPQ04	How much did your experience in the virtual environment seem consistent with your real world experience?	149	2.44	0.12	1.52	2.30
IPQ14	I was completely captivated by the virtual world.	150	2.18	0.13	1.58	2.50
IPQ12**	The virtual world seemed more realistic than the real world.	150	0.86	0.09	1.08	1.17
	IPQ	**150**	**2.50**	**0.08**	**0.94**	**0.88**

*NOTES: 6 = highest possible score; [a] Reverse coded variables; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed); Chronbach's alpha for the scale = 0.87 (p = .00); Listwise N = 143.*

APPENDIX Q

BCPQ SCALE RESULTS ANALYSIS

Table Q1. *BCPQ Scale Items Ranked by Mean*

Item		*N*	*M*	*SE*	*SD*	*V*
BCPQ01*	I perceived that I was in the presence of another person in the room with me.	68	2.87	0.25	2.02	4.09
BCPQ03 [a]	The thought that the person was not a real person crossed my mind often.	68	2.81	0.22	1.79	3.20
BCPQ02*	I felt that the person was watching me and aware of my presence.	68	2.04	0.18	1.50	2.25
BCPQ04	The person appeared to be sentient (conscious and alive) to me.	68	1.96	0.20	1.67	2.79
BCPQ05 [a]	I perceived the person as being only a computerized image, not as a real person.	68	1.78	0.21	1.73	2.98
	BCPQ*	**68**	**2.29**	**0.13**	**1.03**	**1.07**

*NOTES: 6 = highest possible score; [a] Reverse coded variables; * p-value is significant at the .05 level (2-tailed); ** p-value is significant at the .01 level (2-tailed); Chronbach's alpha for all items = 0.53 (p = .00).*

APPENDIX R

GLOSSARY OF TERMS AND ABBREVIATIONS

Abbrev.	Term	Definition
ANOVA	Analysis of Variance	Statistical method comparing mean scores of two groups based on one or two DVs.
BCPQ	Bailenson et al. Co-Presence Questionnaire (2005)	Measure of perceived social presence.
Bots	Robotic Avatars	Study condition in which subjects encountered robotic avatars.
CMC	Computer-Mediated Communication	Communication enabled by computer hardware and software applications.
CVE	Collaborative Virtual Environment	A VE in which more than one person can participate and participants interact with one another.
FTF	Face-to-face	Communication occurring in real-time in the physical world.
IPQ	Igroup Presence Questionnaire	Measure of spatial presence.
IRB	Institutional Review Board	Accredited body of committee members within the University of Kentucky's Office of Research Integrity which must approve all human and animal studies.
MANCOVA	Multivariate Analysis of Covariance	Statistical method comparing the variance of mean scores for two groups with more than two dependent variables.
MANOVA	Multivariate Analysis of Variance	Statistical method comparing the mean scores of two groups with more than two dependent variables.

Abbrev.	Term	Definition
MPI	Measure of Perceived Interactivity	McMillan and Hwang's (2002) instrument for measuring subjects' perceived interactivity of websites.
MPIVW	Measure of Perceived Interactivity for Virtual Worlds	Modified version of McMillan and Hwang's (2002) instrument for measuring subjects' perceived interactivity of VWs.
Not	No Other Avatars Present	Study condition in which subjects did not encounter other avatars.
SPSS	Statistical Package for the Social Sciences	Program used for data analysis.
SSTARS	Social Sciences Teaching And Research Statistics	University of Kentucky Center for Statistical Computing Support: http://uky.edu/ComputingCenter/SSTARS/
UK	University of Kentucky	University in Lexington, Kentucky, where the study took place.
VE	Virtual Environment	A setting composed of computer-generated images.
VR	Virtual Reality	A computer-generated artificial reality experienced by the user as a substitute for true reality (Huang & Alessi, 1999); a computer-generated experience based on an illusion, which generates a real experience (Berneburg, 2007).
VW	Virtual World	A computer-generated environment emulating the real world.

APPENDIX S

EXAMPLES OF SUBJECT COMMENTS

Table S1. *Subject Comments on Engagement*

Questionnaire Open-ended Item Responses
Felt fully engaged the entire time . . . .
The environment was visually engaging. . . .
I thought that the virtual world was engaging . . . .
I thought experiencing the "virtual world" was interesting and made me more engaged in the activity.
The virtual world was very interesting and engaging. I felt as if I were playing some sort of video game or computer game.
Today's experience was very engaging . . . .
Very interesting, never experienced a virtual world, I was engaged in the world not paying attention to the real world but still knew I was on a computer in a virtual world.

Table S2. *Subject Comments on Attention and Interest*

Questionnaire Open-ended Item Responses
I thought that the virtual world was very interesting. . . . Everything was very bright and colorful, which easily caught my attention.
It was fun. The virtual world was very interesting. It held my attention.
It was interesting and not at all what I expected . . . it kept my attention . . . .
I thought the virtual world was very interesting. It was easy to control and kept my undivided attention.
. . . the virtual world was interesting and slightly captivating.

Questionnaire Open-ended Item Responses
I thought the virtual world was very interesting . . . .
Interesting, I've never taken part in a virtual world but it was interesting . . . .
Interesting program. Visually challenging. A little bit confusing.
The Virtual World was a little difficult to navigate but interesting and something I would be interested in learning more about.
Interesting interaction with the virtual world. . . .
. . . The virtual world was very interesting and I like all the decorations inside the house. . . .

Table S3. *Subject Comments on Brevity of Experimental Task*

Questionnaire Open-ended Item Responses
It only took me like 15 seconds to find the room, so my experience was extremely limited. For future tests, I would suggest a more difficult or, at the very least, time-consuming task.
I walked around in it for 2 minutes...
. . . it was very easy and quick to do. Was not hard to find the room but I felt as if there could have been more I could have explored.
I wish there would have been more to walking around the house.
I'm not sure what really went on here today I felt like maybe the virtual world should have lasted a little longer so I could have answered your questions better.
I didn't feel like my experience in the virtual world was long enough to answer the questions.
I liked the virtual world, I wish the experience inside the house would have been longer with more people involved.
It was interesting. I thought the virtual world would have been more interactive or longer, maybe even harder to find the room. It was sorta weird how it was a straight path to the room I needed to find and all the questions about interactions seemed silly because I just had to walk straight there & do nothing on the way.

Table S4. *Subject Comments on Lack of Speed & Control at Venue 2*

Questionnaire Open-ended Item Responses
I enjoyed navigating through the house but the graphics often got messed up and it became confusing.
I was confused and borderline frustrated in the virtual world. It was hard to control the person, she did not take turns well and I had no idea where I was going.
. . . The controls were delayed but overall it was interesting to use.
The virtual world was interesting but it did not respond to the controls very quickly and felt like a house of mirrors at times.
. . . The camera angles were somewhat confusing at times, especially with the delayed reactions, but other than that it was fine.
. . . sometimes frustrating with the lag time and accuracy of the person that was to be directed in the virtual world.
. . . I felt like the turning keys did not work as well as the moving forward keys did.
This was a different experience, but overall the loading speed of the world was too slow for me to actually feel like I was there.
This experience was okay. I'm used to playing very detailed video games with easy and quick movements between the controller and the screen, so the lagging was a little bit annoying.

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Zhao, S. (2003). Toward a Taxonomy of Copresence. *Presence, 12*(5), 445-455.

VITA

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EDUCATION

2005-2011	Ph.D. Candidate College of Communications and Information Studies University of Kentucky, Lexington, Kentucky	CGPA: 3.55/4.00
1994-1996	M.A. College of Liberal Arts, Communication Studies Dept. Marshall University, Huntington, West Virginia	CGPA: 4.00/4.00
1990-1993	B.A., *summa cum laude* College of Liberal Arts, Political Science Dept. Marshall University, Huntington, West Virginia	CGPA: 3.95/4.00

ACADEMIC EXPERIENCE

2010-Present	Assistant Professor - Communication Arts Department Concord University, Athens, West Virginia
2005-2010	Adjunct Instructor - Communication, History, & Social Sciences Bluegrass Community & Technical College, Lexington, Kentucky
2005-2009	GTA Instructor - College of Communications and Information Studies University of Kentucky, Lexington, Kentucky
2004-2005	Adjunct Instructor - Department of Communication Studies Marshall University, Huntington, West Virginia
1997-1998	Faculty Member Beacon College, Leesburg, Florida
1996-1997	Adjunct Instructor - Department of Communication Seminole Community College, Sanford, Florida
1996-1997	Adjunct Instructor - Department of Communication Valencia Community College, Orlando, Florida

1996-1997	Adjunct Instructor - Department of Communication University of Central Florida, Orlando, Florida
1994-1996	GTA Instructor - Department of Communication Studies Marshall University, Huntington, West Virginia

PROFESSIONAL EXPERIENCE

2002-2004	Account Executive - WV/Southeastern Ohio/Southwestern Pennsylvania Toshiba America Medical Systems, Tustin, California
2000-2002	Pharmaceutical Sales Representative - Central and Southern WV Bayer Pharmaceuticals, West Haven, Connecticut
2000	Campaign Manager Mike Oliverio for Secretary of State, Morgantown, West Virginia
1999	Research Analyst Ryan-McGinn-Samples Research, Charleston, West Virginia
1998-1999	Program Coordinator - Inside Washington '99 Seminar Washington Center – Internships & Academic Seminars, Washington, DC
1997-1998	Administrator - Director of Student Services and the Writing Center and Interim Director of the Field Placement Internship Program Beacon College, Leesburg, Florida
1996	Lobbyist and Political Consultant Larry Swann Government Relations, Charleston, West Virginia
1995	Legislative Liaison - Supreme Court Administrative Office West Virginia Supreme Court of Appeals, Charleston, West Virginia

HONORS AND AWARDS

2005-2009	Graduate Teaching Assistantship College of Communications and Information Studies University of Kentucky, Lexington, Kentucky
2001	Cipro MVP: Market Share=40% v. Nat'l Average of less than 30% Central and Southern West Virginia Territory Bayer Pharmaceuticals, West Haven, Connecticut
2001	3rd in the Nation for Territories outselling Tequin by 1.0:0.6 Script Ratio Central and Southern West Virginia Territory Bayer Pharmaceuticals, West Haven, Connecticut

2001	1st in Charlotte Sales Area/Top 25 Nationally for Avelox Sales Growth Central and Southern West Virginia Territory Bayer Pharmaceuticals, West Haven, Connecticut
1996	Catherine Cummings Graduate Award for Communication Pedagogy Department of Communication Studies Marshall University, Huntington, West Virginia
1994-1996	Graduate Teaching Assistantship Department of Communication Studies Marshall University, Huntington, West Virginia
1993	*Pi Sigma Alpha* Award for Highest CGPA of Political Science Graduates Department of Political Science Marshall University, Huntington, West Virginia
1993	Judith A. Herndon Fellowship State of West Virginia West Virginia Legislature, Charleston, West Virginia
1992	Best Paper of the Year Undergraduate Division West Virginia Political Science Association, Morgantown, West Virginia

ASSOCIATION MEMBERSHIPS

International Communication Association

International Association for Media and Communication Research

National Communication Association

Public Relations Society of America

West Virginia Public Relations Society of America

PROFESSIONAL ACTIVITIES

Presentations

Robinette, J. L. (2008, May 23). *Fast forward into the future: Trends in the interactivity of online news publications*. Paper presented at the 58th Annual International Communication Association Conference, Montreál, Canada.

Robinette, J. L. (2011, April 20). *Promise among the mountains*. Grant project presented at the West Virginia Campus Compact Conference, Fairmont, West Virginia.

Reviews

Wahl, S. *Persuasion in Your Life.* Allyn & Bacon 1st edition Textbook, November, 2010.

PUBLICATIONS

Manuscripts in Preparation for Submission

Robinette, J. L. (2010). *Understanding interactive experiences: Perceived interactivity and presence with and without other avatars in the online Virtual World Second Life*. University of Kentucky, Lexington, KY.

Robinette, J. L. (2008). *Cyberspace invaders: Schoolyard bullies, cyber-bullying and cognitive complexity*. University of Kentucky, Lexington, KY.

Robinette, J. L. (2008). *The stigma of second wives: A rhetorical analysis of Web sites, message boards, and books*. University of Kentucky, Lexington, KY.

Chung, D. S., & Robinette, J. L. (2007). *Fast forward into the future: Trends in the interactivity of online news publications*. 58th Annual International Communication Association Conference, Montreál, Canada.